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Superfund Record of Decision:

Northernaire Plating, MI

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Northernaire Plating, MI
Second Remedial Action - Final

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Northernaire Plating facility is a former electroplating facility in the Cadillac industrial park in the city of Cadillac, Wexford County, Michigan. Approximately 40 industries operate in the 1-square mile industrial park including Kysor Industrial, another Superfund site. The Kysor Industrial site will be addressed by this action as well. There are several private residences including a trailer park within the industrial park, and another residential neighborhood lies adjacent to the northern boundary of the park. The city of Cadillac water supply well field is located near the center of the park, and ground water beneath the site generally flows towards the city wells. The Clam River flows through the southeast portion of the site draining runoff from the site. The Northernaire Plating facility provided custom chromium and nickel plating finishes to automobile and other metal parts. Improper waste handling and faulty sewer systems are believed to be responsible for releasing toxic compounds (including hexavalent chromium, chromium, and cyanide) to the soil which have subsequently leached from the soil to the ground water. A 1985 Record of Decision addressed the soil contamination and included excavation and offsite disposal of contaminated soil and sewer sediment. Ground water contamination has since been detected throughout the shallow and intermediate aquifers underlying the park. At present the deep aquifer (in which the Cadillac city well field is located) is not affected by this contamination. The primary contaminants of concern affecting (Continued on next page)

17. Document Analysis a. Descriptors
Record of Decision - Northernaire Plating, MI
Second Remedial Action - Final
Contaminated Medium: gw
Key Contaminants: VOCs (toluene, TCE, PCE, xylene), metals (chromium)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

16. Abstract (Continued)

e ground water are VOCs including toluene, tce, PCE, and xylene; and metals including chromium.

The selected remedial action for this site includes a two-stage ground water pumping and treatment system using carbon adsorption for the removal of chromium and air stripping with vapor-phase carbon adsorption for the removal of VOCs and discharge to the Clam River; ground water monitoring; and institutional controls including site access and ground water and land use restrictions. The estimated present worth cost for this remedial action is $16,000,000, which includes present worth O&M costs of $5,000,000 over 60 years.

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Northernaire Plating Company
Cadillac, Michigan

Statement of Basis and Purpose

This decision document presents the United States Environmental Protection Agency's (U.S. EPA's) selected remedial action for the Northernaire Plating Company site located in Cadillac, Michigan. This decision document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Contingency Plan (NCP). This decision is based on information and documents contained in the administrative record for this site. The attached index identifies the items that comprise the administrative record upon which the selection of the remedial action is based.

The State of Michigan does not concur with the U.S. EPA's Record of Decision. The Michigan Department of Natural Resources (MDNR) has indicated that they agree with the remedial technology selected by U.S. EPA to remediate the Northernaire site. However, the State of Michigan does not concur with the cleanup level for Trichloroethylene specified in the ROD summary.

Assessment of the Site

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

Description of the Selected Remedy

This remedy is the final remedial action for the Northernaire Plating Company site. The groundwater extraction and treatment alternative for the Northernaire site chosen in the attached Record of Decision constitutes the final and overall remedy for the site. The primary goals of the remedial actions at the Northernaire site are:

- to eliminate any human exposure to residual hazardous waste disposed of or contaminated materials at the site, and;

- to address all potential risks to human health and/or impacts to the environment.

The Cadillac Area Groundwater Remedial Investigation which included the Northernaire Plating Company site identified areas of concern that include areas of contaminated groundwater.

The potential risks associated with the site are posed by human consumption of contaminated on-site groundwater. The selected remedy addresses these site concerns by a combination of treatment, and site use restrictions. A groundwater extraction and treatment system will be installed to eliminate groundwater contamination. Additionally, the selected remedy will provide for long-term monitoring of the groundwater. Corrective action measures will also be taken should this monitoring indicate a failure of any component of the remedy. Site use and access restrictions will be placed on the property to ensure the integrity and performance of the remedy.

The major components of the selected remedy consist of the following:

- o Install groundwater extraction and treatment system to remove groundwater contamination from the area surrounding the site.
- o Conduct groundwater monitoring to assess quality of area groundwater.
- o Impose access and use restrictions.
- o Estimated Total Cost: $ 16,000,000.00
- o Estimated time to complete: 64 years

Declaration of Statutory Determinations

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. Treatment is a major component of this remedy, as groundwater contamination will be treated to reduce the toxicity, mobility, and volume of the contaminants. The groundwater alternative satisfies the statutory preference for treatment as the principal element of the final remedy.

A review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus [signature]   29 SEP 1989

Valdas V. Adamkus, Regional Administrator
U.S. Environmental Protection Agency, Region V

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Kysor of Cadillac, Inc.
Cadillac, Michigan

Statement of Basis and Purpose

This decision document presents the United States Environmental Protection Agency's (U.S. EPA's) selected remedial action for the Kysor of Cadillac, Inc., site located in Cadillac, Michigan. This decision document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Contingency Plan (NCP). This decision is based on information and documents contained in the administrative record for this site. The attached index identifies the items that comprise the administrative record upon which the selection of the remedial action is based.

The State of Michigan does not concur with the U.S. EPA's Record of Decision. The Michigan Department of Natural Resources (MDNR) has indicated that they agree with the remedial technology selected by U.S. EPA to remediate the Kysor site. However, the State of Michigan does not concur with the cleanup level for Trichloroethylene specified in the ROD summary.

Assessment of the Site

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

Description of the Selected Remedy

This remedy is the first and final remedial action for the Kysor of Cadillac, Inc., site. The combination of the soil cleanup alternative and the groundwater extraction and treatment alternative for the Kysor site chosen in the attached Record of Decision constitutes the final and overall remedy for the site. The primary goals of the remedial actions at the Kysor site are:

- to eliminate any human exposure to residual hazardous waste disposed of or contaminated materials at the site, and;

- to address all potential risks to human health and/or impacts to the environment.

The Cadillac Area Groundwater Remedial Investigation which included the Kysor of Cadillac, Inc., site identified areas of concern that include areas of contaminated soils and groundwater.

The potential risks associated with the site are posed by continued contamination of the groundwater by the contaminated soils, and human consumption of contaminated on-site groundwater. The selected remedy addresses all site concerns by a combination of treatment, and site use restrictions. Contaminated soils will be treated using a vacuum extraction system removing the contamination from the soils, thus reducing the likelihood of future ground water contamination. A groundwater extraction and treatment system will be installed to eliminate groundwater contamination. Additionally, the selected remedy will provide for long-term monitoring of the groundwater. Corrective action measures will also be taken should this monitoring indicate a failure of any component of the remedy. Site use and access restrictions will be placed on the property to ensure the integrity and performance of the remedy.

The major components of the selected remedy consist of the following:

- o Install groundwater extraction and treatment system to remove groundwater contamination from area surrounding the site.
- o Install vacuum extraction system to remove contamination from the soils.
- o Conduct groundwater monitoring to assess quality of area groundwater.
- o Impose access and use restrictions.
- o Estimated Total Cost: $ 16,000,000.00
- o Estimated time to complete: 64 years

Declaration of Statutory Determination

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. Treatment is a major component of this remedy, as soil and groundwater contamination will be treated to reduce the toxicity, mobility, and volume of the contaminants. The combination of the soil and groundwater alternatives satisfy the statutory preference for treatment as the principal element of the final remedy.

A review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus, Regional Administrator
U.S. Environmental Protection Agency, Region V

29 SEP 1989

RECORD OF DECISION

ROD Summary
Northernaire Plating Company Site
Kysor of Cadillac, Inc., Site
Wexford County, Michigan

1.0. SITE NAME, LOCATION, AND DESCRIPTION

The Cadillac industrial park encompasses an approximate 1-square-mile area along the northern boundary of the city of Cadillac, Wexford County, Michigan (Figure 1-1). The park is bounded by Thirteenth Street to the north, Mitchell Drive (Route 131) to the east, Wright Street to the south, and Leeson Avenue to the west. The city of Cadillac water supply wellfield is located near the center of the industrial park. Several private residences, including a trailer park, exist within the industrial park. Another residential neighborhood, referred to as the North Park Subdivision, is located adjacent to the northern boundary of the park, across Thirteenth Street, in Haring Township. The Clam River flows through the southeast portion of the site and accepts run-off from the site.

Currently, approximately 40 industries operate in the industrial park, two of which are Superfund sites; Northernaire Plating Company (Northernaire), and Kysor of Cadillac, Incorporated (Kysor).

Northernaire is a former electroplating facility which operated from a 100-foot by 50-foot prefabricated metal building on 12.75 acres of land at the corner of Sixth Street and Eighth Avenue.

The Kysor facility, located on Wright Street on the southern edge of the industrial park, is a large active manufacturer of truck parts. Use of solvent cleaner and degreasers is common at this facility.

Site geology consists of five strata; three sand aquifers alternately separated by two clay aquitards. The upper aquitard, ranging in thickness from zero to about 20 feet, slopes upward from the southwest to the northeast, until it pinches out along a northwest-southeast trending line halfway across the industrial park. The lower aquitard appears to be a clay-sand-clay sequence, which is thickest (i.e., 30 to 35 feet) in the immediate vicinity of the city wellfield. This lower aquitard, previously thought to be extensive and thick, was shown to be thick only below the wellfield, becoming substantially thinner (i.e., 3 to 8 feet) short distances in all directions away from the wellfield.

Groundwater must be considered separately in each of the three aquifers, although there is vertical seepage downward between aquifers. The sand above the upper aquitard defines the shallow aquifer, in which groundwater flows north to northeast at 200 ft/yr. The intermediate aquifer is confined in areas where the upper aquitard exists and is unconfined elsewhere; flow direction is north-northwest. Where the shallow and intermediate aquifers merge, the latter dominates and groundwater flow turns northwest. Average groundwater flow in the intermediate aquifer is 80 ft/yr. The municipal water supply aquifer lies below the lower aquitard. Only a few wells penetrate this aquifer (3 monitoring wells and 7 city supply wells) therefore, information concerning this aquifer is limited. The soils are similar to those in the aquifers above. but may locally contain more gravel. The flow direction east of the wellfield is westward toward the city wells (probably under their pumping influence).

The site, located in an area of both industrial and residential properties, is a relatively flat glacio-lacustrine environment. The population of Cadillac, Michigan, is approximately 10,000. This population has a potential to be impacted by the site because they are served by area groundwater.

2.0. SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1. Northernaire Plating Company

Northernaire, located at the northwestern corner of Sixth Street and Eighth Avenue, operated from 1971 to 1981, providing custom chromium- and nickel-plating finishes to automobile and other metal parts. Improper waste handling and faulty sewer systems are believed responsible for releasing toxic compounds (including hexavalent chromium, cadmium, and cyanide) to the surrounding soils. As a result of leaching through soils to the groundwater, the highly soluble hexavalent chromium was detected in private wells downgradient of Northernaire in 1978. The city revoked Northernaire's wastewater discharge permit and plugged their discharge pipe, forcing Northernaire to seek other means of disposing their wastewater.

Also in 1978, MDNR ordered Northernaire to conduct hydrogeologic studies of the problem. In 1979, Northernaire submitted a plan for the requested study, but later stated no funds were available for the investigation. A 1981 MDNR inspection of the site found the facility closed and apparently out of business. Further inquiries revealed that Northernaire's assets had been purchased by Top Locker Enterprises of Florida, which had also ceased operations. Two children playing in the area received chemical burns from the hazardous wastes stored in containers outside the Northernaire building. Emergency response measures were conducted by U.S. EPA and MDNR shortly thereafter in 1983, including chemical testing; removal of waste drums and liquids from process tanks, decontaminating tanks and building surfaces (with hypochlorite for treatment of cyanide); and removal of a section of the discharge sewer line.

On March 13, 1984, Region V referred an action to the Department of Justice for the filing of a civil complaint for the recovery of all "response costs" associated with the removal action. A complaint was filed in the District Court for the Western District of Michigan, and on May 6, 1988, the Court rendered a judgment granting the U.S. EPA all of its response costs, including prejudgment interest and indirect costs. This judgement was for $268,818.25. The Court instructed the Agency to file a statement of the exact amount of its prejudgment interest. That was done, and on August 8, 1988 the Court made a second ruling granting the U.S. EPA $74,004.97 in prejudgment interest. One defendant, R.W. Meyer, Inc., has appealed the case to the 6th Circuit Court of Appeals. That case has been fully briefed and we are presently awaiting a decision by that court.

The site was included on the National Priorities List (NPL) in July 1982 primarily based on concerns for the possible impact of wastes on the municipal wellfield (about a quarter-mile northeast and apparently downgradient of Northernaire) and the potential for direct contact hazards. A Remedial Action Master Plan (RAMP) was completed for Northernaire in 1983.

For the Northernaire Remedial Investigation (RI) (1984-1986), a series of borings and monitoring wells were installed by hollow-stem auger and screened auger sampling techniques to determine site stratigraphy and the vertical and horizontal distribution of site contaminants. The RI was a state-lead, federally funded project. During the initial phase of the RI, groundwater samples were analyzed for metals, cyanide, and VOCs. Cyanides were not detected; the VOCs noted were not attributable to Northernaire. VOCs were detected at similar concentrations in both upgradient and downgradient wells at Northernaire. There were no historical records or indications of significant solvent usage at Northernaire.

Elevated levels of some metals were found in the groundwater; most were believed to derive from salting of area roads (some unpaved) for dust control in summer and ice control in winter. Hexavalent chromium, attributed to Northernaire, was detected in two wells in the intermediate aquifer, which led to a second phase of well installations to determine its distribution. However, knowing that VOC contamination was the focus of the future Cadillac Area RI, the screened auger groundwater samples were analyzed for VOCs in addition to hexavalent chromium. The well screens for the Northernaire study monitoring wells (identified by the designation "MW") were placed in the zone of highest hexavalent chromium concentration, which usually did not correspond to the zone of highest VOC contamination.

At that time it was decided to proceed with a source control operable unit in order to expedite remediation of the soil contamination and continue investigation of the groundwater contamination. A Focused Feasibility Study (FFS) of proposed source control measures for the Northernaire site was completed by MDNR in July 1985. Subsequently, with input from the public, a remedy was selected for the soil cleanup. A Record of Decision was signed for this source control operable unit (#1) remedy on September 11, 1985. This included excavation of contaminated soil and sewerline sediments and disposal at an off-site facility, limited modification of the building, and restoration of the sewerline. A remedial design for this soil removal was completed for MDNR in 1987. This action was implemented in 1988 and is scheduled for completion in September of 1989.

2.2. Kysor of Cadillac, Inc.

The Kysor facility is a large manufacturer of truck parts located on Wright Street at the southern edge of the industrial park. This facility commonly uses solvent cleaner and degreasers. Past disposal practices included dumping barrels of spent solvent directly on the soils behind the plant. The site was proposed for the NPL in September 1985.

A series of borings and wells were installed for the Kysor facility hydrogeologic studies in 1980 and 1983. A total of 24 borings with monitoring wells were widely distributed over the industrial park with several in the vicinity of the city wellfield. These wells (designated by "K") monitor both the shallow and intermediate aquifers. All of the K wells were installed by Kysor. The well installations consisted principally of 4-inch galvanized steel casings with 2- to 5-foot-long stainless steel screens. Vertical screening for VOCs in the groundwater was conducted during installation. Analysis of groundwater samples from K-4 in 1983 found elevated levels of TCA, TCE, tetrachloroethane (PCE), 1,1-dichloroethene (DCE), 1,2,-dichloroethane (DCA), xylene, toluene, ethylbenzene, and chloroform. Specific details were not reported on the monitoring well installation techniques. However, boring logs indicate that the borehole annulus was not typically grouted after installation of the well. Without a grout seal (usually powdered bentonite) in the annulus, the effectiveness of the upper clay aquitard to restrict downward groundwater flow is essentially eliminated at the well point location. A conduit for contaminant migration from the shallow to the intermediate aquifer exists under the impetus of measured downward hydraulic gradients.

The 1983 hydrogeologic study for Kysor also included a 24-hour pump test of City Well Number 7. Water levels in the intermediate aquifer were monitored in nearby K-24. The report concluded that there was little or no apparent influence of pumping in the municipal well aquifer on groundwater flow in the intermediate aquifer. However, MDNR and U.S. EPA are concerned that (1) the test was inadequate because it was of limited duration; and (2) the apparent effectiveness of the aquitard at the wellfield might not extend throughout the study area.

Partial remediation of the contaminated soils at the disposal area was conducted by Kysor in 1981. Excavation depth averaged approximately 6 feet in two primary removal areas. Approximately 700 cubic yards of soil were removed; MDNR observers noted strong odors remaining in the completed excavation pit. Samples taken by MDNR indicated greater than 100 parts per million (ppm) of TCE, TCA, PCE, ethylbenzene, and xylenes remaining in soils. The excavation was backfilled with clean material.

The PRPs were given the opportunity to perform the Cadillac area RI/FS but declined to do so. This RI/FS was a state-lead, state-funded project. To date there have been no significant enforcement efforts (apart from the Northernaire cost recovery action described above) which address the combined Cadillac area groundwater contamination problem. On May 20, 1988 a general notice letter and information request was sent out to a number of potentially responsible parties.

The Alternatives Array document reports that over 40 industrial facilities are located within the Cadillac Industrial Park. Of that group, five are likely sources of the contamination of the groundwater, according to the RI. They are Kysor of Cadillac, Inc., Northernaire Plating Co., Four Winns, Four Starr, and Leo Ingraham. There are other facilities located in the area, but present information does not indicate that they contributed to the groundwater contamination associated with these two sites.

Other PRPs identified are landowners or somehow affiliated with the aforementioned five facilities. They are Willard S. Garwood (Northernaire), R.W. Meyer Inc./Meyer Construction Company (Northernaire), Top Locker Enterprises Inc. (Northernaire), and Jomar Company (Four Star).

A total of nine PRPs have been identified to date. They are:

Kysor of Cadillac, Inc.	Northernaire Plating Company
Four Winns Company	Top Locker Enterprises Inc.
Four Star Corporation	R.W. Meyer Inc./Meyer Construction Co.
Jomar Company	Willard S. Garwood
Leo Ingraham	

3.0. COMMUNITY RELATIONS

The MDNR and U.S. EPA conducted a community relations program to keep the public informed of progress during the RI/FS for the Northernaire and Kysor sites and to discuss upcoming events. The RI for the Cadillac area groundwater study, including the Northernaire and Kysor sites, was released to the public in August, 1988, and the FS and Proposed Plan were released in July, 1989. The MDNR and U.S. EPA provided the public with an opportunity to comment on the U.S. EPA's preferred alternative and the other alternatives presented in the Feasibility Study during a 30 day public comment period from July 27, to August 28, 1989. During this time period, interested individuals were encouraged to review the FS and Proposed Plan and send written comments to the U.S. EPA. Individuals were also encouraged to review the Administrative Record for the sites located at the Cadillac Wexford Library, 411 South Lake Street, Cadillac, Michigan.

Notification of the availability of the documents was published in the Cadillac Evening News on July 27, 1989.

On August 7, 1989, the MDNR and U.S. EPA held a formal public meeting at the Wexford County Courthouse in Cadillac, Michigan. During the meeting, the MDNR made presentations to the community on topics such as: the results of the RI; the remedial alternatives developed in the FS; and the U.S. EPA's preferred alternative. Following the presentations, MDNR and U.S. EPA answered questions from interested parties present at the meeting.

A transcript of the meeting is included as part of the Administrative Record (see Administrative Record index, attached as Appendix A) for the Northernaire and Kysor sites. The U.S. EPA's responses to comments received during this public meeting and to written comments received during the public comment period are included in the Responsiveness Summary attached to this document.

This decision document presents the U.S. EPA's selected remedial action for the Northernaire and Kysor sites located in Cadillac, Michigan. This decision document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on information and documents contained in the administrative record for the sites.

4.0. SCOPE AND ROLE OF RESPONSE ACTION

As with many Superfund sites, the problems at the Northernaire Plating Company Site are complex. As a result, U.S. EPA organized the work into two operable units (OUs). These are:

OU One: Contamination in the soils and sewer sediments.
OU Two: Contamination in the groundwater aquifers.

U.S. EPA has selected a remedy for OU One (contaminated soils and sewer sediments). The ROD for this action was signed on September 11, 1985. This action consisted of removal of contaminated soil and sewer sediments as well as removal of parts of the sewer line and building at the Northernaire site. The design for the action is complete and implementation is underway and is scheduled for completion in September of 1989. The groundwater investigation determined the groundwater contamination from the Northernaire Site had mingled with the groundwater contamination emanating from the Kysor Site. Therefore, U.S. EPA decided to treat the groundwater, using a two-phased approach, to remove the contaminants associated with both sites. Thus the groundwater contamination from both sites are being remediated with one action. There are also other contributors to the groundwater contamination but again the groundwater will be treated for all the contaminants using this two-phased treatment process. There are contaminated soils at the Kysor Site which will be addressed by this action as well. This action will be the second and final action for the Northernaire Site and first and final action for the Kysor Site.

The remedy for the Northernaire/Kysor sites was selected by combining aspects of source control, treatment, site access restrictions, and long-term monitoring. In summary, the selected remedy for the Northernaire/Kysor sites includes a vacuum extraction technique for the soils at the Kysor site and a two stage groundwater remediation process. The first stage will use carbon absorption to remove the hexavalent chromium contamination, while the second stage will be an air stripping process with vapor phase carbon to remove the VOC contamination from the groundwater.

The principal threats posed at the Northernaire/Kysor sites are exposure to contaminated groundwater, contamination of the city wellfield through downward leaching of the contaminated groundwater, and continued contamination of the groundwater by the contaminated soils at Kysor. The selected remedy will address these threats by removal of the VOC contamination in the soils using a vacuum extraction technique, limiting access to the soil contaminated area at Kysor, limiting use of the currently contaminated aquifers, and extraction and treatment of the contaminated groundwater. The selected remedy will provide for long-term monitoring to evaluate the effectiveness of the extraction and treatment system of the groundwater. Also, since the extraction and treatment system could take as long as 64 years, the site will be re-evaluated each 5 years to determine the effectiveness of the selected remedy.

5.0. SITE CS

The RI consisted of on-site scientific studies and laboratory analyses to determine the nature and extent of contamination at the sites and affected areas. During the RI samples were taken from surface and sub-surface soils, groundwater, and residential wells. The RI report for the Cadillac area groundwater, including the Northernaire and Kysor sites, was completed in August 1988. Approximately sixteen (16) chemicals on the U.S. EPA's Hazardous Substances List (HSL) were detected in the various media at the site (Table 5-1). The substances were grouped into inorganics and VOCs. These two groups were then divided into noncarcinogens or carcinogens. The results of the RI are summarized below.

5.1. Groundwater

The nature and extent of groundwater contamination was defined at the site (Figure 5-1). The study identified three aquifers beneath the site, a shallow, intermediate, and deep aquifer, each separated by a clay aquitard. The shallow aquifer is composed of mostly sand and fine gravel with groundwater flow generally in a northeastern direction. The clay aquitard separating the shallow and intermediate aquifers pinches out in the northwestern half of the industrial park leaving the intermediate aquifer unconfined to the surface. The intermediate aquifer is a much thicker sand sequence with areas of coarse gravel. The groundwater flow in the intermediate aquifer is in a north-northwest direction. The shallow and intermediate aquifers appear to have good communication as there is evidence of contaminant flow from the shallow aquifer to the intermediate aquifer. The deep aquifer is similar geologically to the upper two aquifers, but contains more gravel. Groundwater flow direction in the deep aquifer is in a north-northwesterly direction. There is no evidence of communication between the deep aquifer and the intermediate aquifer. The Cadillac city wellfield is located in this deep aquifer.

Groundwater contamination was detected throughout the shallow and intermediate aquifers (see Figure 5-1). This contamination consists of two small hexavalent chromium plumes, emanating from the Northernaire facility, one in the shallow aquifer and one in the intermediate aquifer. Commingled with this hexavalent chromium contamination in the shallow aquifer is a large VOC plume coming from the Kysor plant. This commingling occurs in the intermediate aquifer as well, where a large VOC plume from Kysor has mingled with the hexavalent chromium contamination. Other small VOC contamination plumes originating on the property of Four Star Corporation and Four Winns Company are commingled with these aforementioned hexavalent and VOC plumes creating a collage of hexavalent chromium and VOC contamination in the shallow and intermediate aquifers. At present the deep aquifer is not affected by this contamination.

5.2. Soil

The only soil contamination remaining at either of the sites is VOC contaminated soil just north of the main Kysor plant. The contaminated soils and sediments at the Northernaire facility were removed through an earlier source control remedy (first "operable unit").

The top 6 feet of contaminated soil was excavated at the Kysor site in 1981. The remaining contamination, consisting of VOCs, is from 6 to 25 feet in depth. The highest concentration of contaminants was found to be approximately 150 feet north from the middle of the main Kysor building at a depth of 20 feet. The primary contaminants found included xylene, toluene, ethylbenzene, TCE, and TCA. This contamination is relatively localized.

Numerous samples were taken to establish background levels and contaminant migration. Results did not indicate that off-site soils have been affected by site activity.

Table 5.2 shows indicator chemicals for groundwater and soil contaminants and target cleanup levels (TCLs).

5.3. Air

On-site air sampling and monitoring was conducted during the drilling of the monitoring wells for the groundwater study. Interpretation of the results indicated that on-site or off-site air contamination would not occur unless there is a substantial surface disturbance of the site, particularly in the area of the soil contamination at Kysor. During the construction phase of the remedy controls will be implemented to minimize exposure.

6.0. SUMMARY OF SITE RISKS

The MDNR conducted a risk assessment to determine if the sites pose a potential effect on public health and the environment. The study concluded that the sites presently pose a significant risk to human health through ingestion of contaminated groundwater and if untreated the contaminated groundwater could continue to pose significant future risks. There are also risks associated with possible contamination of the city wellfield, but due to the difficulties in determining the migration of contaminants through the lower aquitard these risks are not quantified.

6.1. Introduction

The risk assessment did use the indicator selection process in the Superfund Public Health Evaluation Manual (SPHEM; U.S. EPA 1986g). The chemicals of concern (Table 6-1) were as follows:

VOLATILE ORGANIC COMPOUNDS

Noncarcinogens	Carcinogens
1,1,1-Trichloroethane	1,1-Dichloroethene
Acetone	1,2-Dichloroethane
Toluene	Methylene Chloride
Trans-1,2-dichloroethene	Tetrachloroethane
	Trichloroethene

Chromium (Hexavalent)
Cyanide

Elevated levels of inorganics such as calcium, sodium, potassium, and magnesium were also found in the shallow and intermediate aquifers. These contaminants are believed to have been caused by salting of roads for ice and dust control. Although they effect water quality, they are not believed to be associated with any manufacturing facility.

Cyanide was not detected in the June and August 1987 sampling events. However, this contaminant was of concern in the Northernaire study because of its presence in plating baths. Low levels of cyanide were detected in Northernaire wells in 1985 (maximum concentration = 22 ppb), and it can be assumed that the recent lower concentrations (non-detects) may be due to the fact that we are now sampling a different portion of the Northernaire plume. Therefore, the maximum value of cyanide detected in 1985 was evaluated in order to assess the potential for that chemical to pose a risk to public health.

6.2. Exposure Assessment

The contaminants of concern identified in the groundwater during the RI were evaluated to determine the level of risk they pose to public health. Due to the absence of contaminants on the surface of the ground in soil or sediments, or in surface water, remaining at either the Northernaire or Kysor sites, the risks for inhalation of contaminants and ingestion of soil or sediment were not assessed quantitatively. Consequently, the only risk assessed quantitatively was the ingestion of groundwater.

6.2.1. Ingestion of Ground Water

The risk assessment made the conservative assumption that the groundwater in both the shallow and intermediate aquifers would be used for a water supply because there are no legal restrictions for groundwater use. The risks associated with groundwater use were estimated based on June and August 1987 groundwater monitoring well data.

Based on the continuous use assumption, the assessment identified a potential risk from drinking water associated with the sites in both the shallow and intermediate aquifers. The plumes of contaminated groundwater addressed by this remedy are limited to the areas shown in Figure 5-1. The groundwater associated with the Northernaire and Kysor sites did contaminate numerous private groundwater supplies. These private wells have since been placed on city water, at the state's expense, to alleviate this initial concern. Groundwater in this area contains VOCs, hexavalent chromium, and cyanide. Certain levels detected exceed the U.S. EPA's Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for drinking water (Table 6-2). Therefore, consumption of the groundwater poses a risk to human health.

The risk evaluation for present groundwater ingestion is summarized in Tables 6-3, 6-4, and 6-5. Groundwater in the shallow aquifer where carcinogens were detected incurred excess lifetime cancer risks ranging from $4x10^{-4}$ to $5x10^{-2}$, while in the intermediate aquifer the lifetime cancer risks incurred from carcinogenic contaminants ranged from $1x10^{-5}$ to $4x10^{-3}$. Non-carcinogenic hazard indices ranged from less than 1 to 11 in the shallow aquifer and the range in the intermediate aquifer was from less than 1 to 66.

Although the risks were not assessed quantitatively, the subsurface contaminated soils at the Kysor site, until remediated, will be a continuing source of groundwater contamination by VOCs. This would add to the actual risk incurred by ingestion of this groundwater.

Another addition to actual risk incurred is the risk of contaminating the city wellfield. This risk is not addressed quantitatively, but could be significant in the years to come if no remediation is done at these sites.

Although these risks are significant, exposure is unlikely to occur at this time. Groundwater on-site in the shallow and intermediate aquifers is currently not used as a drinking water source and the contaminants will be removed as part of the remedy for the site. Residents in the area are connected to a municipal water supply and will not be impacted by the cleanup activity. However, many residents who have been connected to the municipal water supply have retained their old wells for non-consumptive uses.

6.3. Toxicity Assessment

The assessment addressed contaminants in terms of two categories of toxicity; carcinogenic and noncarcinogenic health effects. Carcinogenic Potency Factors (CPFs) and Reference Dose Factors (RfDs) for the chemicals detected at the sites which have these values are presented in Table 6-6.

6.4. Summary of Risk Characterization

The risk assessment for the Northernaire and Kysor sites addressed the most critical risks to public health, however the risk characterization for some compounds and pathways were not quantified. Standards or critical toxicity values do not exist for every chemical detected at the site. Therefore, all exposure pathways and their associated routes of exposure could not be quantified.

The adverse potential risks associated with the sites are summarized below.

Groundwater

There are no current exposures associated with groundwater, but if residential wells were installed on-site, residents would be exposed to an excess lifetime cancer risk ranging from $4x10^{-4}$ to $5x10^{-2}$ in the shallow aquifer and a range of $1x10^{-5}$ to $4x10^{-3}$ for the intermediate aquifer. The residents would also be exposed to concentrations of noncarcinogens at levels that exceed their respective RfDs.

The risk assessment assumed that a 70-kg adult would drink 2 liters of groundwater per day over a 70-year lifetime, and a 35-kg child would drink 1 liter of groundwater per day over a 10-year span. All toxicokinetic factors were assumed to be 1.

Limitations and Assumptions

The risk assessment is based on a variety of factors including:

* Sampling and analysis
* Fate and transport estimation
* Exposure estimation
* Toxicological data
* Possible synergistic/antagonistic effects
* Additional routes of exposure

Within the limits of these assumptions and factors this risk characterization does present an accurate representation of the present and future potential for risk to public health posed by the contaminated soils and groundwater in the Cadillac area.

6.5. Analytical Methods

Cancer potency factors (CPFs) have been developed by U.S. EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$ or 1E-6). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Reference doses (RfDs) have been developed by U.S. EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the Rfds will not underestimate the potential for adverse noncarcinogenic effects to occur.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as a hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

6.6. Potential Future Risks

The Northernaire site is no longer in operation and the soil contamination has been remediated (first "operable unit") removing any further source of groundwater contamination by hexavalent chromium and cyanide. The Kysor facility is still in operation and current waste handling procedures should prevent any new contamination from occurring at the facility. However soil contamination still remains at the Kysor site and a major remedial action objective for the Kysor site is to remove the continuing source of VOC contamination of the groundwater. Although the groundwater is not being used for drinking water purposes, there is still a potential threat of migration of the contamination off-site to the north into residential areas or areas which could be developed for residential use. There is also the significant threat of contaminating the city wellfield.

To evaluate future risks posed at the sites from ingestion of contaminated groundwater, contaminant concentrations were modeled to theoretical receptor locations on the projected center line of the plumes at 13th street (see Figure 6-1). Using various modeling techniques the arrival time of the plume at its receptor well was estimated as well as the length of time the plume would remain at its receptor well before migrating past the receptor location. Maximum and average concentrations were calculated in order to determine average and worst-case scenarios for future risk assessment assuming no remediation would be performed at the sites. Using these methods residents drinking the groundwater in the future would be exposed to excess lifetime cancer risks ranging from 7×10^{-5} to 1×10^{-3} for the shallow aquifer and $6x10^{-5}$ to $5x10^{-3}$ for the intermediate aquifer for at least another 10 to 15 years. Noncarcinogenic hazard indices for future consumption of the groundwater would range from less than 1 to 1.29 in the shallow aquifer and in the intermediate aquifer the range is from less than 1 to 17.14, indicating there would still be significant risks in the years to come if no remediation is done at the sites. The risk evaluation for future groundwater ingestion is summarized in Tables 6-7 and 6-8.

Again the major concerns at the sites are the large groundwater contamination plumes in the shallow and intermediate aquifers. These concerns shall be addressed through implementation of the selected groundwater treatment remedy.

7.0. DOCUMENTATION OF SIGNIFICANT CHANGES

This Record of Decision selects an extraction, treatment and discharge system for cleanup of the contaminated groundwater. Groundwater Alternative 3A using Carbon Adsorption for treatment of the chromium and Soil Alternative 5, as described in the Proposed Plan and later in this ROD, will be use to remediate the Northernaire and Kysor sites. The U.S. EPA has reviewed and responded to all relevant comments received from the interested parties, including those from the State and community, during the public comment period. Comments were made on the selected alternatives as well as other remedial alternatives. Based on the public comments, the U.S. EPA has determined that there is no need for any significant changes to Groundwater Alternative 3A with Carbon Adsorption, and Soil Alternative 5.

In the event that additional data or information during the design of the remedy reveals the need for a modification, the U.S. EPA will notify the public of any changes to the remedy presented here in this Record of Decision in accordance with applicable law and Agency guidance.

8.0. DESCRIPTION OF ALTERNATIVES

Based on information gathered during the RI, MDNR in cooperation with U.S. EPA completed a FS that involved reviewing all possible remedial methods, and identifying and evaluating several remedial alternatives to address concerns related to the Northernaire and Kysor sites.

The FS presented a detailed analysis of four alternatives for remediation of the contaminated groundwater and six alternatives for the remediation of the contaminated soils at Kysor. The evaluation considered the effectiveness of each alternative in minimizing potential risks and future threats posed by the sites. It also estimated the costs and implementation time associated with each alternative. A brief summary of each alternative is presented below.

8.1. Groundwater Alternatives

Due to the commingling plumes of groundwater contamination, the groundwater treatment would need to be in two stages. The VOC and hexavalent chromium contaminants differ considerably and cannot be treated by the same process. Therefore, the groundwater remediation would require one treatment for hexavalent chromium and a separate treatment for the VOC contamination. However, both of these treatments would be conducted in the same treatment facility.

All of the alternatives considered for groundwater remediation, except the "no action" alternative, would include the following:

Groundwater Extraction System: This would consist of a system of pumping wells for extraction of groundwater in the shallow and intermediate aquifers. These extraction wells would be strategically located to intercept contaminated groundwater. An underground piping system would interconnect the extraction wells and transport the extracted groundwater to the VOC and hexavalent chromium treatment facility.

Hexavalent Chromium Treatment: There are two options which can be utilized to treat the hexavalent chromium. One of these two options would be included in all of the treatment alternatives. They are as follows:

Option 1 - Ion Exchange

This treatment would require the extracted groundwater to be run through a treatment process where toxic metals salts including chromium, and ions are electrostatically bound to a solid resin material and removed from solution. The resulting residuals include spent resins which would be regenerated on-site by washing with caustic and acid solutions. This regeneration would produce about 500 gallons of chromium waste per day requiring off-site disposal.

Time to Implement:	18-21 months
Capital Cost:	$ 271,000
Annual O & M Cost:	$ 977,000
Total Present Worth Cost:	$1,248,000

Option 2 - Carbon Adsorption

The hexavalent chromium-contaminated groundwater would be passed through an activated carbon filtering system in this treatment process. The activated carbon selectively adsorbs organics and certain metals such as chromium by a surface attraction phenomenon that binds organic molecules to available carbon pores. This process would produce 15,000 pounds of spent carbon, used in the filtering process, per year for disposal.

Time to Implement:	18-21 months
Capital Cost:	$140,000
Annual O & M Cost:	$364,000
Total Present Worth Cost:	$504,000

Treated Groundwater Discharge: As a component of the groundwater treatment alternatives, treated water would be discharged to the Clam River. Discharge to the river would require construction of a force main constructed of polyvinyl chloride (PVC) piping.

Groundwater Monitoring: Groundwater would be monitored from the existing monitoring wells to determine effectiveness of the extraction system and plume migration. This would include sampling of the monitoring wells annually.

The major components of the groundwater alternatives are described below.

8.1.1. Groundwater Alternative 1 - No Action

The no-action alternative consists solely of groundwater monitoring and a five-year review for the site. A monitoring program, inspection/ maintenance program, and contingency plan would be implemented. This alternative would allow the groundwater plumes at the Cadillac Industrial Park to disperse and dilute by natural mechanisms. A groundwater monitoring plan would be necessary to periodically assess the fate and transport of the contaminant plumes. A five-year review would be done to determine whether public health and the environment are protected.

Time to Implement:	None
Capital Cost:	$ 0
Annual O & M Cost:	$824,000
Total Present Worth Cost:	$824,000

8.1.2. Groundwater Alternative 2 - Extraction, Hexavalent Chromium Treatment, UV/Oxidation and Discharge

This alternative would include extraction, a treatment for the hexavalent chromium contamination, and discharge as described previously. Additionally, a ultraviolet (UV) light/oxidation treatment would be utilized for treatment of the VOC contamination.

The UV/oxidation treatment would chemically oxidize the organic compounds in the groundwater using a combination of UV light, ozone, and/or hydrogen peroxide. Ozone and hydrogen peroxide are powerful oxidants of organic compounds in water.

There are four main components of a UV/oxidation system: an air compressor, an ozone generator, a reactor tank, and an electrical source for the UV lamp bulbs. The system would utilize a baffled UV/ozone contactor, within which the UV bulbs are mounted inside quartz sheets. Ozone is diffused into the bottom of the contactor, and allowed to make contact with the contaminated water in the presence of UV light. A manifold attached to the contactor collects any residual ozone from the process and catalytically converts it back to molecular oxygen. Hydrogen peroxide may be added to the influent stream prior to entering the contactor. Hydrogen peroxide and ozone are oxidants that can be utilized separately or in combination to achieve maximum oxidation conditions. This system could be fully automatic, has no filtering or adsorption medium to dispose of or regenerate, and treats groundwater contaminated with VOCs without air emissions or generation of hazardous wastes.

Time to Implement: 18-21 months

Using Ion Exchange for Hexavalent Chromium Treatment:

Capital Cost:	$ 6,115,000
Annual O & M Cost:	$32,358,000
Total Present Worth Cost:	$38,473,000

Using Carbon Adsorption for Hexavalent Chromium Treatment:

Capital Cost:	$ 5,935,000
Annual O & M Cost:	$31,611,000
Total Present Worth Cost:	$37,546,000

8.1.3. Groundwater Alternative 3 - Extraction, Hexavalent Chromium Treatment, Air Stripping and Discharge

This alternative would include extraction, a treatment for the hexavalent chromium contamination, and discharge as described previously. Additionally, an air stripping treatment would be utilized for treatment of the VOC contamination.

The air stripping treatment is the mass transfer of VOCs from the liquid (water) phase to the gas (air) phase. The liquid waste is descended through a packed tower. Air is supplied by a blower or compressor that is introduced to the bottom of the tower. The packing material functions to increase the area of contact between the air and the descending liquid waste. As the liquid waste descends through the packed tower the organics are transferred from the liquid phase to the gas phase. Air stripping requires treatment of gases generated during the process. There are two methods of air stripping which could be implemented at these sites. They are as follows:

8.1.3(A). Air Stripping with Vapor-Phase Carbon Adsorption

This method of air stripping treats the off-gases with a vapor phase carbon filtering system. This system would consist of two stripping columns operating in series. The first air stripper would be designed to remove 99 percent of the VOCs from the liquid phase. The second air stripper would reduce VOC concentrations to meet the liquid-phase effluent discharge requirements. The second stripper would provide a 50:1 air-to-water ratio which would not need treatment of the off-gases. However, vapor-phase treatment is required for the off-gases from the first air stripper, which would be accomplished by a vapor-phase carbon adsorption unit. This vapor-phase unit uses a carbon filtering system which would be regenerated in-situ and avoids the need for off-site disposal of spent carbon.

Time to Implement:	18-21 months
Using Ion Exchange for Hexavalent Chromium Treatment:	
Capital Cost:	$ 4,414,000
Annual O & M Cost:	$11,637,000
Total Present Worth Cost:	$16,051,000

Using Carbon Adsorption for Hexavalent Chromium Treatment:	
Capital Cost:	$ 4,234,000
Annual O & M Cost:	$10,890,000
Total Present Worth Cost:	$15,124,000

8.1.3(B). <u>Air Stripping with Liquid-Phase and Vapor-Phase Carbon Adsorption</u>

This method of air stripping would use only one stripping column. The contaminated vapor exiting the column would be treated by vapor-phase carbon adsorption, as described in the first air stripping system. Water that discharges from the base of the stripper would be pumped to the carbon adsorption beds for liquid-phase carbon adsorption treatment. Approximately 225,000 pounds of spent carbon would be produced per year for disposal at an off-site RCRA facility.

Time to Implement:	18-21 months
Using Ion Exchange for Hexavalent Chromium Treatment:	
Capital Cost:	$ 4,959,000
Annual O & M Cost:	$16,174,000
Total Present Worth Cost:	$21,133,000

Using Carbon Adsorption for Hexavalent Chromium Treatment:	
Capital Cost:	$ 4,779,000
Annual O & M Cost:	$15,427,000
Total Present Worth Cost:	$20,206,000

8.1.4. <u>Groundwater Alternative 4 - Steam Stripping</u>

This alternative would include extraction, a treatment for the hexavalent chromium contamination, and discharge as described previously. Additionally, a Steam Stripping treatment would be utilized for treatment of the VOC contamination.

As with air stripping, steam stripping operates on the principle of mass transfer of organics from the liquid phase to the vapor phase. This method also occurs in a packed tower, but instead of using air, steam is used in the packed tower. The contaminated steam, which passes out through the top of the column, is condensed to a liquid and decanted to produce a concentrated liquid stream that must be treated and/or disposed at an off-site permitted facility. Approximately 231 gallons per hour of concentrated organics would be produced for disposal at an off-site RCRA facility.

Time to Implement: 18-21 months

Using Ion Exchange for Hexavalent Chromium Treatment:

Capital Cost:	$ 4,590,000
Annual O & M Cost:	$17,708,000
Total Present Worth Cost:	$22,298,000

Using Carbon Adsorption for Hexavalent Chromium Treatment:

Capital Cost:	$ 4,410,000
Annual O & M Cost:	$16,961,000
Total Present Worth Cost:	$21,371,000

8.2. Soil Alternatives

8.2.1. Soil Alternative 1 - No Action

This alternative consists of establishment of institutional controls, development of a site inspection and maintenance plan, installation of a perimeter surface barrier, and a five-year review for the site. Institutional controls (e.g., deed and land restrictions) would be necessary to restrict future site use for the protection of public health. These controls would restrict site activities of the current site owners/operators, as well as alert future owners to potential site-related risks. Additional fencing would need to be installed at Kysor to restrict access. A five-year review would be done to determine whether public health and the environment are protected.

Time to Implement:	None
Capital Cost:	$ 24,500
Annual O & M Cost:	$138,500
Total Present Worth Cost:	$163,000

8.2.2 Soil Alternative 2 - Surficial Capping and Subsurface Containment Wall

This alternative consists of installation of a surficial cap and a subsurface slurry wall to contain contaminated soils at Kysor.

The slurry wall would be constructed in an excavated trench and would be tied in to the low-permeable underlying clay layer about 90 feet below the ground. It would completely surround the contaminated soils.

To prevent rainfall seepage into the contaminated soils a multilayer cap would be constructed to cover the area encircled by the slurry wall. This cap would consist of 24 inches of low-permeability clay, followed by a synthetic liner. The liner would be covered with a minimum 12-inch permeable drainage layer and 24 inches of soil, which would support a topsoiled vegetative layer to reduce the potential for soil erosion.

Time to Implement:	24-30 months
Capital Cost:	$1,050,000
Annual O & M Cost:	$ 125,000
Total Present Worth Cost:	$1,175,000

8.2.3. Soil Alternative 3 - Excavation and Low-Temperature Thermal Stripping

This alternative would consist of excavation of contaminated soils and treatment of these soils by low temperature thermal stripping.

Low temperature thermal stripping is a treatment method that uses temperatures typically 150 to 700°F to remove adsorbed contaminants from the soils. The thermal stripping unit consists of a process feed system, large rotating drum (kiln), and a temperature-controlled burner system. The thermal stripping unit is operated under controlled conditions, and will generate emissions such as particulates, water vapor, VOCs, and products of incomplete combustion. To prevent these emissions from being released into the environment, gaseous emission control equipment will be required. Process emissions are typically controlled using an afterburner to thermally destroy the contaminants, or vapor-phase carbon adsorption. If vapor-phase activated charcoal canisters are employed in the emission control, the canisters will be transported and treated off-site.

The contaminated soils at Kysor would be excavated and burned in a thermal stripping unit to remove the VOC contamination. The clean soil would be backfilled and disposed of onsite. Any emissions from this process would be treated, either captured or burned, in an afterburner emission control unit.

Time to Implement:	24-27 months
Capital Cost:	$8,600,000
Annual O & M Cost:	$ 0
Total Present Worth Cost:	$8,600,000

8.2.4. Soil Alternative 4 - In-situ Soil Flushing

The contaminated soils would be flushed with water causing migration of the VOC contamination from the soil into the groundwater where it would be treated by one of the onsite groundwater treatments described earlier.

The soil-flushing system would consist of infiltration piping installed above the zone of contaminated soils. A source of flushing water would be provided at the Kysor site. The water would be flushed through the affected soils and subsequently discharge to groundwater. The contaminated groundwater would be collected using groundwater recovery wells and treated at the onsite groundwater treatment facility proposed for groundwater remediation.

Time to Implement:	21-27 months
Capital Cost:	$154,000
Annual O & M Cost:	$ 71,000
Total Present Worth Cost:	$225,000

8.2.5. Soil Alternative 5 - In-situ Vacuum Extraction

This alternative would entail vacuum extraction of the soil contaminants by placing a series of wells to circulate soil gas within the unsaturated zone of the contaminated soil. A series of induction and extraction wells would be installed to the water table at the Kysor site. A gas induction blower system would force clean gases into the unsaturated zone and soil pore spaces. These purging gases volatilize the VOCs from the soil. At the same time, the vacuum extraction system would be withdrawing the contaminated gases from the unsaturated zone. These contaminated gases are treated by emission control equipment before being released to the atmosphere.

Time to Implement:	21-27 months
Capital Cost:	$925,000
Annual O & M Cost:	$ 0
Total Present Worth Cost:	$925,000

8.2.6. Soil Alternative 6 - Soil Excavation and Onsite Incineration

This alternative would consist of excavating the contaminated soil and incineration of this soil onsite.

Thermal destruction is a treatment method that uses high temperature to oxidize contaminants under controlled conditions, thereby degrading a substance into products that generally include carbon dioxide, water vapor, sulfur dioxide, hydrochloric acid gases, and process ash. The hazardous products of the thermal destruction/incineration unit (e.g., particulates, sulfur dioxide, nitrogen oxide, hydrochloric acid, and products of incomplete combustion) require air pollution control equipment to prevent release into the environment. Thermal destruction methods can be used to destroy organic contaminants in liquid, gaseous, and solid wastestreams.

The contaminated soils would be excavated and staged for onsite incineration. A mobile incinerator would be installed at the Kysor site, and all contaminated soils would be incinerated. If delisted and considered nonhazardous, the residual ash will be disposed of at Kysor using backfilling methods. If not delisted the residual ash would be disposed of in a RCRA landfill.

Time to Implement:	25-27 months
Capital Cost:	$14,300,000
Annual O & M Cost:	$ 0
Total Present Worth Cost:	$14,300,000

9.0. SUMMARY OF COMPARATIVE ANALYSIS OF

The alternatives are evaluated by balancing technical considerations (implementability) with the cost and protectiveness (effectiveness) of the alternatives. This evaluation determines the most cost-effective alternative that will meet the objectives of the feasibility study for implementation at the Northernaire/Kysor sites. The alternatives are evaluated against the nine criteria recommended by U.S. EPA (U.S. EPA, 1987). The criteria are as follows:

1) **Overall protection of human health and the environment.** U.S.EPA measures each alternative against how it protects human health and the environment and describes how threats are eliminated, reduced, or controlled through treatment, engineering methods (e.g., a soil and clay cap), or institutional controls (e.g., deed restrictions).

2) **Compliance with state and federal regulations.** The alternatives are evaluated for compliance with those environmental regulations determined to be applicable, or relevant and appropriate to the site.

3) **Long-term effectiveness.** Long-term effectiveness relates to the remedy's ability to maintain reliable protection of human health and the environment over time once it has been implemented.

4) **Reduction of contaminant toxicity, mobility, and volume.** U.S. EPA evaluates each alternative based on how it reduces (1) potential threats to human health and the environment, (2) the contaminant's ability to move, and (3) the amount of contamination.

5) **Short-term effectiveness.** Implementing each alternative may take varying lengths of time and present different risks to human health and the environment during implementation (e.g., will contaminated dust be produced during soil excavation?).

6) **Implementability.** U.S. EPA considers the technical (e.g., how difficult is the alternative to construct and operate?) and administrative (e.g., coordination with other government agencies) feasibility of a remedy, including the availability of goods and services.

7) **Cost.** The benefits realized by implementing a remedial alternative are weighed against the cost of implementation.

8) **State acceptance.** After reviewing the Remedial Investigation and Feasibility Study reports, the state may concur with, oppose, or have no comment on U.S. EPA's proposed plan for cleaning up a site.

9) **Community acceptance.** U.S. EPA considers community response to the proposed cleanup plan and the other remedial alternatives when selecting the final remedial action.

9.1. Overall protection of human health and the environment

9.1.1. Groundwater Alternatives

With the exception of the No-Action alternative (Groundwater Alternative #1), each alternative would protect human health and the environment.

Both technologies for treatment of the hexavalent chromium contamination Option 1 (Ion Exchange) and Option 2 (Carbon Adsorption) would be protective by reducing the chromium ions to the levels required by MDNR limitations for discharge to the Clam River. Because state levels are below the MCLs and Ambient Water Quality Criteria (AWQC), discharge concentrations would be considered protective of human health and the environment.

Groundwater Alternative 3(A) would protect human health by reduction of the VOC contamination in the groundwater through treatment, to meet the cleanup goals as outlined later in this section. This would minimize potential risks from ingesting VOC contaminated groundwater through a reduction of contaminant concentrations to acceptable levels. Because the cleanup goals are set at levels protective of public health and the environment, no adverse impacts would occur due to exposure to the effluent.

Groundwater Alternatives 2, 3(B), and 4, would also be protective by reducing VOC contamination to acceptable levels through treatment.

Under Groundwater Alternative 1, no remedial action would be conducted at the site, and therefore risk to human health and the environment as identified in the risk assessment would not be reduced. As this alternative is judged to not be protective of human health, Groundwater Alternative 1 will be dropped from further consideration or discussion.

The cleanup levels, which will be used to determine protectiveness, for each of the groundwater treatment alternatives are outline for the indicator contaminants as follows:

COMPOUND	TARGET CLEANUP LEVELS (ug/l)
1,1,1-Trichloroethane	200
Trans-1,2-dichloroethylene	70
1,1-Dichloroethylene	5
1,2-Dichloroethane	5
Methylene chloride	5
Tetrachloroethylene	1
Trichloroethylene	5
Chromium (Hexavalent)	50
Xylene	440
Toluene	40

These levels were calculated so that the cleanup level for each contaminant meets or exceeds Maximum Contaminant Levels (MCLs) required by the Safe Drinking Water Act and the additive risk of all contaminants falls within U.S. EPA's acceptable risk range of $1x10^{-4}$ to $1x10^{-7}$.

9.1.2. Soil Alternatives

Soil Alternative 5 by reducing the VOC soil contamination through treatment would provide adequate protection to human health and the environment. Risks to public health would be reduced due to the minimization of organic chemicals present in the soils, and therefore eliminating the source for continuing groundwater contamination. This alternative would result in an improvement in the environment over current site conditions.

Soil Alternatives 3 and 6 would be very protective of human health and the environment by completely eliminating the soil contamination through excavation and incineration. Therefore these alternatives would eliminate the source of groundwater contamination at the Kysor site, reducing future site risks to public health.

Soil Alternative 4 would eliminate the risks associated with soil contamination, but would flush the contaminants into the groundwater, thus requiring groundwater treatment in order to be protective of human health and the environment.

Soil Alternative 2 would reduce risks by capping and containing the soil contaminants and would be more protective than current site conditions. However, most of the risks incurred at this site from the soils are as a source of groundwater contamination. Soil Alternative 2 would not permanently remove the soil contamination and therefore is not as protective as Soil Alternatives 3, 4, 5, or 6.

Under Soil Alternative 1, no remedial action would be conducted at the site, and therefore risk to human health and the environment as identified in the risk assessment would not be reduced. As this alternative is judged to not be protective of human health, Groundwater Alternative 1 will be dropped from further consideration or discussion.

The cleanup levels, which will be used to determine protectiveness, for each of the soil treatment alternatives are outlined for the indicator contaminants as follows:

COMPOUND	TARGET CLEANUP LEVELS (mg/kg)
Trichloroethylene	0.07
Xylene	141.00
1,1,1-Trichloroethane	7.60
Toluene	724.00

Soil cleanup levels were calculated so that residual contamination in the soil will not result in a continuing source of contamination to the groundwater above groundwater cleanup levels.

9.2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

9.2.1. Groundwater Alternatives

All groundwater treatment alternatives will meet MCL's under the Safe Drinking Water Act (SDWA). The SDWA is considered to be relevant and appropriate to the treatment of groundwater. All alternatives will also comply with construction and operating standards required by the Michigan Safe Drinking Water Act and the emission standards of the Clean Air Act and Michigan Air Pollution Control Act 348.

Both hexavalent chromium treatment options would create hazardous waste for off-site disposal. This waste shall be handled, treated, and/or disposed as a RCRA hazardous waste pursuant to federal RCRA regulations and the Michigan Hazardous Waste Management Act 64. Disposal shall occur in a fully permitted RCRA facility and transported in accordance with RCRA, Department of Transportation, and Michigan transportation regulations. Alternatives 3(B) and 4 would also produce hazardous waste which shall be handled in compliance with these regulations.

Alternatives 2, 3(A), 3(B), and 4 shall meet all ARARS pertaining to groundwater quality by collecting and treating the contaminated groundwater. These alternatives shall incorporate a groundwater treatment system which shall be designed to produce effluent that meets the substantive requirements of a NPDES permit and Michigan Wastewater Discharge Permit Rules.

The discharge limitations were developed by the State in order to be protective of the Clam River. The discharge applicable to all of the groundwater treatment alternatives shall be as follows:

COMPOUND	DISCHARGE LIMITATION
Trichloroethylene	20 ug/l
1,1,1-tricholorethane	10 ug/l
Total Benzene + Toluene + Xylene(s)	20 ug/l
Total Chromium	52 ug/l
Hexavalent Chromium	6 ug/l

Other discharge limitations may be applicable depending on the treatment technology. These limitations shall be part of meeting the substantive requirements of a NPDES permit and the Michigan Wastewater Discharge Permit Rules.

Groundwater monitoring, extraction, and treatment under all alternatives shall be consistent with RCRA Corrective Action Monitoring.

ARAR requirements are further discussed in Sections 10 and 11.

9.2.2. Soil Alternatives

All of the Soil Alternatives shall comply with RCRA and Michigan facility design and operating standards, Michigan hazardous waste monitoring regulations, and OSHA Standards for Hazardous Waste Operations. Fugitive emissions from grading and excavation shall be controlled so that the CAA and Michigan Air Pollution Control Act 348 regulations are not exceeded.

Soil Alternatives 3, 4, 5, and 6 shall achieve the cleanup standards established in Section 9.1 thus reducing the risks associated with continuing groundwater contamination by reducing the amount of contamination in the soil through treatment.

Soil Alternative 2 shall achieve the requirements of health based TBC criteria for soil by using a cap and containment wall to prevent direct contact with the contaminated materials. This cap and containment wall shall also limit the migration of this soil contamination into the groundwater, however, it would not eliminate it.

Soil Alternatives 3, 5, and 6 shall comply with the substantive requirements of the CAA and Michigan Air Pollution Control Act 348 regulations to control emission rates, quantities of emissions, fugitive dust and particulates. These three alternatives would also generate hazardous wastes and shall therefore comply with RCRA, Department of Transportation, and Michigan generator and transporter regulations by proper handling of the hazardous waste.

Soil Alternatives 3 and 6 shall excavate contaminated soils and would therefore comply with RCRA Closure/Post Closure regulations and Michigan Hazardous Waste Management Act 64. The cap design and construction of the containment wall of Soil Alternative 2 shall comply with RCRA and Michigan landfill regulations.

Soil Alternative 6 would use an incinerator and would comply with RCRA and Michigan requirements for incinerators.

Potential ARARs for all of the soil and groundwater alternatives are summarized in Table 9-1, and further discussion is located in Section 10 and 11.

9.3. Long-Term Effectiveness

9.3.1. Groundwater Alternatives

Both of the hexavalent chromium treatment options would equally provide long-term effectiveness and permanence. Since these treatments would only be necessary for approximately 4 years to reduce the hexavalent chromium to acceptable levels they both provide the necessary permanence.

All of the Groundwater Alternatives are permanent remedies and therefore provide for long-term effectiveness. Groundwater Alternative 3(A) is comparable to 2, 3(B), and 4 in the long-term effectiveness and permanence it affords. These remedies involve long-term treatment of groundwater in excess of 60 years. All of these groundwater alternatives would include an extraction, treatment, and discharge system which would require long-term operation and maintenance. Although it appears unlikely that the shallow or intermediate aquifer groundwaters would be used, all these alternatives would have to provide for long-term restrictions of groundwater use of these two aquifers. This would be done using institutional controls (i.e., deed restrictions).

9.3.2. Soil Alternatives

A permanent remedy for the soils is feasible at the Kysor site. Soil Alternative 5 affords comparable long-term effectiveness and permanence to Soil Alternative 4. Both are permanent remedies for treatment of the VOC soil contamination. No long-term maintenance would be required for either alternative. Soil Alternative 4 would require limited monitoring to verify the effectiveness of the treatment.

Soil Alternative 5 would exceed the long term effectiveness of Soil Alternative 2. Soil Alternative 2 would minimize the amount of contaminants leaching to the groundwater; however, additional degradation of groundwater is possible. Also the surficial cap and subsurface containment wall may require replacement after 20 to 30 years.

Soil Alternatives 3 and 6 provide very good long-term effectiveness and permanence of the alternatives. Since excavation is being performed in both of these alternatives the contaminants are being removed and no long-term management would be required.

9.4. Reduction of Toxicity, Mobility, and Volume

9.4.1. Groundwater Alternatives

Carbon Adsorption would reduce the mobility of hexavalent chromium in the extracted groundwater as would the Ion Exchange treatment. These treatments would reduce the concentration of the chromium in the groundwater to acceptable levels. The mobility of the chromium contamination would be reduced through the transfer of the contaminants from the groundwater to the spent carbon and resin residuals. The Ion Exchange treatment would produce approximately 200,750 gallons of hazardous regeneration waste per year, while Carbon Adsorption would produce about 15,000 pounds of spent carbon. Both of these residuals would be disposed in offsite RCRA facilities and would not pose risks at the site.

All of the treatment alternatives for groundwater, Groundwater Alternatives 2, 3(A), 3(B), and 4, would reduce the mobility of VOC contamination in the groundwater through treatment. The mobility of the VOC contamination would be reduced through the transfer of the VOC contaminants from the groundwater to the treatment residuals. The differences lie in the amounts of residual hazardous waste created in these treatment processes. Groundwater Alternative 3(A) would avoid the need for any off-site disposal of spent carbon consequent to thermal regeneration of the carbon in-situ, while Groundwater Alternative 3(B) would produce 225,000 pounds of spent carbon for off-site disposal. Groundwater Alternative 2 would not produce a secondary wastestream or air emissions requiring treatment. Steam stripping, Groundwater Alternative 4, would produce approximately 84,000 gallons of concentrated organic condensate per year requiring off-site disposal. None of these residuals produced would pose risks at the site due to regeneration onsite or offsite disposal.

9.4.2. Soil Alternatives

The mobility of the VOCs in the soils would be permanently reduced using Soil Alternative 5. Through filtration of the off gases the contamination would be transferred from the soils to residual carbon. Comparably, Soil Alternative 4 would remove the VOCs from the soils and transfer the contaminants to the groundwater, thus permanently reducing the mobility of the contaminants in the soil. However, implementation of Alternative 4 would increase the toxicity, mobility, and volume of groundwater contaminants.

Through excavation the toxicity, mobility, and volume of the soil contaminants would be permanently reduced in Soil Alternatives 3 and 6.

Soil Alternative 2 would not reduce the toxicity or volume of the contaminants in the soils at Kysor. Soil Alternative 2 would however, reduce the mobility of the contaminants through containment.

9.5. Short-Term Effectiveness

9.5.1. Groundwater Alternatives

The hexavalent chromium treatment options would reduce chromium to acceptable level in 4 years. All of the groundwater alternatives would need an excess of 60 years to reduce VOC contamination in the intermediate aquifer to acceptable levels.

The only short term hazards posed by the hexavalent chromium options would be minor construction hazards. For carbon adsorption slight risks would be incurred when handling the spent carbon. Ion Exchange would pose slightly greater risks during handling of the acid and caustic solutions.

Alternative 3(A) would provide no short-term community or worker health impacts, again except for minor construction hazards. These hazards can be effectively mitigated by careful construction techniques. The workers on-site will also have appropriate personal protection. Alternative 2 would be very comparable in short-term risks.

Alternatives 3(B) and 4 would include short-term risks associated with the handling of hazardous waste materials. Proper safety techniques can effectively reduce these risks.

9.5.2. Soil Alternatives

The alternative providing the best short-term effectiveness is alternative 2. Protection provided by this alternative would be achieved in one year. Alternative 3 could provide soil remedial response objectives in approximately 14 months. Alternative 6 would require about 22 months. Alternatives 4 and 5 would need approximately 2 years to reach soil remedial response objectives.

However, the alternatives which reach the soil cleanup goals the soonest, alternatives 2, 3, and 6, also provide the greatest short-term risks to workers through dermal exposure to contaminated soils, or inhalation of VOCs. These three alternatives also produce fugitive dust and VOC emissions which could potentially effect workers or the general public. Through the required proper monitoring and dust control measures these risks can be mitigated.

Alternative 5 would also incur short-term risks to workers through dermal contact or inhalation of dusts or vapors when drilling the extraction wells. These risks can be eliminated through proper safety procedures and equipment.

Soil Alternative 4 would incur the least risk of any of the soil alternatives to on-site workers during implementation because it involves no soil excavation and has limited potential for contact with contaminated soils. It poses a high potential for risk to the environment and groundwater receptors because the migration of contaminants into groundwater is being promoted.

9.6. Implementability

9.6.1. Groundwater Alternatives

Both the Hexavalent Chromium Treatment options are readily implementable at these sites and should require approximately equal times to implement, 18-21 months. Most of this time would be spent constructing the groundwater extraction system with only a few days needed for construction of the treatment facility. This treatment facility would include the treatment for the VOC contamination.

All of the treatment alternatives for VOC groundwater contamination, Groundwater Alternatives 2, 3(A), 3(B), and 4 are technically feasibly for these sites and the equipment is readily available. Implementation would consist of construction of a treatment facility in each case, and would take approximately 18-21 months, again with most of the time spent on constructing the extraction system.

Implementation of these treatment alternatives could be complicated by the amount of piping necessary to connect all of the necessary extraction wells to the treatment plant as well as the piping needed for the discharge to the Clam River. The rights to place this piping across private land must be obtained.

9.6.2. Soil Alternatives

Soil Alternative 5 would require construction of a soil gas collection system. The hydrogeology of the Kysor site is well-suited to the vacuum extraction of soil gas. The sandy soils present are highly permeable. The relatively shallow water table limits the cost of well installation. Site access would not restrict placement of wells. This implementation would take approximately 21-27 months.

Soil Alternative 2 would require the installation of a surficial cap and slurry wall. A deep trench would need to be excavated to the clay aquitard approximately 60-90 feet. Materials for construction are readily available and the land at Kysor is relatively flat and accessible to construction equipment. Implementation is estimated at 24-30 months.

Soil Alternative 4 would be easily installed. A soil-flushing system is readily available. This system would consist of a series of infiltration pipes overlain by a coarse aggregate drainage layer, filter fabric, and vegetated soil cover. It would require approximately 21-27 months to implement.

Soil Alternatives 3 and 6 would require excavation of all of the contaminated soils at the Kysor site. Soil Alternative 3 would require mobilization and installation of the thermal-stripping unit prior to excavation. If a thermal afterburner is used some complications could occur with the off-gas process systems. The equipment for this alternative is available and 24-27 months would be required for implementation.

Soil Alternative 6 would require mobilization, construction, and operation of the mobile on-site incinerator in addition to the excavation of the soils. A test burn would be necessary during the start-up phase to determine operational parameters. On-site incineration often presents a material handling challenge. This alternative would pose the greatest equipment problems, and would need 25-27 months to implement.

9.7. Cost

9.7.1. Groundwater Alternatives

Cost is a major factor in deciding which of the Groundwater Alternatives to choose in remediation of these two sites. All of the alternatives are protective, comply with ARARs, and provide a permanent remedy by reduction of the contamination through treatment. There are tradeoffs in short-term effectiveness and implementability but these differences are not major.

Ion Exchange is slightly more costly than Carbon Adsorption for treatment of the hexavalent chromium contamination due to the generation of more hazardous waste for disposal.

Alternative 3(A) is the least costly of the groundwater alternatives, while 3(B) is slightly more costly due to generation of spent carbon for disposal.

Alternative 4 is just slightly more costly than alternative 3(B) due to the generation of more volume of hazardous waste for off-site disposal.

Alternative 2 is the most costly of the groundwater alternatives due to a more expensive treatment process.

9.7.2. Soil Alternatives

Cost is not a determining factor in the Soil Alternatives since there is considerable variance in the long-term effectiveness and permanence of the soil remedies, as well as reduction of TMV, short-term effectiveness, and implementability. However, all soil remedies are protective and could comply with ARARs.

The least costly of the soil alternatives is Alternative 4, due to low capital costs and maintenance. This remedy may cause the cost of the Groundwater Alternative to increase due to a possible need for longer operation of the chosen Groundwater Alternative.

Alternative 5 is slightly more costly due to higher capital costs, but it has no major maintenance or operating costs.

Alternative 2 has slightly higher capital and overall costs than 4 or 5, and it does not provide a permanent remedy.

The two excavation remedies, Alternatives 3 and 6 are by far the most costly due to much higher capital costs. However, these two remedies provide the most permanent remedies.

9.8. State Acceptance

The State of Michigan does not concur with the U.S. EPA's cleanup level for Trichloroethylene (TCE) of 5 parts per billion (5 ppb). Instead, the State would seek a TCE cleanup level of 1 ppb. U.S. EPA has examined the total additive risk posed by the two different cleanup levels, and has found that the additive risk level associated with the 5 ppb cleanup level is not significantly different from the additive risk level associated with the 1 ppb cleanup level. The level proposed by U.S. EPA is within the Agency's acceptable risk range.

However, the State does concur with the selection of Option 2, Carbon Adsorption treatment for hexavalent chromium with Groundwater Alternative 3(A) for groundwater, and Soil Alternative 5 for soil as the preferred remedial alternatives for the Northernaire/Kysor sites. The Michigan Department of Natural Resources has indicated their agreement with the U.S. EPA's selected remedial alternatives for these two sites.

9.9. Community Acceptance

The U.S. EPA's preferred remedial alternative for the Northernaire and Kysor sites was presented at the start of the public comment period through distribution of a fact sheet and publication of a display advertisement in the Cadillac Evening News on July 27, 1989. The advertisement informed the public on the placement of the proposed plan and public comment FS in the site information repository. A formal public meeting to discuss the proposed plan was held in Cadillac, Michigan on August 7, 1989. Comments received indicate that most residents are supportive of the U.S. EPA's preferred alternative.

Several residents expressed support for the Cogeneration project proposed by the Cogeneration Michigan Associates (CMA), pursuant to when the contaminated groundwater would be treated and used in the Cogeneration plant. The Agency is keenly aware that the Cogeneration project holds strong possibilities for supplementing or substituting for all or part of the Agency's proposed cleanup activities at the Northernaire and Kysor sites. However, the Agency's primary interest is in accomplishing a proper environmental cleanup, and while the Cogeneration project has other important aspects (i.e. jobs, economic benefits to the City), these aspects lie outside the scope of CERCLA. At this time it is too soon for the Agency to focus on Cogeneration as a preferred remedial alternative. However, should the Cogeneration project advocates demonstrate to the Agency's satisfaction that the Cogeneration project will adequately treat the groundwater to meet the

Agency's specifications, then the Agency would consider a proposal for the Cogeneration project to work with the Agency to meet our environmental goals. At this time the Agency is not informed as to the actual details and specifications of the Cogeneration project.

10.0. THE SELECTED REMEDY

Based on the findings of the Remedial Investigation and the Feasibility Study, and the evaluation of the nine criteria, U.S. EPA has identified Groundwater Alternative 3(A) as the selected remedial alternative for the cleanup of the groundwater contamination at the Northernaire and Kysor sites. This alternative will include Option 2 (Carbon Adsorption) for treatment of the hexavalent chromium contamination. Soil Alternative 5 has been identified as the selected remedial alternative for cleanup of the contaminated soils at the Kysor site. In the judgement of the U.S. EPA, these alternatives, Groundwater Alternative 3(A), Option 2, and Soil Alternative 5 represent the best balance among the evaluation criteria and satisfies the statutory requirements of protectiveness, compliance with ARARs, cost-effectiveness, the utilization of permanent solutions and treatment to maximum extent practicable.

The major components of the selected remedy consist of the following:

* Taking appropriate action to ensure that current or future landowners do not use the contaminated groundwater aquifers as a source of drinking water. Activities at the Kysor site will be controlled to prevent new contaminant releases from the site by building on or excavating soil from the site.

* Constructing a fence around the Kysor site to prevent trespassing.

* Construction of a groundwater extraction and treatment system. This system shall consist of a number of extraction wells strategically located to intercept contaminated groundwater. An underground piping system will interconnect the extraction wells and transport the extracted groundwater to the treatment facility where the groundwater will be treated for the hexavalent chromium and VOC contamination.

* Construction of a force main to discharge the treated groundwater to the Clam River.

* Installation of a vapor extraction system to remove the VOC contamination from the soils at the Kysor site.

These selected alternatives for remediation will provide treatment for the contaminated soils and groundwater associated with the Northernaire and Kysor sites. This treatment is considered a primary component of Groundwater Alternative 3(A) with Option 2, and Soil Alternative 5, and the principal threat of the contaminated groundwater is being addressed through this treatment. This treatment will meet the remediation goals for cleanup of the groundwater (page 24) and soils (page 25) as outlined earlier in this document.

These alternatives also address all remaining public health and environmental threats posed by the contaminated soils and groundwater at the sites.

Based on the RI/FS U.S. EPA has concluded that Groundwater Alternative 3(A) with carbon adsorption treatment for the hexavalent chromium, is the best choice for remediation of the groundwater at the Northernaire and Kysor sites. However, all of the other treatment alternatives are permanent alternatives, easily implemented treatment technologies, and would be acceptable remedies but for their lack of cost effectiveness. U.S. EPA has also concluded, based on the RI/FS that Soil Alternative 5 is the best alternative for remediation of soils at the Kysor site.

10.1 Extraction, Treatment, and Discharge System

An extraction, treatment, and discharge system will be designed for the Northernaire and Kysor sites to reduce groundwater contamination to acceptable levels.

The extraction system will consist of approximately 10 pumping wells for extraction in the shallow and intermediate aquifers. These extraction wells would be strategically located to intercept contaminated groundwater (Figure 10.1). An underground piping system would interconnect the extraction wells and transport the extracted groundwater to the hexavalent chromium and VOC treatment facility. To install the collection piping, existing on-site utilities would have to be considered. Water, sewer, storm, natural gas, electrical, and telephone lines run underground throughout the sites. Exact locations of these utilities would have to be identified before construction activities. The collection piping would have to be located at least 10 feet from existing water supply lines and on the opposite side of the street, where possible. The existing roadways generally have a 66-foot right-of-way, and several roads within the industrial park have a 10-foot utility right-of-way on either side of the road. These areas should be utilized to lay the piping. The appropriate rights-of-way would have to be attained prior to construction activities. Installation of collection piping would take approximately three months. Installation of the extraction wells would take approximately two weeks per well, or 20 weeks for 10 wells. Approximately 8800 feet of pipe would be required to interconnect the system. Force mains and gravity sewers would be used, depending on topography of the area where piping is to be laid. Submersible pumps would pump groundwater from each well into a manhole (when discharge from well flows into a gravity sewer), where it would then enter the collection piping. The system would be designed to transport all flow to an enclosed wet well inside the treatment facility, which would be situated east of Holman Street, north of its intersection with Frisbee Street. The facility would house equipment for both VOC and hexavalent-chromium treatment systems (Figure 10.1) Actual specifications of the extraction, treatment, and discharge system will be determined during the remedial design phase of the project.

The Michigan Safe Drinking Water Act 399 shall be complied with during this design phase and the Michigan Department of Public Health shall be consulted before any final designs are implemented. Care shall be taken to see that fugitive dust emissions do not exceed the PM10 standards under the CAA - NAAQS (40 CFR 50), during construction of the extraction, treatment and discharge system.

As a component of the groundwater treatment alternatives, treated water would be discharged to the Clam River. Discharge to the river shall require construction of a force main constructed of polyvinyl chloride (PVC) piping. Approximately 6000 feet of piping would be required to discharge the treated water. The discharge point (Figure 10.2) would be located on the Clam River at its junction with River Street, on the northern side of River Street and the western side of Mitchell Street.

Discharges to surface water shall comply with several federal and state requirements. Michigan is authorized to administer the NPDES permit program which governs discharges to surface waters. Under the Michigan Wastewater Discharge Permit Rules (MWDPR), MDNR has established technology-based discharge levels for total VOCs and hexavalent chromium to the Clam River (page 26). The proposed groundwater treatment technology is expected to reduce concentrations of VOCs and hexavalent chromium to the discharge levels established by MDNR. Because discharge will occur on-site, a Michigan Wastewater Discharge Permit is not required but the substantive requirements of this permit will be met. In addition, routine completion of monitoring records must be performed in accordance with MWDPR 323, Part 21.

A groundwater sampling and analysis program shall be developed to evaluate the effectiveness of the remediation by groundwater extraction. The purposes of the monitoring program are to (1) assess the amount of contaminant reduction near the center and at the edges of each identified plume by sampling groundwater from monitoring wells at these locations; and (2) ensure that contamination is not migrating in the direction of regional groundwater flow. This would be accomplished by obtaining water level measurements to determine groundwater flow directions in the plume areas toward the extraction wells. Groundwater sampling shall occur quarterly for the first year, after which the sampling shall be reduced to an annual frequency. Using periodic groundwater monitoring and sampling, the effectiveness of the designed system can be evaluated and pumping conditions changed as required. This periodic sampling is a necessary phase of the remedial alternative to evaluate progress toward reaching clean-up objectives. This groundwater monitoring would be consistent with RCRA Corrective Action Monitoring (40 CFR 264.100).

Groundwater treatment will continue until the cleanup standards discussed in Section 9 are achieved.

All on-site remedial activities will be conducted in compliance with OSHA Standards for the Hazardous Waste Operations (29 CFR 1910).

10.2 Hexavalent Chromium Treatment

The extracted groundwater would be treated to reduce the hexavalent chromium contamination using a carbon adsorption treatment. In this treatment the activated carbon matrix selectively adsorbs hazardous organic constituents and certain metals such as chromium by a surface attraction phenomenon that binds inorganic (or organic) molecules to available carbon sites (i.e., internal pores). Carbon adsorption with granular activated carbon is usually accomplished in down-flow contactors, arranged in series to obtain high levels of removal and to increase operating times. This carbon adsorption system shall consist of two carbon adsorption beds operating in series (Figure 10.3). It is estimated the hexavalent chromium contamination could be reduced to acceptable levels in 4 years assuming 90% efficiency of the treatment system.

Construction and operation of the proposed treatment system shall be in compliance with RCRA regulations for Environmental Performance of Miscellaneous Treatment Units (40 CFR 264, Subpart X). In general, these requirements state that the proposed treatment system should be protective of public health and the environment, and prevent releases and migration of contaminants to environmental media; waste analyses and trial tests should be performed; and all equipment and materials must be decontaminated prior to closure.

This treatment will produce spent carbon which must be handled as a hazardous waste. The spent carbon will be transported, treated, and/or disposed of properly according to RCRA regulations (40 CFR, 262 through 264) and the Michigan Hazardous Waste Management Act 64 (R 299). Transportation will occur via a licensed and permitted hazardous waste hauler and vehicle. Final disposal will occur in a fully permitted RCRA facility operating in compliance with 40 CFR 264.

10.3 VOC Treatment

The extracted groundwater shall be treated for VOC contamination using an air stripping with vapor-phase carbon adsorption method. The air stripping treatment is the mass transfer of VOCs from the liquid (water) phase to the gas (air) phase. The liquid waste would be descended through a packed tower. Air is supplied by a blower or compressor that is introduced to the bottom of the tower. The packing material functions to increase the area of contact between the air and the descending liquid waste. As the liquid waste descends through the packed tower the organics would be transferred from the liquid phase to the gas phase. This air stripping technique shall require treatment of gases generated during the process. This method of air stripping shall treat the off-gases with a vapor phase carbon filtering system. This system shall consist of two stripping columns operating in series (Figure 10.4). The first air stripper shall be designed to remove 99 percent of the VOCs from the liquid phase. The second air stripper shall reduce VOC concentrations to meet the liquid-phase effluent discharge requirements. The second stripper shall provide a 50:1 air-to-water ratio which shall not need treatment of the off-gases. However, vapor-phase treatment is required for the off-gases from the first air stripper, which shall be accomplished by a vapor-phase carbon adsorption unit. This vapor-phase unit generally consists of two carbon vessels: one in operation and the other in standby mode. When the first vessel reaches exhaustion, the system automatically switches to the second vessel. The exhausted bed is regenerated in-situ by a thermal oxidizer, which obtains most of its heat from the desorption of VOC compounds from the carbon during the oxidation process. This regeneration process negates the need for disposal of spent carbon.

Assuming a 90% efficiency rate of this treatment system it would take approximately 29 years to remediate the shallow aquifer to acceptable levels and 64 years to have the intermediate aquifer cleaned up to acceptable standards.

ARARs associated with the Air Stripping system shall include the federal CAA regulations [40 CFR 129 and the Michigan Air Pollution Control Act 348 regulations (R336)], and potential approvals required before locating the system on state, city, or private property. Relevant CAA regulations include the particulate matter standards (40 CFR 50). Under the Michigan Air Pollution Control Act 348 regulations, the air stripping treatment system shall be considered a source of air contamination and shall necessitate compliance with the substantive requirements for installation and operation of an air stripping unit (R336). Michigan regulations limit fugitive dust (usually a problem during construction or excavation phases of remediation) and establish the maximum allowable emission rate from new sources of VOCs based on BACT (R336). BACT is determined on a case-by-case basis through information submitted in the permit application. Furthermore, Michigan regulations prohibit the emission of air contaminants in quantities that will cause "injurious effects to human health or safety, animal life, plant life, of significant economic value, or property," or "unreasonable interference with the comfortable enjoyment of life and property" (R336.1901).

It is possible that radiation problems can originate with air stripping systems because groundwater can contain concentrations of radioactive radon (radon-222) and thoron (radon-220) gases. Operations at the site will be monitored to ensure that there are no exposures to radiation.

10.4 Vacuum Extraction of Soils

The vacuum extraction system is an in-situ soil treatment method that shall use a series of wells to circulate soil gas within the unsaturated zone of the contaminated soil. A series of induction and extraction wells shall be installed to the water table at the Kysor site. A gas induction blower system shall force clean gases into the unsaturated zone and soil pore spaces. These purging gases volatilize the VOCs from the soil. At the same time, the vacuum extraction system shall be withdrawing the contaminated gases from the unsaturated zone. These contaminated gases are treated by emission control equipment before being released to the atmosphere.

At the Kysor site, this vacuum extraction system shall include installing a series of induction and extraction wells, control trenches, header piping, air-circulation equipment, and air pollution control equipment (Figure 10.5).

The likely place to install the vacuum extraction and emission control system would be out from the northwestern corner of the Kysor building, and south of the gravel access road leading form Leeson Avenue. Topography of this area is relatively flat and open for the installation of concrete pads to support the vacuum extraction and emission control equipment. These site areas shall require improvements to support the vacuum extraction system, pumping, air pollution control equipment, and ancillary activities. The proper spacing of the wells shall be determined from pilot testing at the Kysor site; however, a 50-by-50-foot horizontal grid is typical, considering the extent and depth of contamination.

It is estimated in two years the soils at Kysor would be able to meet the cleanup criteria specified in Section 9 in order to prevent continuing contamination of the groundwater.

CAA ARARS include particulate matter standards (40 CFR 50), which must not be exceeded during construction and operation of the treatment system. Under Michigan Air Pollution Control Act 348 regulations, the in-situ vacuum extraction system is considered a source of air contamination; therefore the same requirements shall apply as in the Air Stripping technique (See section 10.3).

It is possible that radiation problems can originate with vacuum extraction systems because soils can contain concentrations of radioactive radon (radon-222) and thoron (radon-220) gases. Operations at the site will be monitored to ensure that there are no exposures to radiation.

The RCRA and Michigan facility design and operating standards (40 CFR 264 and R 299.9604) apply to the temporary location of the treatment unit, as well as any final cover systems.

Spent carbon from this treatment shall be considered hazardous waste. The carbon shall either be regenerated on-site, or collected and regenerated off-site by a licensed facility. If carbon is not regenerated onsite, it shall be handled as a hazardous waste and transported via a Michigan-licensed hazardous waste hauler and licensed vehicle to a permitted RCRA disposal facility, in compliance with 40 CFR 264.

10.5 Groundwater and Land Use Restrictions

Restrictions on groundwater use for drinking water purposes in the shallow and intermediate aquifers, shall be placed on the Northernaire and Kysor sites where groundwater contamination is located. There are wells, previously used for residential consumption which are currently contaminated. These residents are now on city water, but a check shall be made to ensure that none of these contaminated wells are still being used for consumption purposes.

Appropriate actions shall be taken to ensure that current or future landowners do not use the contaminated groundwater aquifers as a source of drinking water. Activities at the Kysor site will be controlled to prevent new contaminant releases from the site by building on or excavating soil from the site.

10.6 Reduction of Site Risks

Stringent health and safety measures shall be taken due to the heavy equipment and intense clean-up operations during construction of the remedial alternatives. Measures shall be taken to ensure the health and safety of workers on-site as well as the local residents near the site.

10.7 Cost

The total estimated present worth of the remedy is $16,000,000 which includes an annual operation and maintenance present worth of approximately $5,000,000. These costs are based on a present worth value of 60 years and discount rate of 5%. The costs associated with the soil remediation at the Kysor site would be about $925,000, while the groundwater remediation would be just over $15,000,000. It is difficult to break out costs associated with the hexavalent chromium and VOC treatments, as each treatment would require the extraction and discharge systems. Also the groundwater is so intermingled it will be very difficult to determine what volume is contaminated with the different contaminants.

11.0. STATUTORY

11.1 The Selected Remedy is Protective of Human Health and the Environment

The remedial alternatives selected for the Northernaire and Kysor sites will eliminate current and potential future risks to human health and the environment by the following means:

* Reducing groundwater contamination by extraction, treatment, and discharge of the contaminated groundwater.

* Reducing soil contamination at the Kysor site by using a vacuum extraction treatment system to remove the contaminants.

* Preventing exposure to contaminated groundwater and soils by restricting groundwater and land use.

11.2 The Selected Remedy Attains ARARs

The selected remedy will meet or attain all applicable or relevant and appropriate federal and state requirements. These requirements are listed below.

Chemical Specific

* Safe Drinking Water Act (SDWA) - MCLs and for non-carcinogens for which no MCL has been promulgated, MCLG's (40 CFR 141.11-141.16)

* Clean Water Act Ambient Water Quality Criteria (AWQC).

* RCRA Corrective Action (Subpart F).

* Health advisories as described in Table 9-1, including RfDs and CPFs, will be used in determining risk levels where no MCLs, etc. exist.

All of these criteria were considered when determining target cleanup levels for the groundwater and soils, and determining discharge limits for the effluent from the groundwater treatment facility.

Action Specific

* The Michigan Safe Drinking Water Act 399 shall be complied with during the design of the groundwater treatment plant and the Michigan Department of Public Health will be consulted before any final designs are implemented.

* Care will be taken to see that fugitive dust emissions do not exceed the PM10 standards under the CAA - NAAQS (40 CFR 50), during construction of the extraction, treatment and discharge system, and construction of the vacuum extraction system.

* Discharges to surface water shall comply with several federal and state requirements. Michigan is authorized to administer the NPDES permit program which governs discharges to surface waters. Under the Michigan Wastewater Discharge Permit Rules (MWDPR), MDNR has established technology-based discharge levels for total VOCs and hexavalent chromium to the Clam River (page 26). The proposed groundwater treatment technology is expected to reduce concentrations of VOCs and hexavalent chromium to the discharge levels established by MDNR. Because discharge will occur on-site, a Michigan Wastewater Discharge Permit is not required but the substantive requirements of this permit will be met. In addition to meeting the discharge limitations, routine completion of monitoring records shall be performed in accordance with MWDPR 323, Part 21.

* Groundwater monitoring shall be consistent with RCRA Corrective Action Monitoring (40 CFR 264.100).

* All on-site remedial activities shall be conducted in compliance with OSHA Standards for the Hazardous Waste Operations (29 CFR 1910).

* These treatments will produce spent carbon which shall be handled as a hazardous waste. The spent carbon shall be transported, treated, and/or disposed of properly according to RCRA regulations (40 CFR, 262 through 264) and the Michigan Hazardous Waste Management Act 64 regulations (R 299). Transportation shall occur via a licensed and permitted hazardous waste hauler and vehicle. Final disposal shall occur in a fully permitted RCRA facility operating in compliance with 40 CFR 264.

* The Air Stripping and Vacuum Extraction systems shall comply with the federal CAA regulations (40 CFR 129) and the Michigan Air Pollution Control Act 348 regulations (R 336), and shall need approvals required before locating the system on state, city, or private property. Relevant CAA regulations include the particulate matter standards. Under the Michigan Air Pollution Control regulations, the air stripping treatment system shall be considered a source of air contamination and shall necessitate compliance with the substantive requirements for installation and operation of an air stripping unit (R 336). Michigan regulations limit fugitive dust (usually a problem during construction or excavation phases of remediation) and establish the maximum allowable emission rate from new sources of VOCs based on BACT (R 336). Furthermore, Michigan regulations prohibit the emission of air contaminants in quantities that will cause "injurious effects to human health or safety, animal life, plant life, of significant economic value, or property," or "unreasonable interference with the comfortable enjoyment of life and property" (R336.1901).

11.3 The Selected Remedy is Cost Effective

Alternative 3(A) with Carbon Adsorption for groundwater, and Alternative 5 for soil represents a cost-effective remedy for the Northernaire and Kysor sites. Carbon Adsorption for treatment of the hexavalent chromium contamination will reduce the risks from ingestion of groundwater just as well as the Ion Exchange which is a more costly remedy. Similarly the groundwater alternative 3(A) will reduce risks as effectively as any of the other groundwater alternatives at a more cost-effective value. Groundwater alternative 3(A) and carbon adsorption for hexavalent chromium treatment also provide as much long-term effectiveness as any of the other groundwater alternatives.

Soil alternative 5 will reduce risks associated with the contaminated soils as well as alternative 2 which is a more expensive remedy and not a permanent remedy. Soil alternative 4 is a less costly remedy and will reduce the soil contamination risks as well as alternative 5, but alternative 4 would increase the already significant groundwater problem which U.S. EPA feels is too big a risk to justify the savings in cost. Soil Alternative 5 would also provide an excellent degree of long-term protection, compared to alternatives 2 and 4. Although soil alternatives 3 and 6 may offer slightly increased long-term reliability the relative cost increases outweigh the expected benefits. These additional costs are not justified based on current site conditions and contamination levels.

11.4 The Selected Remedy Utilizes Permanent Solutions and Alternate Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The remedial action selected for implementation at the Northernaire and Kysor sites satisfies the statutory requirements of CERCLA Section 121. The selected remedy is consistent with the NCP, protects human health and the environment, attains ARARs, and is cost-effective. The U.S. EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the Northernaire and Kysor sites. Of those alternatives that are protective of human health and the environment and comply with ARARs, the U.S. EPA has determined that this selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

The selected remedy is judged to provide the same degree of protectiveness as the other groundwater alternatives at a substantially lower cost, which is more cost effective.

The selected remedy will provide long-term effectiveness from the risks associated with the contaminated soils at a cost less than all of the soil alternatives except one. The one less costly soil alternative will provide adequate long-term effectiveness, but will also greatly increase risks associated with the groundwater contamination.

The selected remedy is comparable in short-term effectiveness to any of the other soil or groundwater alternatives. The selected remedy will also utilize permanent treatment technologies to reduce not only the principal risks, but all risks associated with contaminated groundwater and soil.

While the selected remedy does not offer as high a degree of long-term reliability and permanence as the options which excavate and burn the contaminated soils, it will significantly reduce the inherent hazards posed by the contaminated soils through vacuum extraction treatment.

The selected remedy does satisfy the statutory preference for a permanent solution, however since the selected remedy will take up to 64 years to completely reduce groundwater contamination to acceptable levels, the effectiveness of this remedial action must be reviewed at least once every 5 years.

11.5 The Selected Remedy Reduces Toxicity, Mobility, or Volume of Waste Materials as a Principal Element

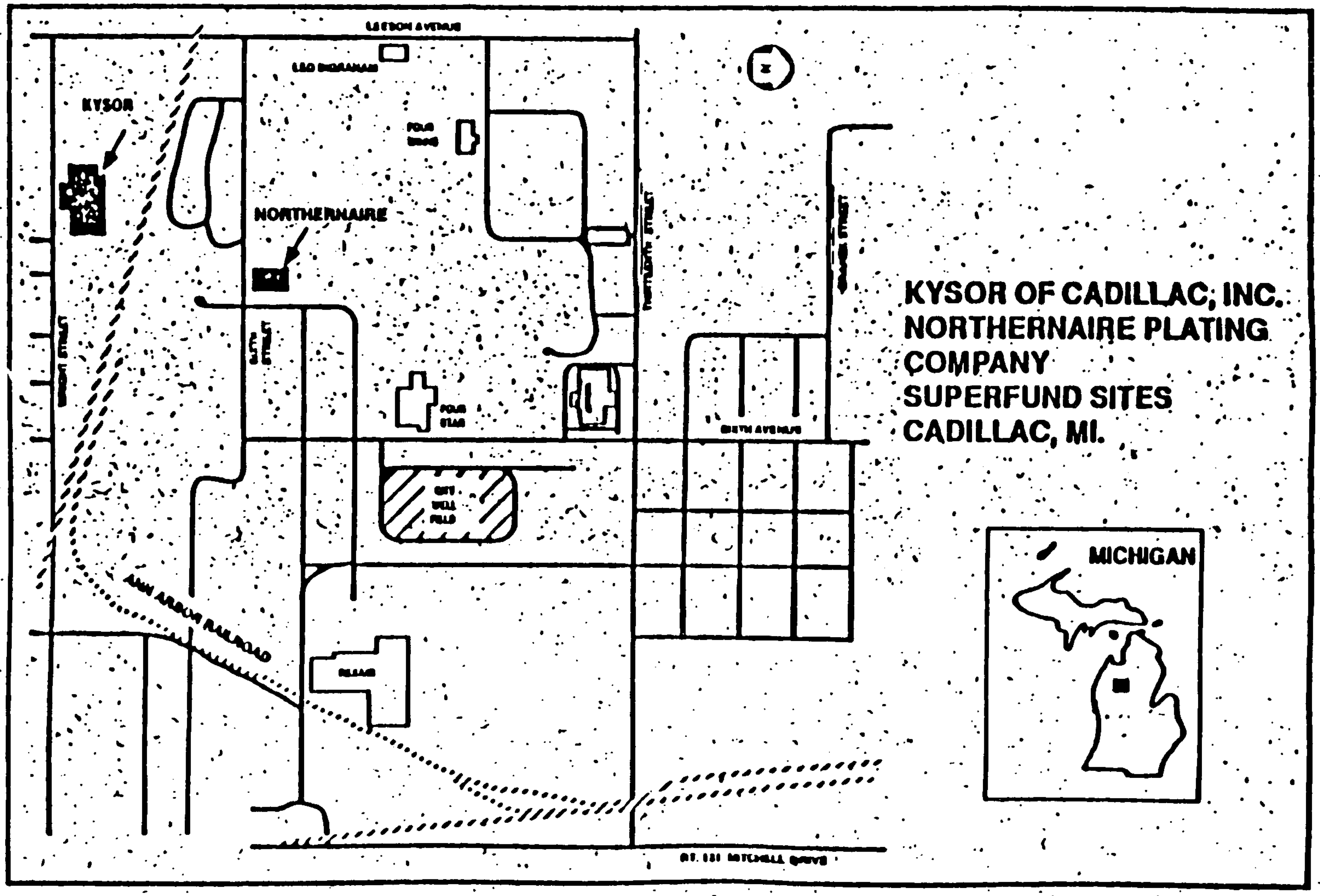
Groundwater alternative 3(A) with carbon adsorption for the hexavalent chromium treatment will reduce the mobility of the contaminants within the groundwater at the Northernaire and Kysor sites. This reduction will be accomplished by extraction and treatment of the contaminated groundwater. By treating this contaminated groundwater the remedy addresses the principal threat posed at the Northernaire and Kysor sites through the use of treatment technologies.

Soil Alternative 5 will reduce the mobility of the soil contaminants at the Kysor through treatment of the soils by vacuum extraction. This treatment will reduce the soil contamination to acceptable levels. Therefore, all the threats posed at the Northernaire and Kysor sites are being remedied through treatment technologies.

FIGURES AND TABLES

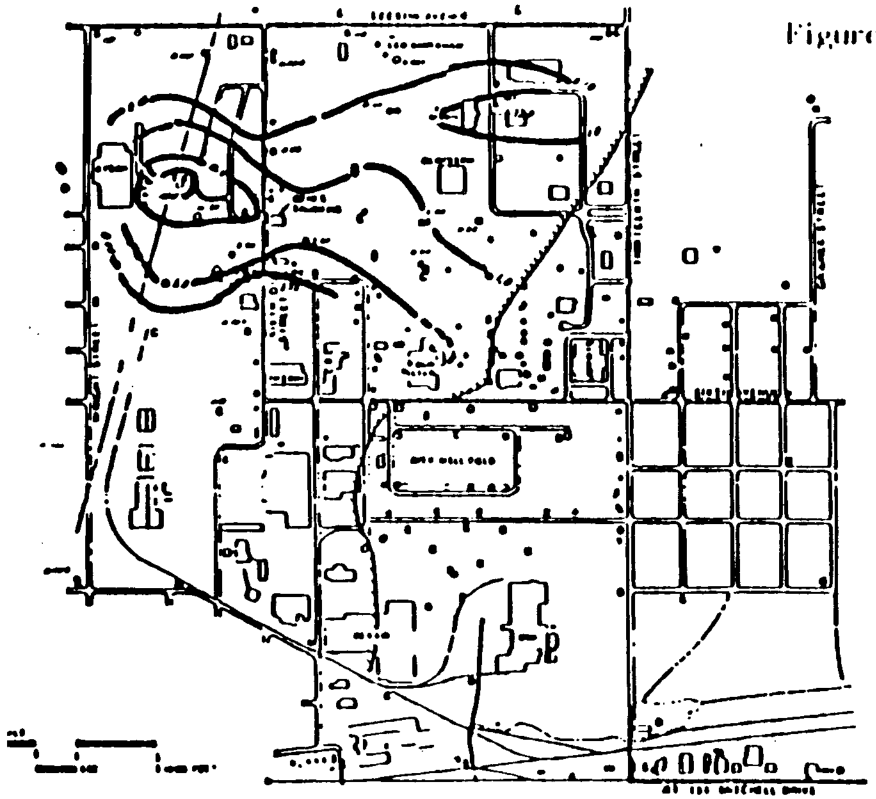
All figures and tables come directly from the Cadillac Area RI, FS, or Proposed Plan or information contained within these documents.

Figure 1-1

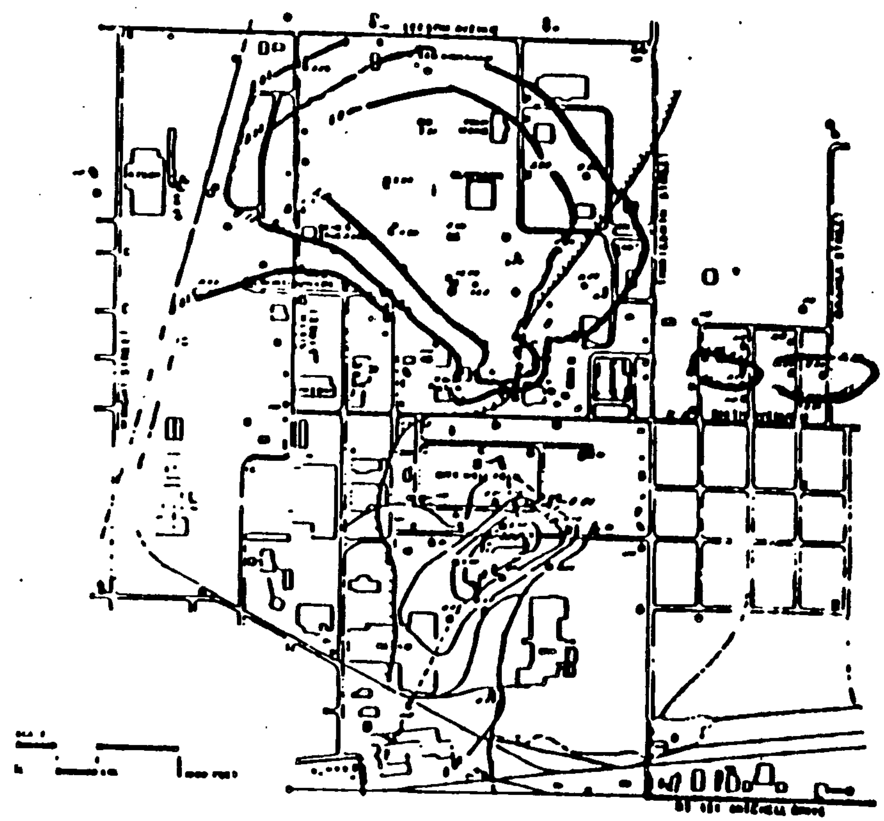


KYSOR
NORTHERNAIRE
ANN ARBOR RAILROAD
KYSOR OF CADILLAC, INC.
NORTHERNAIRE PLATING
COMPANY
SUPERFUND SITES
CADILLAC, MI.
MICHIGAN

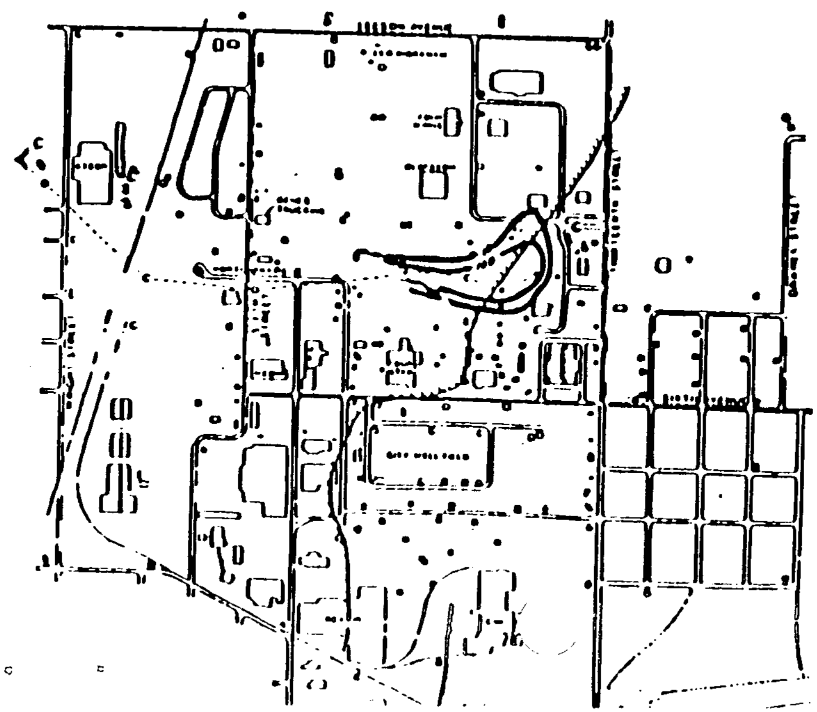
Figure 5-1



OW AQUIFER AND TOTAL
LE ORGANIC COMPOUND
CENTRATIONS: JUNE 1987
CADILLAC AREA FS
CADILLAC, MICHIGAN



INTERMEDIATE AQUIFER AND TOTAL
VOLATILE ORGANIC COMPOUND
CONCENTRATIONS: MAY/JUNE 1987
CADILLAC AREA FS
CADILLAC, MICHIGAN



NORTHERNAIRE PLUMES AND
HEX-CHROME CONCENTRATIONS

LEGEND

- FOUR STAR WELLS
- DNR WELLS
- KYSOR WELLS
- M.W. WELLS (NORTHERNAIRE)
- CITY WELL HOUSES
- SOURCE LOCATION WELLS
- GENERAL WELLS
- PIEZOMETERS
- MUD BORINGS
- KYSOR SOIL BORINGS
- MUD ROTARY WELLS
- 1.0 VOC CONCENTRATION CONTOUR IN ppm
- NORTHERN EXTENT OF UPPER AQUITARD
- VOC CONCENTRATION IN ppm

Figure 6-1

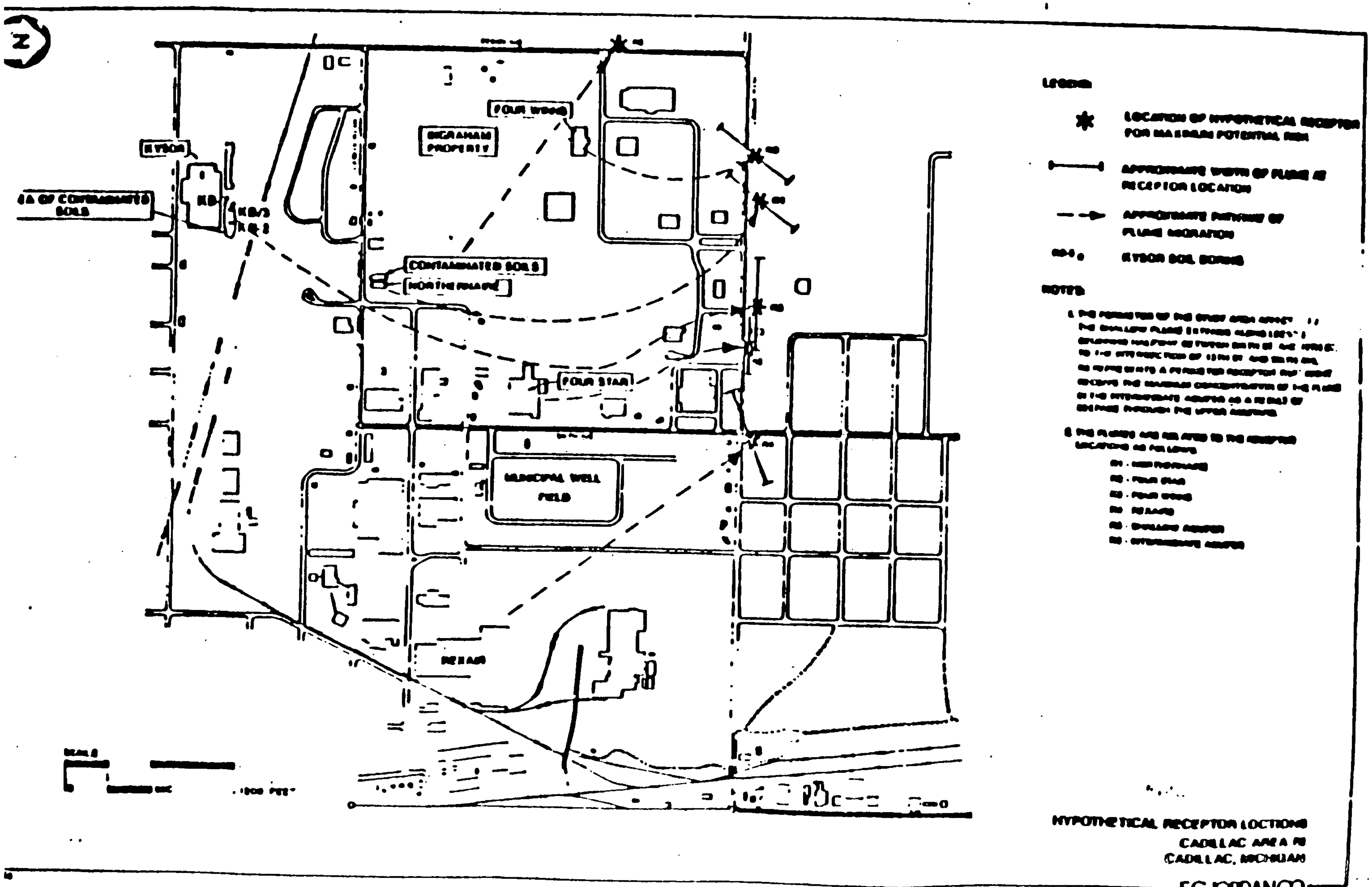
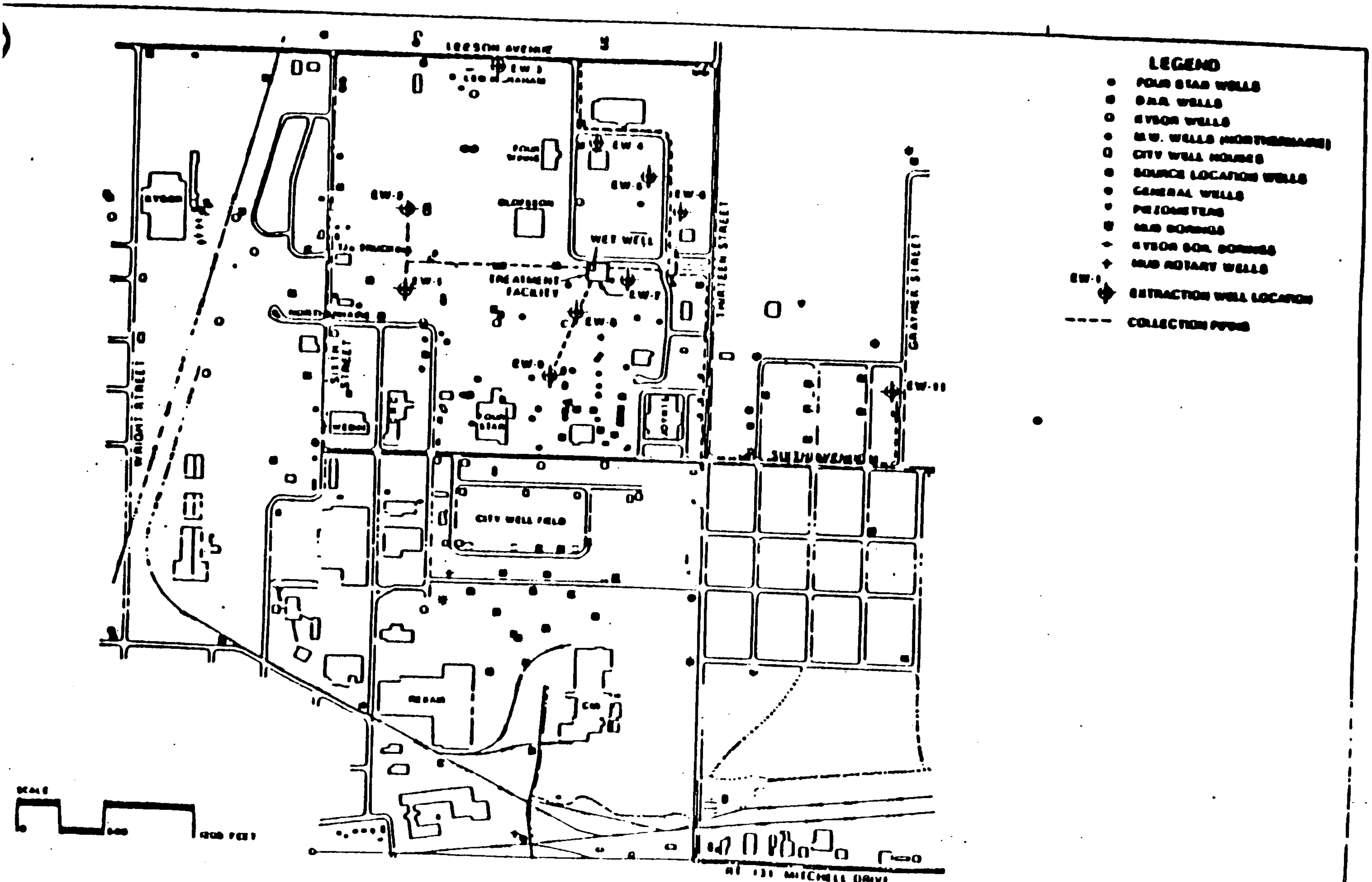

KYSOR
FOUR WINDS
CONTAMINATED SOILS
NORTHERNAIRE
FOUR STAR
MUNICIPAL WELL FIELD
REHAB
RECEPTOR LOCATION
KYSOR SOIL BORING
HYPOTHETICAL RECEPTOR LOCTIONS
CADILLAC, MICHIGAN
E.C.JORDAN CO.

Figure 10-1



EXTRACTION SYSTEM COLLECTION PIPING
CADILLAC AREA GROUNDWATER STUDY
CADILLAC, MICHIGAN
E.C. JORDAN CO.

Figure 10-2

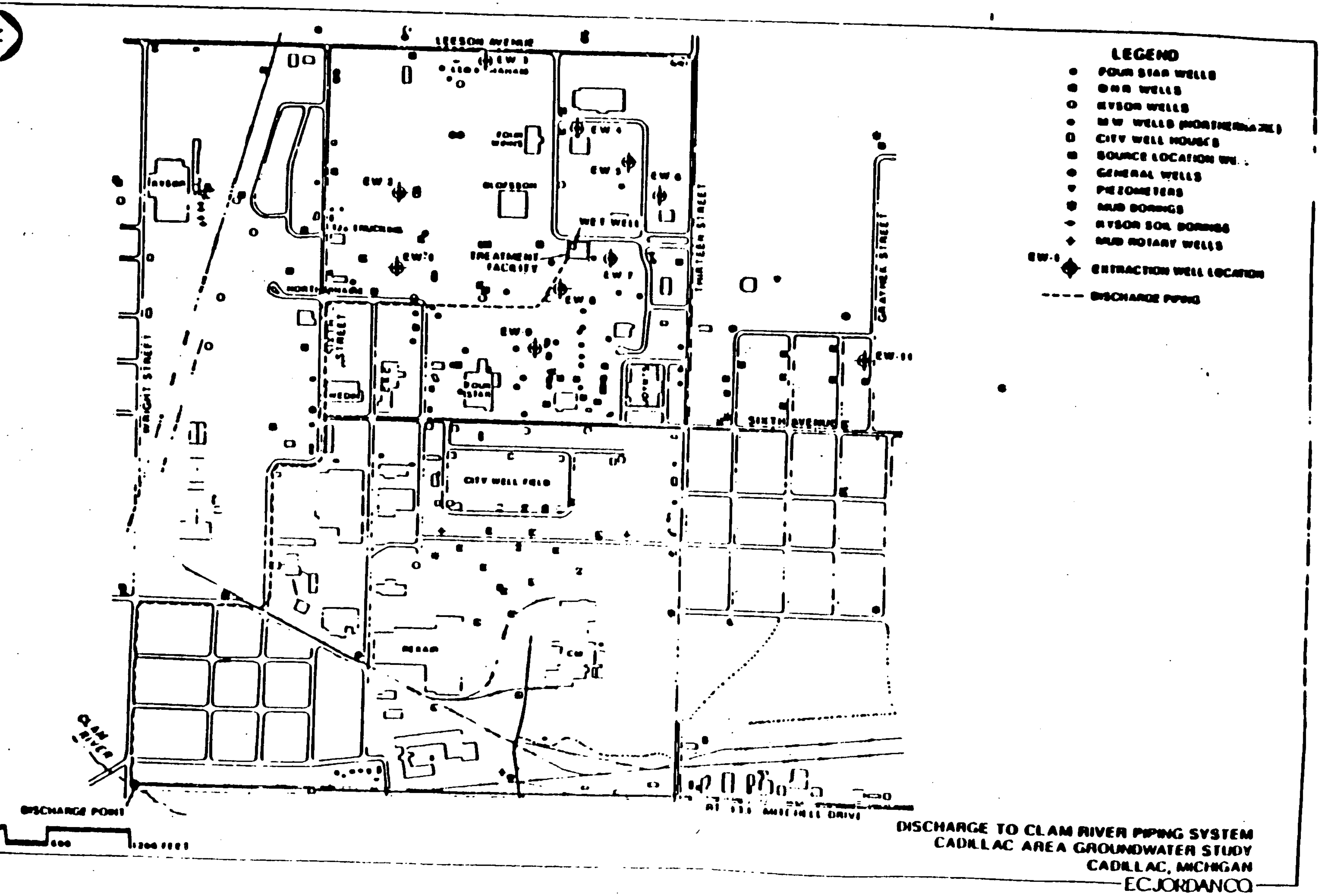
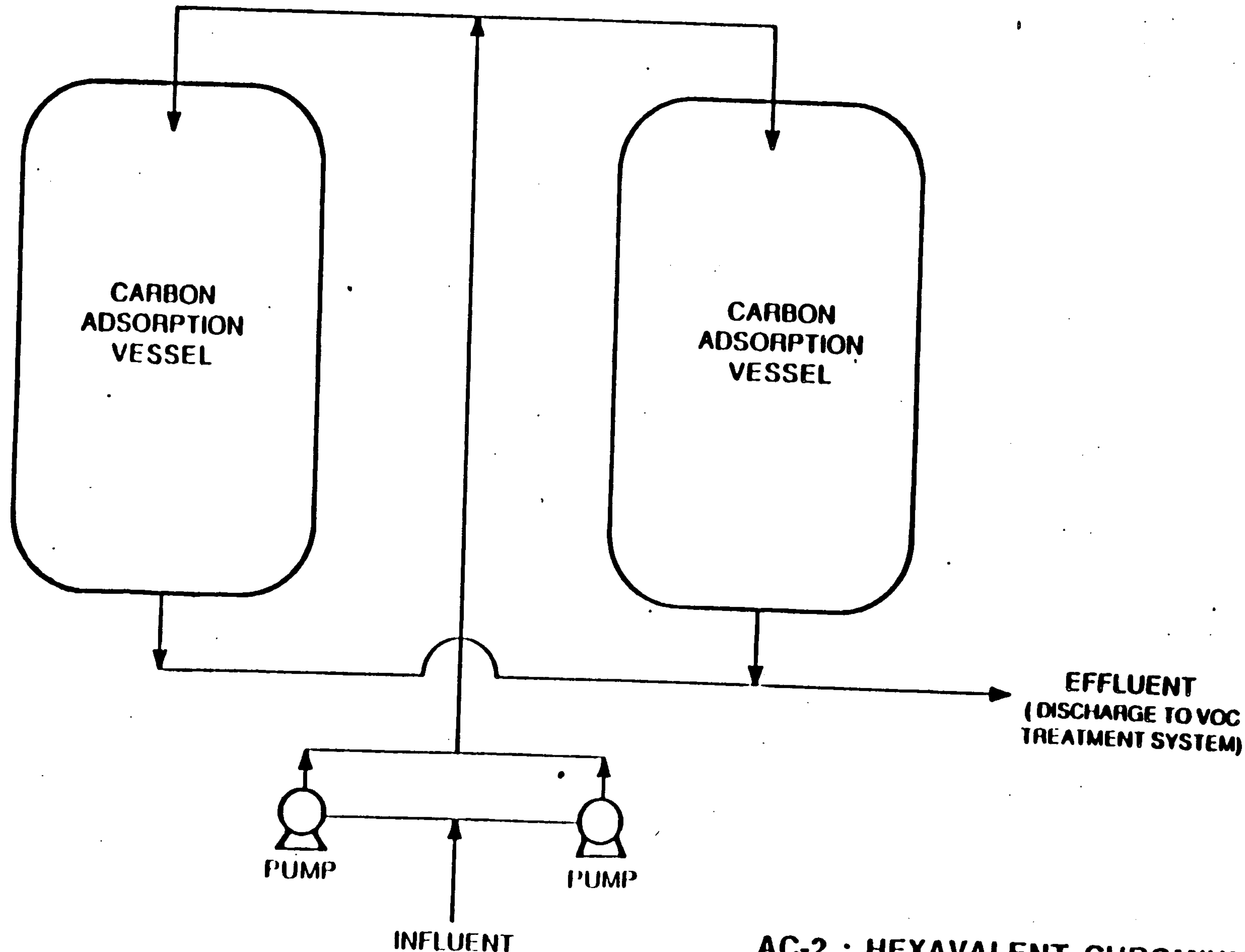

LEGEND
FOUR STAR WELLS
CITY WELL HOUSES
GENERAL WELLS
PIEZOMETERS
MUD BORINGS
MUD ROTARY WELLS
EXTRACTION WELL LOCATION
DISCHARGE PIPING
LEESON AVENUE
TREATMENT FACILITY
WET WELL
CITY WELL FIELD
SIXTH AVENUE
THIRTEEN STREET
WRIGHT STREET
CLAM RIVER
DISCHARGE POINT
EW 1
EW 3
EW 4
EW 5
EW 6
EW 7
EW 8
EW 9
EW 11
DISCHARGE TO CLAM RIVER PIPING SYSTEM
CADILLAC AREA GROUNDWATER STUDY
CADILLAC, MICHIGAN
E.C.JORDAN CO.

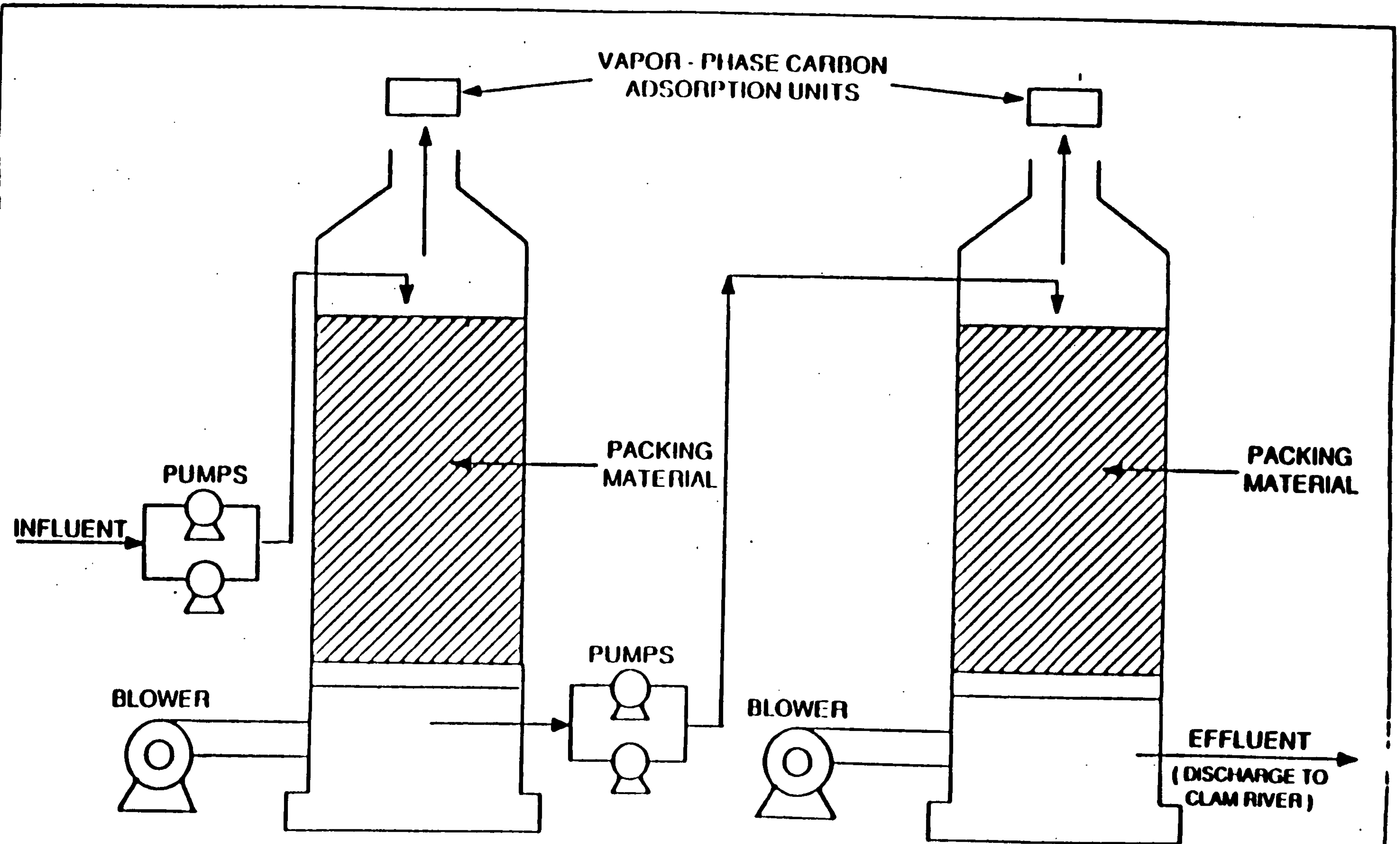
Figure 10-1



AC-2 : HEXAVALENT CHROMIUM -
CARBON ADSORPTION
CA[illegible]LAC AREA GROUNDWATER STUDY
CADILLAC, MICHIGAN

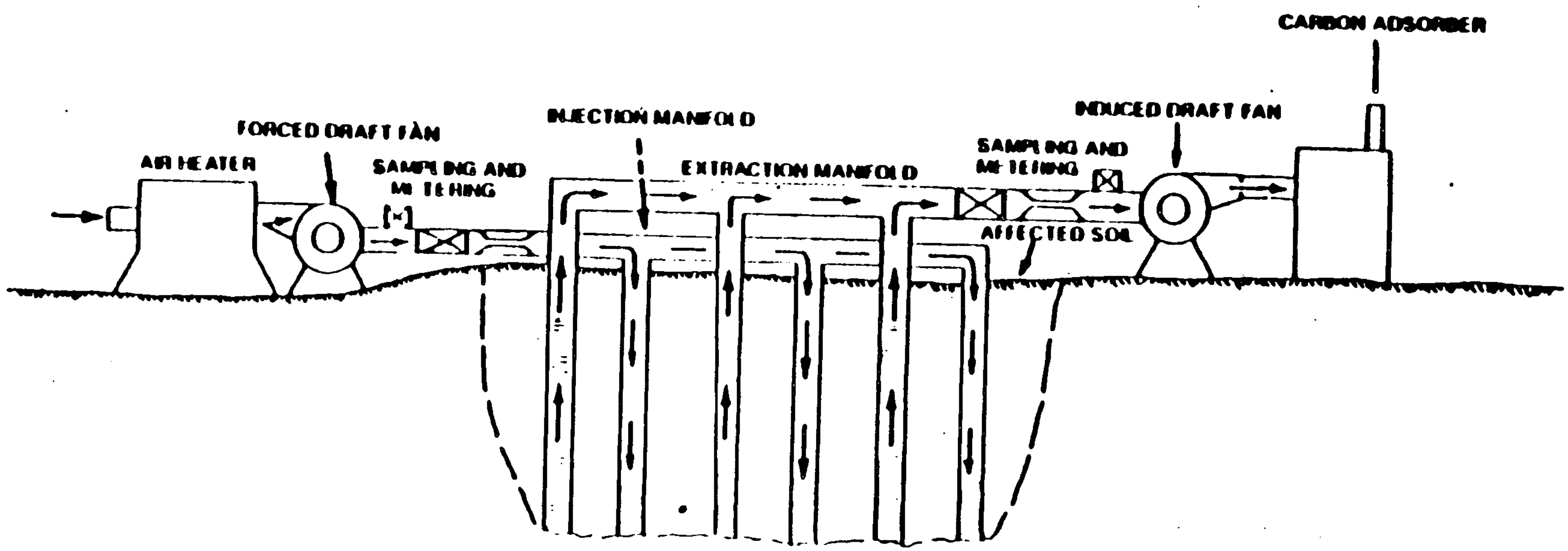
4656 52

Figure 10-4



GW-3a : AIR STRIPPING WITH VAPOR - PHASE CARBON ADSORPTION
CADILLAC AREA GROUNDWATER STUDY
CADILLAC, MICHIGAN

Figure 10-5



SC-9: IN SITU VACUUM EXTRACTION
CADILLAC AREA FEASIBILITY STUDY
CADILLAC, MICHIGAN

TABLE 5-1

CADILLAC AREA GROUNDWATER CONTAMINATION
CONTAMINANTS DETECTED

ORGANICS

NONCARCINOGENS	CARCINOGENS
Acetone	Chloroform
Ethylbenzene	1,1-Dichloroethene
1,1-Dichloroethane	1,2-Dichloroethane
Toluene	Methylene Chloride
1,1,1-Trichloroethane	Tetrachloroethane
Trans-1,2-dichloroethene	Trichloroethane
Xylenes	Benzene

INORGANICS

NONCARCINOGENS

Chromium (hexavalent)
Cyanide

TABLE 5-2
CADILLAC AREA RI

GROUNDWATER CONTAMINATION EVALUATION
NORTHERNAIRE/KYSOR SITES

MPOUND	EXISTING MAXIMUM CONCENTRATIONS (mg/l) SHALLOW AQUIFER	INTERMEDIATE AQUIFER	NORTHERNAIRE PLUME*	TARGET CLEANUP LEVELS (mg/l)	REFERENCE
1,1-Trichloroethane	32.00	1.20	0.44	0.200	MCL
ans-1,2-dichloroethylene	--	4.60	0.04	0.070	MCLG
1-Dichloroethylene	1.00	0.099	0.026	0.005	CRDL
2-Dichloroethane	2.00	--	--	0.005	MCL
thylene chloride	0.69	0.24	--	0.005	Calculated
trachloroethylene	0.72	0.17	0.003	0.001	Calculated
ichloroethylene	78.00	7.50	2.50	0.005	MCL
romium (Hexavalent)	--	--	0.773	0.050	MCL
lene	1.70	--	--	0.440	MCLG
luene	3.20	0.001	--	0.040	SMCL

The VOCs present within the boundaries of the Northernaire plume are not derived from Northernaire; the chromium from northernaire and VOCs from other sources have mixed in the aquifer.

L = Maximum Contaminant Level; MCLG = Maximum Contaminant Level Goal;
CL = Secondary Maximum Contaminant Level; CRDL = Contract Required Detection Level

SOIL CONTAMINATION EVALUATION
KYSOR SITE

COMPOUND	MAXIMUM CONCENTRATION (ppm)	TARGET CLEANUP LEVEL (ppm)[1]
Trichloroethylene	74	0.07
Xylene	520	141.00
1,1,1-Trichloroethane	24	7.60
Toluene	95	724.00

[1] All TCLs for soils are 10-6 risk based levels.

NOTE: Zone of contaminated soil (depth below grade) = 6 to eet.
Estimated volume of soil to be remediated = 13,200 cubic yards.

Table 6-1

CHEMICALS OF CONCERN
CADILLAC AREA GROUNDWATER STUDY
BASELINE RISK ASSESSMENT

VOLATILE ORGANIC COMPOUNDS

Noncarcinogens

1,1,1-Trichloroethane
Acetone
Toluene
Trans-1,2-dichlorethene

Carcinogens

Chloroform
1,1-Dichloroethene
1,2-Dichloroethane
Methylene Chloride
Tetrachloroethene
Trichloroethene

INORGANIC COMPOUNDS

Chromium (hexavalent)
Cyanide

Table 6-2

CADILLAC AREA GROUNDWATER STUDY: GROUNDWATER CHEMICAL-SPECIFIC ARARS COMPARISON

CADILLAC AREA FEASIBILITY STUDY

COMPOUND	ARARS (mg/ℓ) MCL	MCLG	AWQC*	EXISTING MAXIMUM CONCENTRATIONS (mg/ℓ) REXAIR	UPPER AQUIFER	INTERMEDIATE AQUIFER	NORTHERNAIRE PLUME[1]
1,1,1-Trichloroethane	0.2	0.2	18.4	0.017	32.0	1.2	0.44
Trans-1,2-dichloroethylene	--	0.07**	--	0.048	--	4.6	0.04
1,1-Dichloroethylene	0.007	0.007	0.00033	--	1.0	0.099	0.026
1,2-Dichloroethane	0.005	0	0.00094	--	2.0	--	--
Methylene chloride	--	--	0.00019	0.078	0.69	0.24	--
Tetrachloroethylene	--	0**	0.0008	--	0.72	0.17	0.003
Trichloroethylene	0.005	0	0.0028	153.0	78.0	7.5	2.5
Chromium (hexavalent)	0.05	0.12**	0.05	--	--	--	0.773
Xylene	--	0.44**	--	--	1.7	--	--
Toluene	--	2.0**	14.3	0.042	3.2	0.001	--

* AWQC are adjusted for drinking water exposure only (USEPA, 1986) or calculated for water and fish ingestion if drinking water exposure value does not exist.

** Proposed levels.

[1] The VOCs present within the boundaries of the Northernaire plume are not derived from Northernaire; the chromium from Northernaire and VOCs from other sources have mixed in the aquifer.

NOTE: AWQC = Ambient Water Quality Criteria; MCL = Maximum Contaminant Level; MCLG = Maximum Contaminant Level Goal

TABLE 6-3
RISK CALCULATION SUMMARY
NORTHERNAIRE/KYSOR SITES
SHALLOW PLUME
(PRESENT)

GROUNDWATER INGESTION

NONCARCINOGENIC EFFECTS

COMPOUND	MAXIMUM CONCENTRATION (ug/l)[1]	AVERAGE CONCENTRATION (ug/l)[2]	HAZARD INDEX MOST PROBABLE CHILD	HAZARD INDEX MOST PROBABLE ADULT	HAZARD INDEX WORST CASE CHILD	HAZARD INDEX WORST CASE ADULT
,1,1-Trichloroethane	32000.0	3102.0	1.03	1.03	10.63	10.63
oluene	3200.0	129.4	0.01	0.01	0.30	0.30
cetone	920.0	44.5	0.01	0.01	0.26	0.26
ummary of Hazard Indices			1.06	1.06	11.20	11.20

ARCINOGENIC EFFECTS

OMPOUND	MAXIMUM CONCENTRATION (ug/l)	AVERAGE CONCENTRATION (ug/l)	CANCER RISK MOST PROBABLE CHILD	CANCER RISK MOST PROBABLE ADULT	CANCER RISK WORST CASE CHILD	CANCER RISK WORST CASE ADULT
,1-Dichloroethene	1000.0	93.9	2.22x10-4	1.56x10-3	2.37x10-3	1.66x10-2
etrachloroethane	720.0	64.6	1.34x10-5	9.41x10-5	1.50x10-4	1.05x10-3
-ichloroethane	78000.0	2879.4	1.29x10-4	9.05x10-4	3.50x10-3	2.45x10-2
iloroform	15.0	0.4	1.32x10-7	9.26x10-7	4.96x10-6	3.47x10-5
2-Dichloroethane	2000.0	104.4	3.88x10-5	2.71x10-4	7.43x10-4	9.20x10-3
-thylene Chloride	890.0	33.9	1.04x10-6	7.26x10-6	2.11x10-5	1.48x10-4
mmary of Cancer Risk			4.05x10-4	2.83x10-3	6.79x10-3	4.75x10-2

)TE: [1] Maximum concentrations were used to calculate worst case scenarios.
[2] Average concentrations were used to calculate most probable scenarios.

TABLE 6-4
RISK CALCULATION SUMMARY
NORTHERNAIRE/KYSOR SITES
INTERMEDIATE PLUME
(PRESENT)

OUNDWATER INGESTION

NCARCINOGENIC EFFECTS

	MAXIMUM CONCENTRATION (ug/l)[1]	AVERAGE CONCENTRATION (ug/l)[2]	HAZARD INDEX			
			MOST PROBABLE		WORST CASE	
MPOUND			CHILD	ADULT	CHILD	ADULT
,1-Trichloroethane	1200.0	185.2	0.06	0.06	0.40	0.40
uene	1.0	0.0	0.00	0.00	0.00	0.00
tone	420.0	35.9	0.01	0.01	0.04	0.04
ns-1,2-Dichloroethene	4600.0	419.0	5.99	5.99	65.71	65.71
mary of Hazard Indices			6.06	6.06	66.15	66.15

CINOGENIC EFFECTS

	MAXIMUM CONCENTRATION (ug/l)	AVERAGE CONCENTRATION (ug/l)	CANCER RISK			
			MOST PROBABLE		WORST CASE	
MPOUND			CHILD	ADULT	CHILD	ADULT
-Dichloroethene	99.0	12.0	2.84x10-5	1.99x10-4	2.34x10-4	1.64x10-3
rachloroethene	17.0	0.8	1.67x10-7	1.17x10-6	3.54x10-6	2.48x10-3
chloroethene	7500.0	2251.7	1.01x10-4	7.08x10-4	3.37x10-4	2.36x10-3
oroform	4.0	0.2	6.61x10-8	4.63x10-7	1.32x10-6	9.26x10-6
hylene Chloride	240.0	15.1	4.62x10-7	3.24x10-6	7.35x10-6	5.14x10-5
mary of Cancer Risk			1.30x10-4	9.11x10-4	5.83x10-4	4.08x10-3

E: [1] Maximum concentrations were used to calculate worst case scenarios.
[2] Average concentrations were used to calculate most probable scenarios.

TABLE 6-5
RISK CALCULATION SUMMARY
NORTHERNAIRE/KYSOR SITES
NORTHERNAIRE PLUME
(PRESENT)

GROUNDWATER INGESTION

NONCARCINOGENIC EFFECTS

COMPOUND	MAXIMUM CONCENTRATION (ug/l)[1]	AVERAGE CONCENTRATION (ug/l)[2]	HAZARD INDEX MOST PROBABLE CHILD	HAZARD INDEX MOST PROBABLE ADULT	HAZARD INDEX WORST CASE CHILD	HAZARD INDEX WORST CASE ADULT
Chromium	773.0	103.9	0.59	0.59	4.42	4.42
Cyanide	22.0	0.0	0.00	0.00	0.02	0.02
1,1,1-Trichloroethane	440.0	44.6	0.01	0.01	0.15	0.15
Trans-1,2-Dichloroethene	40.0	2.4	0.03	0.03	0.57	0.57
Summary of Hazard Indices			0.64	0.64	5.16	5.16

CARCINOGENIC EFFECTS

COMPOUND	MAXIMUM CONCENTRATION (ug/l)	AVERAGE CONCENTRATION (ug/l)	CANCER RISK MOST PROBABLE CHILD	CANCER RISK MOST PROBABLE ADULT	CANCER RISK WORST CASE CHILD	CANCER RISK WORST CASE ADULT
1,1-Dichloroethene	26.0	1.7	4.02×10^{-6}	2.82×10^{-5}	6.16×10^{-5}	4.31×10^{-4}
Tetrachloroethene	3.0	0.1	2.08×10^{-8}	1.46×10^{-7}	6.24×10^{-7}	4.37×10^{-6}
Trichloroethene	2500.0	201.7	9.06×10^{-6}	6.34×10^{-5}	1.12×10^{-4}	7.86×10^{-4}
Summary of Cancer Risk			1.31×10^{-5}	9.17×10^{-5}	1.74×10^{-4}	1.22×10^{-3}

NOTE: [1] Maximum concentrations were used to calculate worst case scenarios.
[2] Average concentrations were used to calculate most probable scenarios.

Table 6-6

DOSE-RESPONSE AND CHEMICAL-SPECIFIC ARAR TABLE

COMPOUND	RfD (mg/kg/day)	UNIT CANCER RISK (mg/kg/day)-1	MCL (mg/l)	MCLG (mg/l)	HEALTH ADVISORY (mg/l) 1-DAY (10 kg)	10-DAY (10 kg)	LONGER TERM (10 kg)	LONGER TERM (70 kg)	LIFETIME (70 kg)	AWQC (mg/l) Water & Fish Ingestion	Fish Ingestion Only	Drinking Water Ingestion Only
	ORAL	ORAL										
ACETONE	0.1	—	—	—	—	—	—	—	—	—	—	—
CHROMIUM	5E-3 (VI)	NA (VI)	0.05	0.12	1.4	1.4	0.24	0.84	0.17	0.05	—	0.05
CYANIDE	2.00E-2	—	—	—	0.22	0.22	0.22	0.75	0.75	0.200	—	0.200
1,2-DICHLOROETHANE	—	9.10E-2	0.005	0	0.74	0.74	0.74	2.60	NA	9.4E-4	0.243	—
1,1-DICHLOROETHYLENE	9.00E-3	5.80E-1	0.007	0.007	2.0	1.0	1.0	3.5	0.007	3.3E-5	1.85E-3	3.3E-5
TRANS-1,2-DICHLOROETHYLENE	—	—	—	0.07	2.72	1.0	1.0	3.5	0.35	—	—	—
METHYLENE CHLORIDE (DICHLOROMETHANE)	6E-2	7.5E-3	—	—	13.3	1.5	—	—	—	1.9E-4	0.0157	1.9E-4
TETRACHLOROETHYLENE	1E-2	5.10E-2	—	0	—	34.0	1.40	5.0	—	8E-4	8.85E-3	8E-4
TOLUENE	3E-1	—	—	2.0	18.0	6.0	—	—	10.0	14.3	424	15
1,1,1-TRICHLOROETHANE	9.0E-2	—	0.2	0.2	140.0	35.0	35.0	125.0	1.0	18.4	1030	—
TRICHLOROETHYLENE	—	1.1E-2	0.005	0	—	—	—	—	0.26	2.7E-3	0.0807	2.8E-3
CHLOROFORM	1E-2	6.1E-2	—	—	—	---	—	—	—	1.9E-4	0.0157	1.9E-4

Footnote: Chloroform [illegible] tetrachloroethylene are presently being reevaluated by CAG (IRIS).

TABLE 6-7
RISK CALCULATION SUMMARY
NORTHERNAIRE/KYSOR SITES
SHALLOW PLUME
(FUTURE)

ROUNDWATER INGESTION
ONCARCINOGENIC EFFECTS

OMPOUND	MAXIMUM CONCENTRATION (ug/l)[1]	AVERAGE CONCENTRATION (ug/l)[2]	HAZARD INDEX MOST PROBABLE CHILD	HAZARD INDEX MOST PROBABLE ADULT	HAZARD INDEX WORST CASE CHILD	HAZARD INDEX WORST CASE ADULT
,1,1-Trichloroethane	1066.0	487.0	0.16	0.11	0.35	0.35
oluene	53.0	24.5	0.00	0.00	0.01	0.01
ummary of Hazard Indices			0.16	0.11	0.36	0.36
,1,1-Trichloroethane[3]	2139.0	493.0	0.16	0.16	0.71	0.71
cetone[3]	1792.0	417.5	0.12	0.12	0.51	0.51
rans-1,2-Dichloroethene[3]	5.0	1.6	0.02	0.02	0.07	0.07
ummary of Hazard Indices[3]			0.31	0.31	1.29	1.29

ARCINOGENIC EFFECTS

OMPOUND	MAXIMUM CONCENTRATION (ug/l)	AVERAGE CONCENTRATION (ug/l)	CANCER RISK MOST PROBABLE CHILD	CANCER RISK MOST PROBABLE ADULT	CANCER RISK WORST CASE CHILD	CANCER RISK WORST CASE ADULT
,1-Dichloroethene	11.0	5.0	1.18×10^{-5}	1.21×10^{-5}	2.60×10^{-5}	1.82×10^{-4}
ichloroethane	2600.0	1190.0	5.34×10^{-5}	5.51×10^{-5}	1.50×10^{-4}	8.17×10^{-4}
etrachloroethene	12.0	5.5	1.14×10^{-6}	1.19×10^{-6}	3.50×10^{-6}	1.75×10^{-6}
mmary of Cancer Risk			6.64×10^{-5}	6.83×10^{-5}	1.45×10^{-4}	1.02×10^{-3}
1-Dichloroethene[3]	61.0	14.0	2.65×10^{-5}	2.65×10^{-5}	1.44×10^{-4}	1.01×10^{-3}
ichloroethane[3]	248.0	57.0	2.05×10^{-6}	2.05×10^{-6}	1.11×10^{-5}	7.79×10^{-5}
trachloroethene[3]	89.0	20.0	3.33×10^{-6}	3.33×10^{-6}	1.85×10^{-5}	1.30×10^{-4}
2-Dichloroethane[3]	260.0	59.5	1.77×10^{-5}	1.77×10^{-5}	9.66×10^{-5}	6.76×10^{-4}
mmary of Cancer Risk[3]			4.96×10^{-5}	4.96×10^{-5}	2.71×10^{-4}	1.89×10^{-3}

TE: [1] Maximum concentrations were used to calculate worst case scenarios.
[2] Average concentrations were used to calculate most probable scenarios.
[3] These risks are associated with the Four Winns plume in the shallow aquifer.

TABLE 6-8
RISK CALCULATION SUMMARY
NORTHERNAIRE/KYSOR SITES
INTERMEDIATE PLUME
(FUTURE)

DWATER INGESTION

RCINOGENIC EFFECTS

	MAXIMUM CONCENTRATION (ug/l)[1]	AVERAGE CONCENTRATION (ug/l)[2]	HAZARD INDEX			
			MOST PROBABLE		WORST CASE	
UND			CHILD	ADULT	CHILD	ADULT
-Trichloroethane[3]	132.0	49.0	0.02	0.01	0.04	0.04
-1,2-Dichloroethene	1200.0	665.0	9.50	9.50	17.14	17.14
ium[4]	600.0	294.0	1.69	0.70	3.43	3.43

IOGENIC EFFECTS

	MAXIMUM CONCENTRATION (ug/l)	AVERAGE CONCENTRATION (ug/l)	CANCER RISK			
			MOST PROBABLE		WORST CASE	
UND			CHILD	ADULT	CHILD	ADULT
ene Chloride	70.0	38.0	1.16x10-6	8.14x10-6	2.14x10-6	1.50x10-5
oroethane	2140.0	1200.0	5.38x10-5	3.77x10-4	9.61x10-5	6.73x10-4
y of Cancer Risk			5.50x10-5	3.84x10-4	9.82x10-5	6.88x10-4
hloroethane[3]	1740.0	585.0	1.22x10-4	1.36x10-4	3.62x10-4	2.54x10-3
oroethane[3]	6730.0	2450.0	1.10x10-4	1.11x10-4	3.02x10-4	2.12x10-3
y of Cancer Risk			2.32x10-4	2.48x10-4	6.64x10-4	4.65x10-3

[1] Maximum concentrations were used to calculate worst case scenarios.
[2] Average concen[illegible]tions were used to calculate most probable scenarios.
[3] These are ris[illegible] sociated with the Four Star plume in the intermediate aquife
[4] These are risks associated with the chromium plume in the intermediate aquifer.

Table 9-1

CHEMICAL-SPECIFIC ARARS
CADILLAC AREA RI

SITE FEATURE	REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI
GROUNDWATER			
Federal Applicable Requirements	SDWA - Maximum Contaminant Levels (MCLs) (40 CFR 141.11 - 141.16)	MCLs have been promulgated for a number of common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, and are considered applicable for groundwater aquifers used for drinking water.	When the risks to human health due to consumption of groundwater are assessed, concentrations of contaminants should be compared to their MCLs.
	RCRA - Subpart F Groundwater Protection Standards Alternative Concentration Levels (ACLs)	ACLs are one of three possible standards (other than MCLs and background concentrations) available under Subpart F for setting a clean-up level for remediating groundwater contamination from a RCRA facility.	ACLs may be applicable if certain conditions relating to transport and exposure are met. ACLS may need to be determined by USEPA. Procedures for developing ACLs are outlined in RCRA Subpart F, Section 264.94.
Federal Relevant and Appropriate Requirements	SDWA - Maximum Contaminant Level Goals (MCLGs)	MCLGs are health-based criteria that are relevant and appropriate for drinking water sources, as a result of SARA, when extraordinary risks exist. These goals are available for a number of organic and inorganic contaminants.	Groundwater concentrations of noncarcinogenic contaminants should be compared to their MCLGs when extraordinary risks exist.
	Federal Ambient Water Quality Criteria (AWQC)	Federal AWQC are health based criteria that have been developed for 95 carcinogenic and noncarcinogenic compounds.	AWQC should be used in characterizing human health risks due to contaminant concentrations in groundwater.
Federal Advisories and Guidance to be Considered	Health Advisories (USEPA Office of Drinking Water)	Health advisories are estimates of risks due to consumption of contaminated drinking water; they consider noncarcinogenic effects only.	Health advisories should be considered for contaminants in groundwater that is used for drinking water.
	USEPA Risk Reference Doses (RfDs)	RfDs are dose levels developed by USEPA for noncarcinogenic effects.	USEPA RfDs are used to characterize risks due to exposure to contaminants in groundwater, as well as other media.
	USEPA Carcinogen Assessment Group Potency Factors	Potency Factors are developed by USEPA from Health Effects Assessments (HEA) or evaluations by the Carcinogen Assessment Group.	USEPA Carcinogenic Potency Factors are used to complete the individual incremental cancer risk resulting from exposure to contaminants.

Table 9-1 (continued)

CHEMICAL-SPECIFIC ARARS
CADILLAC AREA RI

SITE FEATURE	REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI
	Acceptable Intake - Chronic (AIC) and Subchronic (AIS) - USEPA Health Assessment Documents	AIC and AIS values are developed from RfDs and HEAs for noncarcinogenic compounds.	AIC and AIS values are used to characterize the risks due to several noncarcinogens in various media.
	USEPA Office of Water Guidance - Water Related Fate of 129 Priority Pollutants (1979)	This guidance manual gives transport and fate information for 129 priority pollutants.	The manual is used to assess the transport and fate of a variety of contaminants.
DISCHARGE TO PUBLICLY-OWNED TREATMENT WORKS			
Federal Applicable Requirements	CWA - Pretreatment Standards (40 CFR 403)	Discharges to a POTW must comply with the POTW's USEPA-approved pretreatment requirements.	POTWs in the area with approved pretreatment programs will be identified. The discharge must be treated to those levels required by the program.
State Applicable Requirements	MWRC, Act 245, R 323.2163 Pretreatment Program	Discharges to a POTW must comply with the POTW's pretreatment requirements.	POTWs in the area with approved pretreatment program will be identified. The discharge must be treated to those levels required by the program.
DISCHARGE TO SURFACE WATER/MERRIMAC RIVER			
State Applicable Requirements	Michigan Water Quality Standards, Act 245, R 323.	Standards have been developed for dissolved oxygen; temperature standards for specific contaminants are developed on a case-by-case basis.	These standards will be used for setting limits for discharge to surface water.
Federal Relevant and Appropriate Requirements	Federal Ambient Water Quality Criteria (AWQC)	Federal AWQC are health-based criteria that have been developed for 95 carcinogenic and noncarcinogenic compounds.	AWQC may be used for setting limits for discharge to surface water.

Table 9-1 (continued)

POTENTIAL ACTION-SPECIFIC ARARs
CADILLAC AREA RI

ARARS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN ARARS
FEDERAL ARARs		
RCRA - Standards for Owners and Operators of Permitted Hazardous Waste Facilities (40 CFR 264.10 - 264.18)	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.	Facilities will be constructed, fenced, posted, and operated in accordance with this requirement. Workers will be properly trained. Wastes will be evaluated for the characteristics of hazardous waste to assess further RCRA requirements.
RCRA - Preparedness and Prevention (40 CFR 264.30 - 264.31)	This regulation outlines requirements for safety equipment and spill control.	Safety and communication equipment will be installed at the site; local authorities will be familiarized with site operations.
RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50 - 254.56)	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	Plans will be developed and implemented during site work, including installation of monitoring wells and implementation of site remedies. Copies of the plans will be kept on-site.
RCRA - Manifesting, Recordkeeping, and Reporting (40 CFR 264.70 - 264.77)	This regulation specifies the recordkeeping and reporting requirements for RCRA facilities.	Records of facility activities will be developed and maintained during remedial actions.
RCRA - Groundwater Protection (40 CFR 264.90 - 264.109)	This regulation details requirements for a groundwater monitoring program at the site.	A groundwater monitoring program is a component of all alternatives. RCRA regulations will be considered during development of this program.
RCRA - Closure and Post-closure (40 CFR 264.110 - 264.120)	This regulation details specific requirements for closure and post-closure of hazardous waste facilities.	Those parts of the regulation concerned with long-term monitoring and maintenance of the site will be considered during remedial design.
OSHA - General Industry Standards (29 CFR Part 1910)	This regulation specifies the 8-hour, time-weighted average concentration for various organic compounds.	Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below the concentrations required in the regulations.
OSHA - Safety and Health Standards (29 CFR Part 1926)	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.	Appropriate safety equipment will be on-site. In addition, OSHA safety procedures will be followed during on-site activities.
OSHA - Recordkeeping, Reporting, and Related Regulations (29 CFR 1904)	This regulation outlines the recordkeeping and reporting requirements for an employer under OSHA.	These requirements apply to all site contractors and subcontractors and must be followed during all site work.
RCRA - 40 CFR 268 USEPA Regulations on Land Disposal Restrictions	This regulation outlines land disposal requirements and restrictions for hazardous wastes.	Regulations to be phased in over the next few years require contaminated soils to be treated to the Best Demonstrated Available Technology levels before being placed or replaced on the land. Hazardous waste cannot be stored except for accumulation for recovery, treatment, or disposal.
RCRA - Surface Impoundments (40 CFR 264.220 - 264.249)	This regulation details the design, construction, operation, monitoring, inspection, and contingency plans for a RCRA surface impoundment. Also provides three closure options for CERCLA sites.	At closure, owner must remove or decontaminate all waste or eliminate free liquid, stabilize remaining waste, and cover impoundment with a cover that complies with the regulation. Integrity of cover must be maintained, groundwater system monitored, and runoff controlled.

Table 9-1 (continued)

POTENTIAL ACTION-SPECIFIC ARARs
CADILLAC AREA RI

ARARS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN ARARs
RCRA - Landfills (40 CFR 264.300 - 264.339)	This regulation details the design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements for a RCRA landfill.	Disposal of contaminated materials from the site must be to a RCRA-permitted facility that complies with all RCRA landfill regulations.
CWA - 40 CFR Parts 122, 125	Any point source discharges must meet NPDES permitting requirements, which include compliance with applicable water quality standards; establishment of a discharge monitoring system; and routine completion of discharge monitoring records.	If groundwater that has been treated by on-site treatment processes is discharged to on-site surface water, treated groundwater must be in compliance with applicable water quality standards. In addition, a discharge monitoring program must be implemented. Routine discharge monitoring records must be completed.
CWA - 40 CFR Part 403	This regulation specifies pretreatment standards for discharges to a publicly owned treatment works (POTW).	If a collection system is installed and the discharge is sent to a POTW, the POTW must have an approved pretreatment program. The collection system water quality must be in compliance with the approved program. Prior to discharging, a report must be submitted containing identifying information, list of approved permits, description of operations flow measurements, measurement of pollutants, certification by a qualified professional, and a compliance schedule.
CAA - NAAQS for PM10 STANDARDS (40 CFR 50 -)	This regulation specifies maximum primary and secondary 24-hour concentrations for particulate matter.	Fugitive dust emissions from site excavation activities will be maintained below 260 ug/m³ (primary standard) by dust suppressants, if necessary.
Protection of Archeological Resources (32 CFR Part 229, 229.4; 43 CFR Parts 107, 171.1-171.3)	This regulation develops procedures for the protection of archeological resources.	If archeological resources are encountered during soil excavation, work will stop until the area has been reviewed by federal and state archeologists.
DOT Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-171.3)	This regulation outlines procedures for the packaging, labeling, manifesting, and transportation of hazardous materials.	Contaminated materials will be packaged, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations.
<u>Michigan ARARs</u>		
Michigan - Hazardous Waste Management Act (Act No. 64, P.A. 1979)	This regulation provides a comprehensive program for the handling, storage, and recordkeeping at hazardous waste facilities. They supplement RCRA regulations.	Because these requirements supplement RCRA hazardous waste regulations, they must also be considered at the site.
Air Pollution Control Commission General Rules (R 336 . . .)	This regulation outlines the standards and requirements for air pollution control in the State of Michigan. All provisions, procedures, and definitions are described.	Particulate matter emissions from site excavation activities must be maintained at an annual geometric mean of 75 µg/m³ and a maximum 24-hour concentration of 60 µg/m³ (primary standards).
Underground Storage Tank Act, Act No. 423, P.A. 1984	This regulation requires the registration and permitting of underground storage tanks.	Alternatives requiring the removal or installation of underground storage tanks would require this regulation to be considered.

Table 9-1 (continued)

POTENTIAL ACTION-SPECIFIC ARARs
CADILLAC AREA #1

ARARS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN ARARs
Environmental Response Act, Act No. 307, P.A. 1982	This regulation requires that risk assessments be conducted for hazardous waste sites	This regulation should be considered for all remedial alternatives.
MDNR-WRC, Wastewater Reporting and Surveillance Fees Rules, and Wastewater Discharge Permits Act 245, R 323, Parts 9, 21	This regulation outlines the requirements for reporting discharges of wastewater to state waters or POTWs. The discharge permit requirements are compatible with NPDES requirements.	Discharges to surface water must not degrade the quality of the water. Requirements for recordkeeping and monitoring must be attained.
MDNR - Liquid Industrial Waste Disposal Act (Act No. 136, P.A. 1969)	This regulation addresses the removal of liquid industrial waste, and outlines the requirements for licenses, recordkeeping, and transportation.	Removal of liquid industrial waste must be recorded. Appropriate licenses will be obtained. Waste will be transported in accordance with these requirements when more stringent than federal requirements.

APPENDIX A

ADMINISTRATIVE RECORD INDEX
UPDATE #2
NORTHERNAIRE SITE
CADILLAC, MICHIGAN

CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	2	89/08/07	Letter regarding the cities' role and position in the clean up	D.Becker-Mayor of Cadillac	USEPA	Correspondence	
	2	89/08/21	Letter concerning questions about cleanup and other related topics	M.Stark-CTH	D. O'Riordan	Correspondence	
	1	89/08/24	Letter concerning the responsible and participating parties in the cleanup	Samuel Bailor	D.Roycraft-MDNR	Correspondence	
	1	89/08/26	Letter accompanying Kysor Industrial Corporation's comments on the RI/FS and proposed plan	J.Dunn -Warner, Norcross & Judd	D. O'Riordan-USEPA	Correspondence	
	3	89/08/30	Comments on Remedial Investigation/Feasibility Study on behalf of Four Winns, Inc: history, perspective of proposed soil and water remediations	R.Cooper & D.Skrocki -ASI	D. O'Riordan-USEPA	Correspondence	
	2	89/09/05	Summary of comments from public hearing meeting on Kysor Industrial and Northernaire Plating Superfund Sites	M.Shanks -Black & Veatch	S. Sanders-USEPA	Correspondence	
	5	89/09/15	Comments on the reviewed Record of Decision draft	D.Roycraft-MDNR	S. Sanders-USEPA	Correspondence	

ADMINISTRATIVE RECORD INDEX
UPDATE #2
NORTHERNAIRE SITE
CADILLAC, MICHIGAN

ICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	4	89/09/22	Comments on the draft Responsiveness Summary for the Northernaire/ Kysor Record of Decision by MDNR	D.Roycraft-MDNR	S. Sanders-USEPA	Correspondence	
	2	89/09/28	MDNR coments concerning Record of Decision: selection of remedial technology, cleanup levels of TCE, rationale used to support selected remedy, & description of the site	D. Rector MDNR	V.Adamkus-USEPA	Correspondence	
	8	89/07/00	Fact sheet describing: background, results of RI, goals of cleanup, alternatives, and schedule for public comments	USEPA		Fact Sheet	
	2	89/08/07	Statement regarding Cadillac groundwater problem: history and proposed plan of action	City of Cadillac		Fact Sheet	
	66	89/08/07	Transcript from Cadillac Area Groundwater Public Meeting (with MDNR, USEPA and E.C. Jordan)	Transcribed by Network Reporting -A.Holmes		Meeting Notes	
	375	89/06/08	Feasibility Study on Cadillac Area Groundwater Contamination	E.C. Jordan	MDNR/USEPA	Reports/Studies	
	129	89/08/26	Kysor Industrial Corporation's comments	Kysor Industries		Reports/Studies	

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UPDATE #2
NORTHERNAIRE SITE
CADILLAC, MICHIGAN

CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			on the RI/FS and proposed plan for the Cadillic Idustrial Park				
	120	89/09/29	Record of Decision (ROD); document explaining final remedy	USEPA		Reports/Studies	

UPDATE - ADMINISTRATIVE RECORD INDEX
NORTHERNAIRE SITE
CADILLAC, MICHIGAN

FICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	6	88/05/24	Cadillac Regional Area Risk Assessment Review Northernaire Site, Cadillac, Michigan.	Malcolm Field-USEPA	Bruce Means-USEPA	Memorandum	
	48	88/04/00	"Cadillac Area Groundwater Contamination Feasibility Study-Cadillac, Michigan Interim Deliverable No. 1." This Report presents the remedial action objectives for the Cadillac FS, including preliminary target levels, and treated groundwater discharge requirements.	E.C.Jordan Co.	MDNR	Reports/Studies	
	108	88/07/00	"Cadillac Area Groundwater Contamination Feasibility Study-Cadillac, Michigan Interim Deliverable No. 2 Alternatives Array Document."	E.C. Jordan Co.	MDNR	Reports/Studies	
	168	88/07/00	"Appendix A ARAR Identification Checklists."	E.C.Jordan Co.	MDNR	Reports/Studies	
	170	88/08/00	"Cadillac Area Groundwater Contamination Remedial Investigation - Cadillac, Michigan."	E.C. Jordan Co.	MDNR	Reports/Studies	

ADMINISTRATIVE RECORD SAMPLING/DATA INDEX
NORTHERNAIRE SITE, CADILLAC, MICHIGAN
Sampling/data documents available for review at USEPA
Region V, Chicago,IL.

DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
87/06/00	Second Round CLP Sample Results: Sample No's. SLW 01 to 09, 10S & 10D, 11, 12S & 12P, 13 to 18, 20 to 25, 25 DIL, 26 to 52. GW 1S & 1D, 2, 3, 6S, 6RE, 6D, 7, 8, 9S, 9D, 10S-RE,10D, 10D-RE, 10S, 11, 13, 14D, 16 to 18, 20. MW-07, 09, 10, 11, 13 to 18. E1, 6, 6D, 7S, 7D, 13, 15, 16S, 16D, 22, 23. MW 100 to 107, 107-RE, 108 to 114. DUP 1 to 7, 9 to 12.	Everett I. Bole-MDNR	Mary E.Gustafson-USEPA	Sampling/Data
87/07/13	Second Round CLP Sample Results. Sample No's. MW-007, 9, 10, 11, 13 to 18. E-15, MW-1067, DUP 6.	Everett Bole-MDNR	Mary E. Gustafson-USEPA	Sampling/Data
87/07/00	Also from 87/08/00. Second Round CLP Sample Results. Sample No's. SLW-1 to SLW-53.	Everett Bole - MDNR	Mary E. Gustafson-USEPA	Sampling/Data
87/07/00	Second Round of CLP Sample Results. Sample No's. GW 1D to GW 20.	Everett Bole-MDNR	Mary E. Gustafson-USEPA	Sampling/Data
87/08/00	Second Round of CLP Sample Results. Sample No's. MW-7, 9 to 11, 13 to 18. E-1, 6D, 6S, 7D, 7S, 13, 15, 16, 22, 23. MW 100 to 115. DUP 1 to 8. HAW 1 to 3. MW7, 9 to 11, 13 to 18.	Everett Bole-MDNR	Mary E. Gustafson-USEPA	Sampling/Data
87/07/16	Second Round of CLP Sample Results. Sample Delivery Group NO. 32275 from Versar to E.C.Jordan Co. Case Number VRR716.	Everett Bole-MDNR	Mary E. Gustafson-USEPA	Sampling/Data
00/00/00	Monitor Well Logs.	E.C. Jordan Co.		Sampling/Data

ADMINISTRATIVE RECORD SAMPLING/DATA INDEX
NORTHERNAIRE SITE, CADILLAC, MICHIGAN
Sampling/data documents available for review at USEPA
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DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
07/06/88	First round CLP sample results. Sample No's. SLW 1 to SLW 52. GW 1 to 3, 6 to 11, 13, 14, 16 to 18 and 20. MW 7, 9 to 11, 13 to 18. E 1, 6, 7, 13, 15, 16, 22, 23. MW 100 to 114. DUP 1 to 7, 9 to 12. MW 007, 009 to 011, 013 to 018.	Everett Dole-MDNR	Mary E. Gustafson-USEPA	Sampling/Data

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Interim Guidance on Compliance with Applicable or Relevant and Appropiate Requirements.	52 FR 32496	87/
Quality Assurance Plan for Superfund (Draft).	OSWER 9200.1-05	
Superfund Community Relations Policy.	OSWER 9230.0-02	
Interim Guidance On Compliance With Applicable Or Relevant AndAppropiate Requirements (ARAR).	OSWER 9234.0-05	
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CERCLA Compliance With Other Laws Manual Volume III (Draft).	OSWER 9234.1-03	
Procedures Manual For Superfund Community Relations Contractor Support (Draft).	OSWER 9242.5-01	
Standard Field Operating Safety Guide Manual, Manual #4 - Site Entry, Manual #7 - Decontamination of Response Personnel, Manual #6 - Work Zones, and Manual #9 - Site Safety Plan.	OSWER 9285.1-01B,.2-01,-02,-04&-05	
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Guidance for Conducting Remedial Investigations And Feasibility Studies Under CERCLA (Draft).	OSWER 9335.3-01	
Guidance on Preparing Superfund Decision Documents: The Proposed Plan And Record of Decision (Draft).	OSWER 9335.3-02	
Preparation of Decision Documents For Approving Fund-Financed And PRP Remedial Actions Under CERCLA.	OSWER 9340.2-01	
Superfund Remedial Design And Remedial Action Guidance (RD/RA).	OSWER 9355.0-04A	
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State Lead Remedial Project Manual.	OSWER 9355.2-01	
Guidance For Conducting RI/FS Under CERCLA (Draft).	OSWER 9355.3-01	
State Procurement Under Superfund Remedial Cooperative Agreements.	OSWER 9375.1-11	

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KYSOR INDUSTRIES
CADILLAC, MICHIGAN

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	2	89/08/07	Letter regarding the cities' role and position in the clean up	D.Becker-Mayor of Cadillac	USEPA	Correspondence	
	2	89/08/21	Letter concerning questions about cleanup and other related topics	M.Stark-CTH	D. O'Riordan	Correspondence	
	1	89/08/24	Letter concerning the responsible and participating parties in the cleanup	Samuel Bailor	D.Roycraft-MDNR	Correspondence	
	1	89/08/26	Letter accompanying Kysor Industrial Corporation's comments on the RI/FS and proposed plan	J.Dunn -Warner, Norcross & Judd	D.O'Riordan-USEPA	Correspondence	
	3	89/08/30	Comments on Remedial Investigation/Feasibility Study on behalf of Four Winns,Inc: history, perspective of proposed soil and water remediations	R.Cooper & D.Skrocki -ASI	D.O'Riordan-USEPA	Correspondence	
	2	89/09/05	Summary of comments from public hearing meeting on Kysor Industrial and Northernaire Plating Superfund Sites	M.Shanks- Black & Veatch	S.Sanders-USEPA	Correspondence	
	5	89/09/15	Comments on the reviewed Record	D.Roycraft-MDNR	S.Sanders-USEPA	Correspondence	

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	4	89/09/22	Comments on the draft responsiveness Summary for the Northernaire/ Kysor Record of Decision by MDNR	D.Roycraft-MDNR	S.Sanders-USEPA	Correspondence	
	2	89/09/28	MDNR coments concerning Record of Decision: selection of remedial technology, cleanup levels of TCE, rationale used to support selected remedy, & description of the site	D. Rector MDNR	V. Adamkus-USEPA	Correspondence	
	8	89/07/00	Fact sheet describing: background, results of RI, goals of cleanup, alternatives, evaluation, and schedule for public comments	USEPA		Fact Sheet	
	2	89/08/07	Statement regarding Cadillac groundwater problem: history and proposed plan of action	City of Cadillac		Fact Sheet	
	66	89/08/07	Transcript from Cadillac Area Groundwater Public Meeting (with MDNR, USEPA and E.C. Jordan)	Transcribed by Network Reporting -A.Holmes		Meeting Notes	
	129	89/08/26	Kysor Industrial Corporation's comments on the RI/FS and proposed plan for the Cadillac Industrial Park	Kysor Industries		Report/Studies	

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	375	89/06/08	Feasibility Study on Cadillac Area Groundwater Contamination	E.C. Jordan	MDNR/USEPA	Reports/Studies	
	120	89/09/29	Record of Decision (ROD); document explaining final remedy	USEPA		Reports/Studies	

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	5	88/05/20	Letter notifying recipients of potential liability with respect to the site. Also, recipients are requested to respond to the request for information enclosed in this letter. ***Information request is not attached***	Mary Gade-USEPA	See service list	Correspondence	
	6	88/05/24	Cadillac Regional Area Risk Assessment Review Northernaire Site, Cadillac, Michigan.	Malcolm Field-USEPA	Bruce Means-USEPA	Memorandum	
	88	83/08/00	Hydrogeologic Investigation Report For Four Star Corp. Cadillac, Michigan.	Gosling Czubak Assoc., P.C.	Four Star Corp.	Reports/Studies	
	28	85/04/11	Hazard Ranking System Scoring Package.	Ronald Bock	USEPA	Reports/Studies	
	48	88/04/00	"Cadillac Area Groundwater Contamination Feasibility Study-Cadillac, Michigan Interim Deliverable No. 1." This Report presents the remedial action objectives for the Cadillac FS, including preliminary target levels, and treated groundwater discharge requirements.	E.C.Jordan Co.	MDNR	Reports/Studies	
	108	88/07/00	"Cadillac Area Groundwater Contamination Feasibility Study-Cadillac, Michigan Interim Deliverable No. 2 Alternatives Array Document."	E.C. Jordan Co.	MDNR	Reports/Studies	

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	168	88/07/00	"Appendix A ARAR Identification Checklists."	E.C.Jordan Co.	MDNR	Reports/Studies	
	170	88/08/00	"Cadillac Area Groundwater Contamination Remedial Investigation - Cadillac, Michigan."	E.C. Jordan Co.	MDNR	Reports/Studies	

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Sampling/data documents available for review at USEPA
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87/06/00	Second Round CLP Sample Results: Sample No's. SLW 01 to 09, 10S & 10D, 11, 12S & 12P, 13 to 18, 20 to 25, 25 DIL, 26 to 52. GW 1S & 1D, 2, 3, 6S, 6RE, 6D, 7, 8, 9S, 9D, 10S-RE,10D, 10D-RE, 10S, 11, 13, 14D, 16 to 18, 20. MW-07, 09, 10, 11, 13 to 18. K1, 6, 6D, 7S, 7D, 13, 15, 16S, 16D, 22, 23. MW 100 to 107, 107-RE, 108 to 114. DUP 1 to 7, 9 to 12.	Everett I. Bole-MDNR	Mary E.Gustafson-USEPA	Sampling/Data
87/07/13	Second Round CLP Sample Results. Sample No's. MW-007, 9, 10, 11, 13 to 18. K-15, MW-1067, DUP 6.	Everett Bole-MDNR	Mary E. Gustafson-USEPA	Sampling/Data
87/07/00	Also from 87/08/00. Second Round CLP Sample Results. Sample No's. SLW-1 to SLW-53.	Everett Bole - MDNR	Mary E. Gustafson-USEPA	Sampling/Data
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87/07/16	Second Round of CLP Sample Results. Sample Delivery Group No. 3227S from Versar to E.C.Jordan Co. Case Number VER716.	Everett Bole-MDNR	Mary E. Gustafson-USEPA	Sampling/Data
00/00/00	Monitor Well Logs.	E.C. Jordan Co.		Sampling/Data

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Region V, Chicago,IL.

DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
07/06/88	First round CLP sample results. Sample No's. SLW 1 to SLW 52. GW 1 to 3, 6 to 11, 13, 14, 16 to 18 and 20. MW 7, 9 to 11, 13 to 18. E 1, 6, 7, 13, 15, 16, 22, 23. MW 100 to 114. DUP 1 to 7, 9 to 12. MW 007, 009 to 011, 013 to 018.	Everett Bole-MDNR	Mary E. Gustafson-USEPA	Sampling/Data

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Interim Guidance on Compliance with Applicable or Relevant and Appropiate Requirements.	52 FR 32496	87/08/27
Quality Assurance Plan for Superfund (Draft).	OSWER 9200.1-05	
Superfund Community Relations Policy.	OSWER 9230.0-02	
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CERCLA Compliance With Other Laws Manual Volume II (Draft).	OSWER 9234.1-02	
CERCLA Compliance With Other Laws Manual Volume III (Draft).	OSWER 9234.1-03	
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Superfund Public Health Evaluation Manual.	OSWER 9285.4-01	
Superfund Public Health Evaluation Manual.	OSWER 9285.4-01	87/07/
Health Assessments by ATSDR in FY-88.	OSWER 9285.4-03	
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Guidance on Feasibility Studies (FS) Under CERCLA.	OSWER 9355.0-05C	
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Guidance For Conducting RI/FS Under CERCLA (Draft).	OSWER 9355.3-01	
State Procurement Under Superfund Remedial Cooperative Agreements.	OSWER 9375.1-11	

RESPONSIVENESS SUMMARY

NORTHERNAIRE PLATING COMPANY &

KYSOR OF CADILLAC, INC.

CADILLAC, MICHIGAN

RESPONSIVENESS SUMMARY
NORTHERNAIRE PLATING COMPANY &
KYSOR OF CADILLAC, INC.
CADILLAC, MICHIGAN

INTRODUCTION

The Michigan Department of Natural Resources (MDNR) in cooperation with the U.S. Environmental Protection Agency (U.S. EPA) has gathered information on the types and extent of contamination, evaluated remedial measures, and recommended remedial actions at the Northernaire Plating Company (Northernaire) and Kysor of Cadillac, Inc. (Kysor) sites. Several public meetings were held to explain the intent of the project, describe the results of investigations, and to receive comments from the public. Opportunities for public participation in Superfund projects is required by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Contingency Plan (NCP). Comments received from the public are considered in the selection of the remedial action for the site. This document summarizes the comments received regarding the proposed final remedy and describes how they were incorporated into the decisionmaking process.

The community relations responsiveness summary has five sections:

- **Overview** discusses U.S. EPA's recommended alternatives for remedy of exposure to contaminated material at the Northernaire and Kysor sites.

- **Background on Community Involvement and Concerns** provides a brief history of community interest and concerns raised during remedial planning activities at the site.

- **Public Comments Received during Public Comment Period** summarizes both oral and written comments received from the community and U.S. EPA's responses grouped by the following topics: general comments, recommended alternative comments.

- **Potential Responsible Party Comments** summarizes comments received from the PRPs and U.S. EPA's responses.

- **Michigan DNR Comments** summarizes comments received from Michigan DNR and U.S. EPA responses.

In addition, Attachment A outlines community activities performed during the remedial response activities conducted at Northernaire and Kysor Superfund sites.

The detailed transcript of the Feasibility Study public meeting and the written comments are not included, but they are available for public inspection from U.S. EPA, Region V, in Chicago. Copies are also available in the Administrative Record at the following repository:

Cadillac-Wexford County Library
411 South Lake Street
Cadillac, Michigan

OVERVIEW

At the time of the public comment period, U.S. EPA had selected a preferred alternative for the Northernaire and Kysor sites in Cadillac, Michigan. U.S. EPA's recommended alternative addressed the soil contamination problems at the Kysor site and the groundwater contamination problems at both sites. The preferred alternative specified in the proposed plan involved vacuum extraction to reduce soil contamination at Kysor, and pumping and treating the contaminated groundwater. Treatment of groundwater would involve air stripping and carbon filtration. The treated groundwater would then be discharged to the Clam River.

Judging from the comments received during the public comment period, the residents and town council of Cadillac would like to see the use of a proposed Cogeneration facility for cleanup of the groundwater. The proposal for the construction of a large Cogeneration facility was brought forward by an entity known as Cogeneration Michigan Associates (CMA). This cogeneration facility would use large amounts of water in its operations and CMA has proposed to extract and treat the contaminated groundwater for use in their cogeneration facility. CMA's proposed treatment method would involve the use of air stripping to cleanup the groundwater. This proposal is also supported by at least one of the PRPs. The community in general had no objections to the alternative proposed by U.S. EPA, but some representatives of the community were in favor of using the Cogeneration facility to implement the cleanup.

BACKGROUND ON COMMUNITY INVOLVEMENT

Community interest in the area groundwater contamination began in 1978 when contamination was discovered in private wells downgradient of the Northernaire facility. In 1980 contamination of private wells was discovered downgradient of the Kysor facility. The major concerns expressed during the remedial planning activities at the Northernaire and Kysor sites focused on possible health effects from the contamination at the sites and the apparent delays in getting the sites cleaned up. These concerns and how U.S. EPA addressed them are described below:

1. Local residents were concerned with the health effects of drinking contaminated groundwater.

   Response: All residents using private wells which were contaminated were put on city water at the State's expense. A health study was done to determine the actual health effects.

2. One of the major concerns expressed by local officials and residents regarded the perceived delays in the cleanup schedule.

   Response: MDNR and U.S. EPA distributed information describing the remedial process and the time required for remedial activities.

PUBLIC COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD AND U.S. EPA RESPONSES

This responsiveness summary addresses both oral and written comments received by the U.S. EPA concerning the RI/FS for the Northernaire and Kysor Sites. The comment period was held from July 27 to August 28, 1989. A public meeting was held on August 7, 1989 at the Wexford County Courthouse to allow interested parties to present oral and written comments.

GENERAL COMMENTS

1. Mr. Darrell Becker, Mayor of Cadillac, Mr. Donald Rennie, City of Cadillac Utilities Director, Mr. Keith Johnson, and Mr. Samuel Bailor commented that U.S. EPA and Michigan DNR should consider cogeneration as a cleanup alternative.

   U.S. EPA's Response: The Agency is keenly aware that the Cogeneration project holds strong possibilities for supplementing or substituting for all or part of the Agency's proposed cleanup activities at the Northernaire and Kysor sites. However, the Agency's primary interest is in accomplishing a proper environmental cleanup, and while the Cogeneration project has other important aspects (i.e. jobs, economic benefits to the City), these aspects lie outside the scope of CERCIA. At this time it is too soon for the Agency to focus on Cogeneration as a preferred remedial alternative. However, should the Cogeneration project advocates demonstrate to the Agency's satisfaction that the Cogeneration project will adequately treat the groundwater to meet the Agency's specifications, then the Agency would consider a proposal for the Cogeneration project to work with the Agency to meet our environmental goals. At this time the Agency is not informed as to the actual details and specifications of the Cogeneration project.

2. Mr. Samuel Bailor had questions on the acute and latent effects of the existing site contaminants. Mr. Bailor also questioned the ability of the area forests to sustain a project such as cogeneration.

   U.S. EPA's Response: Each of the contaminants discovered at the Northernaire or Kysor sites may exhibit certain adverse effects on humans under certain circumstances. The risks posed by these contaminants were thoroughly studied during the "risk assessment" which was conducted as a part of the Remedial Investigation (RI). The risk assessment itself contains specific information on the actual assessment of the risk and the toxic effects of each individual contaminant. Nevertheless, it is the Agency's obligation to remedy these sites so that the public health and welfare are protected from adverse risk, and the selected remedy is designed to do exactly that.

   Questions relating to the raw timber required to supply the Cogeneration plant are beyond the scope of this remedial action, and are not relevant to this remedial action proposed by the Agency.

3. Ms. Mary Stark, Supervisor, Charter Township of Haring, had questions pertaining to the cogeneration project, in particular:

   Would contaminated soils be remedied with cogeneration?

   What effects would the cogeneration have on the local aquifers?

   What would happen to the discharge from the cogeneration plant?

   Will an environmental impact study be done on the cogeneration facility and would it be available?

   U.S. EPA Response: The Agency's selected remedy for these sites provides for cleanup of the contaminated soils near the Kysor plant. However, the Agency is unaware if the plans for the Cogeneration plant would have any impact on the contaminated soils problem at the Kysor plant.

   The pumping rates projected by the Cogeneration plant have not been projected to have any significant effects on the volume of water available from the local aquifer.

   The Agency has not been made aware of all the details of the Cogeneration project, and as a result, is not aware of the plans from any discharge from the plant.

   Environmental Impact Studies under the National Environmental Policy Act are required in certain situations where federal funds are used for a project. While there may be other reasons for doing such a study, the Agency is not aware that one is required for the Cogeneration project.

4. There were other questions at the public meeting on August 7, 1989, which were answered at the meeting (See copy of transcript of meeting contained in the Administrative Record).

PRP COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD AND U.S. EPA RESPONSES

1. Kysor of Cadillac, Inc. (Kysor) submitted a comment pertaining to the Kysor site being listed on the National Priorities List (NPL).

   U.S. EPA's Response: Kysor submitted a comment relating to the legal aspects of the NPL listing for the Kysor site. This comment is beyond the scope of the present public comment period, and the Agency will not now respond to it.

2. Kysor comments that the performance of a portion of the RI work was duplicative and not cost effective. Kysor states that even though it had done a hydrogeological investigation of the area surrounding the Kysor site, the State and U.S. EPA conducted another hydrogeological investigation of much of the same area.

   U.S. EPA's Response: Although some hydrogeological work had been done by Kysor at the Kysor site, the proper Quality Assurance/Quality Control procedures were not in place in order to assure that the data obtained was reliable and of high quality. Therefore, much of the hydrogeological work done by the State, although seeming duplicative in nature, was necessary in order to validate the previous data and fill any data gaps with reliable good quality data. Also a number of the monitoring wells installed by Kysor may have been installed using improper installation techniques, thereby providing a conduit for migration of contaminants from the shallow aquifer to the intermediate aquifer (see section 2.2 of ROD Summary). This necessitated the need for installation of new monitoring wells at the Kysor site.

3. Kysor comments that the baseline risk assessment uses erroneous assumptions in the calculation of exposure risk. First, Kysor comments that the exposure assessment's models used by U.S. EPA are flawed, and secondly, that the exposure assessment uses implausible duration assumptions.

   U.S. EPA's Response: It is the U.S. EPA's position that the models used for the calculation of risk is appropriate for these two sites. The environmental factors taken into consideration by the risk assessment models included natural recharge and dispersion, biological and chemical degradation, adsorption, and volatilization. In conducting risk assessments, the standard length of exposure used is 70 years. While Kysor states that this grossly overstates the actual duration of exposure, 70 years is the commonly used standard which complies with the Superfund Public Health Evaluation Manual (SPHEM).

4. Kysor states that the RI report uses inconsistent and misleading designations for the sources associated with Four Star and Joynts.

   U.S. EPA's Response: The RI states that the Four Star and Joynts facilities are separate sources of contamination. It is difficult to determine what the extent of contribution to the overall contamination that each of these facilities is responsible for due to the commingling of contaminants within the plume. For that reason both facilities were sometimes referred to jointly. However, it is clear that Four Star and Joynts are separate facilities and separate sources of contamination.

5. Kysor comments that the ARARs analysis is based on the erroneous assumption that the affected aquifers are actual or potential drinking water sources.

U.S. EPA's Response: The affected aquifers in the Cadillac industrial park can and have been used as drinking water sources. In fact, the same aquifers underlying the industrial park are presently serving as drinking water sources in the North Park Subdivision area. When establishing ARARs it is the Agency's policy to maintain an aquifer's useability as a drinking water source. In this manner the affected aquifers can be used for drinking water sources after cleanup is complete.

6. Kysor comments that the FS report erroneously applies certain state rules and policies as ARARs, in particular the Part 22 Rules of the Michigan Water Resources Act (Act 245) and the 10^{-6} policy.

   U.S. EPA's Response: For a response, please refer to the response to Comment 1 from the State of Michigan as discussed below.

7. Kysor comments that the FS errs in the calculation of residual risk. In particular, flawed modeling assumptions and failure to consider numerous environmental factors.

   U.S. EPA's Response: It is U.S. EPA's position that the model used for the calculation of risk is appropriate for these two sites (see Comment 3).

8. Kysor comments that the FS errs in setting the final groundwater and soil target cleanup levels for toluene, tetrachloroethylene, 1,1-dichloroethylene, and trans-1,2-dichloroethylene.

   U.S. EPA's Response: It is the responsibility of U.S. EPA through the Superfund program to provide for protection of human health at Superfund sites. The Agency has established numerous guidelines to meet these responsibilities. One of these guidelines is the establishment of a risk range for total additive risk associated with all the contaminants of concern at a Superfund site. The goal is for the total additive risk for all contaminants to fall within the 10^{-4} to 10^{-7} risk range. The target cleanup levels established at the Northernaire and Kysor sites were established in order to meet that goal.

9. Kysor comments that the FS overestimates the requirements for the groundwater treatment system because of the use of unreasonably high estimates for the purge water contaminant concentrations.

   U.S. EPA's Response: The requirements for the groundwater treatment system developed in the FS are only estimates. The actual system will be designed during the remedial design phase of the project. However, U.S. EPA feels that the estimates developed for the treatment system are reasonable for the site conditions at the Northernaire and Kysor sites.

10. Kysor comments that the FS underestimates the time required for implementation of the groundwater remedy.

U.S. EPA's Response: Again the time required for implementation of the groundwater remedy is only an estimate. U.S. EPA feels this is an accurate estimate of the time required for implementation of this type of remedy.

11. Kysor comments that the FS should evaluate the accelerated purge rate that may be associated with the cogeneration project.

    U.S. EPA's Response: The FS is used to help decide what remedy to use to cleanup a Superfund site, not to determine the specifications of the chosen remedy. During the Remedial Design phase of the project the actual purge rates will be analyzed and decided upon.

12. Kysor comments that the FS uses misleading terminology to identify the extraction well systems.

    U.S. EPA's Response: It is true that the extraction well systems in the FS are referred to as "Kysor Shallow" and "Kysor Intermediate". These designations, however, were not intended to make any implication relative to the liabilities of any party. The designation of the well system bears a rational relationship to the name of the site.

13. Kysor comments that the Proposed Plan is inaccurate and misleading. In particular three issues are raised: Why are Northernaire and Kysor the only sites in the industrial park mentioned as having contamination present? Why is the remedy just for Northernaire and Kysor? The portion of the costs attributable to the chromium is understated.

    U.S. EPA's Response: First, this is an action being taken under the authority of the Comprehensive Environmental Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act, more commonly referred to as Superfund. The Superfund remedial program is designed to address Superfund sites, therefore, to the extent practicable, only the contamination at the Superfund sites shall be singled out in the proposed plan. However other contamination located within the industrial park not associated with these two Superfund sites can and is being addressed by other means. This action will only address the contamination associated with the two Superfund sites, Northernaire and Kysor. The groundwater contamination plume associated with these two sites is one indivisible plume with multiple origins, some of which are not Superfund sites (Four Winns, Four Star, Joynts). Since this contamination from multiple origins is commingled, all of the contamination within the plume is being addressed by this action. The one exception is the Rexair contamination plume which can be identified as a separable plume. The Rexair plume is not being addressed by this remedy.

The proposed plan does not attempt to attribute costs to any one facility so it is erroneous to say that costs are attributed unfairly.

14. Kysor comments that the scope of the groundwater remedy is unnecessarily broad.

U.S. EPA's Response: The scope of the groundwater remedy is to remediate the contaminated groundwater associated with the two Superfund sites, Northernaire and Kysor. As mentioned above, some other sources of VOC contamination have comingled with the VOC contamination associated with the Kysor site. In this instance it is impossible, to separate this VOC contamination into those portions contributed by the several different sources. The Rexair plume is the one exception.

15. Kysor comments that U.S. EPA should reconsider Soil Flushing and other technologies as the remedy for the soil contamination at the Kysor site.

U.S. EPA's Response: U.S. EPA did consider soil flushing as an alternative for cleanup of the soils at the Kysor site and it was rejected in favor of the vacuum extraction treatment. This decision was made by balancing the nine criteria against all of the alternatives and choosing the best remedy, based on site conditions. Soil flushing would add to the already extensive contamination of the groundwater, which would increase the amount of time required to reach cleanup levels, which is not desirable.

In reference to Kysor comments about soil composting techniques, if U.S. EPA determines during the Remedial Design stage that the treatment for the contaminated soils at Kysor as outlined in the ROD would not meet the requirements of the cleanup goals, including cost effectiveness, other technologies (perhaps including soil composting) may be considered.

16. Kysor comments that the soils remedy for the Kysor site does not require the use of deed restrictions.

U.S. EPA's Response: U.S. EPA feels that deed restrictions are necessary for implementation of the soils remedy at the Kysor site. However, the deed restrictions would only be in effect for as long as the soil remained contaminated.

17. Kysor comments that groundwater modeling is necessary prior to design and implementation of the remedy.

U.S. EPA's Response: U.S. EPA concurs with this comment and the modeling will be done as part of the Remedial Design.

18. Kysor comments that the cogeneration project provides the appropriate remedy for the area groundwater contamination.

U.S. EPA's Response: The U.S. EPA agrees that the Cogeneration project presents possibilities for a remedy for the groundwater contamination in the Cadillac Area Industrial Park. However, prior to endorsing such a remedy, there are many issues that must be considered and resolved.

19. ASI Environmental Technologies comments that the treatment proposed for the groundwater cleanup appears to be technically feasible. However, it is scaled to address the major contamination plumes and is not practicably applicable to the contamination for which Four Winns is responsible.

U.S. EPA's Response: Since the contamination for which Four Winns is potentially responsible is comingled with the other contamination plumes, in effect making the contamination one bigger plume, it is not practical to attempt to separately treat the potential Four Winns contamination. Therefore, the potential Four Winns contamination should and will be addressed as part of the larger contamination plume.

MICHIGAN DNR COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD AND U.S. EPA RESPONSES

1. The Michigan Department of Natural Resources (MDNR) submitted letters dated September 28, 1989, which stated that MDNR concurs with the remedial technology selected for the Kysor and Northernaire sites, but does not concur with the target cleanup level for Trichloroethene (TCE).

U.S. EPA's Response: The U.S. EPA welcomes the State's concurrence on the remedial technology proposed for the sites. However, the MDNR raises significant issues regarding compliance with State laws. MDNR specifically cites Act 245, and its rules. These rules restrict degradation of waters of the State, and apply to indirect or direct "addition of materials to groundwater from any facility or operation which acts as a discrete or diffuse source..." R323.2202(j). The MDNR further asserts that, "The ROD states that the target cleanup level for TCE is the Maximum Contaminant Level (MCL), which is 5 parts per billion (5 ppb). MDNR does not support the use of MCL's as target cleanup levels; the Department supports a target cleanup level of one part per billion (1 ppb)."

Section 121(d)(2)(A) of the amended CERCLA states that remedies must comply with "any promulgated standard, requirement, criteria, or limitation under a State environmental or facility siting law that is more stringent than any Federal standard, requirement, or limitation" if applicable or relevant and appropriate to the hazardous substance or release in question. General State goals that are contained in a promulgated statute and implemented via specific requirements found in the statute or in other promulgated regulations are potential ARARs. Where such promulgated goals are general in scope, e.g. a general prohibition against discharges to the waters of the State, compliance must be interpreted within the contex of implementing regulations, the specific circumstances at the site, and the remedial alternatives being considered.

The U.S. EPA accepts that a nondegradation law can be an ARAR. However, the specific regulations which implement a general goal are key in identifying what compliance with the goal means. If a state has not promulgated implementing regulations, then the U.S. EPA would have considerable latitude in determining how to comply with the goal. The U.S. EPA may consider guidelines the state has developed related to the provision, as well as state practices in applying the goal, but such guidance would not be ARAR.

The State of Michigan contends that Act 245 is an ARAR for this site. A literal reading of the Act and its Part 22 Groundwater Discharge regulations implementing the Act indicates that the law is prospective and is intended to prevent degradation of ground water quality. The remedy for the Kysor/Northernaire sites consists of extracting contaminated ground water, treating (removing) the contaminants, and discharging the treated water into a surface water body. Therefore, the U.S. EPA does not find Act 245 and its Part 22 Rules to be ARAR. However, U.S. EPA fully supports the State's goal to ensure that the waters of the State are protective of the public health and welfare.

The State asserts that its 1 ppb cleanup goal for TCE is based on Act 245, and Part 22. Unfortunately, neither Act 245, nor the Part 22 Rules, provide specific remediation goals for the contaminants of concern. We note that the only discussion regarding specific concentration levels found in the Part 22 Rules appears in 323.2205(3) which states: "Materials at concentrations that exceed the maximum contaminant levels for inorganic and organic chemicals...which are promulgated pursuant to the safe drinking water act 42 U.S.C. 300f, shall not be discharged into ground waters in usable aquifers..." Therefore, even if Act 245 and Part 22 Rules were considered to be ARAR, the rules do not provide specific criteria or numerical standards which could be applied in establishing remedial cleanup goals.

The U.S. EPA has developed a consistent policy regarding remediation goals for ground water. This policy may be found in the December 21, 1988 proposed revisions to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The U.S. EPA has stated its policy that for surface or ground water that is or may be used for drinking, MCLs are generally relevant and appropriate as cleanup standards. The basis for this policy was that MCLs are protective of human health and represent the level of water quality that U.S. EPA believes is acceptable for over 200 million Americans to consume every day from public drinking water supplies. As the enforceable standard for public water supplies, MCLs are fully protective of human health and, for carcinogens, fall within an acceptable lifetime risk range of 1E-04 to 1E-07. When MCLs do not exist for contaminants identified in the ground water at a site, the Superfund program will use other standards, advisories or criteria to determine if the response action will achieve a level of protection within a range of 1E-04 to 1E-07 individual lifetime excess cancer risk.

The remedy proposed for the Kysor/Northernaire sites establishes cleanup goals for several contaminants. For example, the MDNR, as the lead agency conducting the RI/FS, initially proposed to use MCLs as the target cleanup levels for Trichloroethene (5ppb), and 1,2-Dichloroethane (5 ppb). In addition, the MDNR used a Contract Required Detection Level of 5 ppb for 1,1-Dichloroethylene, and a carcinogenic risk derived level of 1 ppb for Perchloroethylene. If one were to express the risks posed by these contaminants, at these concentration levels, one would find that 5 ppb of TCE represents a lifetime risk of 1.5E-06, 1,1-DCE represents a 8.29E-05 risk, PCE represents a 1.49E-06 risk, and 1,2-DCA represents a 1.3E-05 risk. The U.S. EPA accepted the cleanup goals proposed by the State because the additive risk posed by these chemicals (9.9E-05) remained within U.S. EPA's accepted risk range. Although the MDNR letters state: "MDNR does not support the use of MCL's as target cleanup levels..," there is no discussion regarding the cleanup levels for contaminants other than TCE. The State simply argues that the MCL for TCE is unacceptable, without providing any supporting documentation, or evidence of an overarching rationale for selecting more stringent cleanup goals for particular contaminants. A 1 ppb concentration level for TCE represents a 3.14E-07 lifetime risk. This risk, deemed acceptable by the MDNR for TCE, is an order of magnitude less than the risks deemed acceptable for the other contaminants. The U.S. EPA recognizes that there may be circumstances when individual cleanup goals may be adjusted to ensure that a remedy provides a level of protectiveness within the U.S. EPA's accepted risk range. The remedy selected for the Kysor/Northernaire sites does not exceed the risk range, so adjustments to the cleanup goals are not required. In fact, the additive risk calculated for the sites using a 1 ppb cleanup level for TCE simply reduces the total risk from 9.9E-05 to 9.77E-05. Given the inherent inconsistencies presented by the State's insistence on a 1 ppb cleanup level for TCE at these sites, the U.S. EPA maintains that MCLs are protective, and declines to adopt a 1 ppb cleanup goal for TCE.

2. The State comments that the description of the "Site" needs to be expanded to reflect additional known sources of contamination which are not included within the Proposed Plan but have been addressed in the RI/FS documents upon which the Proposed Plan is based. Specifically, the Rexair TCE plume on the east side of the municipal well field and the contaminated soils on the Four Winns' property require mention as to their presence and why they are not addressed within the Proposed Plan.

U.S. EPA's Response: The Agency does not agree that it is necessary to describe or discuss contamination which is not directly relevant to the determination of a remedy for the Northernaire and Kysor sites. While there may be additional areas of contamination in the vicinity of the industrial park, the scope of the Superfund activities is limited to those activities necessary to remedy only the Northernaire and Kysor contamination. U.S. EPA supports Michigan DNR efforts to bring facilities, outside the scope of CERCLA, into compliance with the State's environmental statutes.

3. The State comments that although contaminated soils on the Four Winns property are not included in this Proposed Plan, it should be stated that each of these soil alternatives have been evaluated for Four Winns' soils. Remediation of soils on both the Kysor and Four Winns properties is assumed in determining the length of time to achieve cleanup goals in the groundwater cleanup alternatives.

   U.S. EPA's Response: The U.S. EPA agrees that the Four Winns soil contamination was evaluated in the FS. However, the U.S. EPA does not believe that an adequate characterization was done on the contamination of the Four Winns soils. Without adequate characterization of the type and extent of the soil contamination at Four Winns it is impossible to adequately evaluate the feasibility of any alternatives for cleanup. Again, U.S. EPA supports Michigan DNR efforts to bring facilities, outside the scope of CERCLA, into compliance with the State's environmental statutes.

Attachment A

COMMUNITY RELATIONS ACTIVITIES CONDUCTED
AT THE NORTHERNAIRE AND KYSOR SITES

Fact sheets were released on the following dates to keep the public informed on the activities going on at the two sites:

October 1983	Fact sheet to inform public of upcoming RI/FS activity at Northernaire site.
February 1984	Fact sheet to inform public of ongoing RI/FS activity at Northernaire site.
July 1984	Fact sheet to inform public of RI/FS activity at Northernaire site.
August 1984	Fact sheet to inform public of RI/FS activity at Northernaire site.
July 1985	Fact sheet to inform public of FFS/Proposed Plan for cleanup of soils at Northernaire site.
April 1986	Fact sheet to inform public RI/FS activity concerning area groundwater study.
August 1986	Fact sheet to inform public of RI/FS activity concerning area groundwater study.
October 1986	Fact sheet to inform public of RI/FS activity concerning area groundwater study.
August 1988	Fact sheet on RI for area groundwater study.
July 1989	Fact sheet on FS/Proposed Plan for cleanup of the contaminated soils at Kysor and contaminated groundwater associated with Northernaire and Kysor.

Public meeting were held on the following dates to provide a forum for the public input, and update the public on important milestones.

February 1984	Public meeting to determine public concern on Northernaire RI/FS activity.
August 1984	Public meeting to determine public concern on Northernaire RI/FS activity.
July 1985	Public meeting to provide forum for comment on FFS/Proposed Plan for soils remedy at Northernaire.

August 1986	Public meeting to determine public concern on Cadillac area groundwater RI/FS activity.
August 1988	Public meeting to discuss RI for the area groundwater study.
August 1989	Public meeting to provide forum for comment on FS/Proposed Plan of area groundwater study.