United States Environmental Protection Agency
Office of Emergency and Remedial Response
EPA/ROD/R07-91/051
September 1991

EPA

Superfund Record of Decision:

Shaw Avenue Dump, IA

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R07-91/051	2.	3. Recipient's Accession No.

4. Title and Subtitle SUPERFUND RECORD OF DECISION Shaw Avenue Dump, IA First Remedial Action	5. Report Date 09/26/91 6.
7. Author(s)	8. Performing Organization Rept. No.
9. Performing Orgainization Name and Address	10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460	13. Type of Report & Period Covered 800/000 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 26-acre Shaw Avenue Dump site is a chemical waste site in Charles City, Floyd County, Iowa. Land use in the area is predominantly residential. Part of the site lies within the 100-year floodplain of the Cedar River, and a wetlands area is located approximately 600 feet south of the site. From 1899 to 1964, Charles City used the site as a municipal landfill for waste incineration, and disposal of liming sludge from the city's publicly owned treatment works (POTW) and asphaltic materials continue to be disposed of in the landfill. Additionally, from 1949 to 1953, chemical wastes generated by chemical batch processing of arsenic and compounds used in the production of animal pharmaceuticals at Salsbury Laboratories were disposed of onsite. Between 1977 and 1981, the State issued reports based on studies of the site and surface water that documented elevated levels of metals in an abandoned gravel pit near the site. Approximately 14,000 to 28,000 cubic feet of chemical waste and 10,000 tons of solid waste from the POTW, including sludge containing hazardous waste from Salsbury Laboratories, and associated contaminated soil are currently present onsite. Leaching of contaminants, especially arsenic, from 370 cubic yards of chemical fill and adjacent soil into ground water is thought to be the pricipal

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Shaw Avenue Dump, IA
First Remedial Action
Contaminated Media: soil, debris
Key Contaminants: VOCs (benzene, toluene, xylenes), other organics (PAHs), metals (arsenic, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 47
	20. Security Class (This Page) None	22. Price

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

Abstract (Continued)

threat at the site. A 200-gallon underground storage tank (UST) is located within the vicinity of the chemical fill, and also is considered to be a possible source of onsite contamination. This Record of Decision (ROD) addresses the chemical fill and surrounding contaminated soil, and the underground gasoline tank as Operable Unit 1 (OU1). A future ROD will address contaminated ground water as OU2. The primary contaminants of concern affecting the soil and debris are VOCs including benzene, toluene, and xylenes; other organics including PAHs; metals including arsenic and lead; and other inorganics.

The selected remedial action for this site includes treating the chemical fill and soil using in-situ fixation and stabilization, followed by constructing a low permeability cap over the fixed and stabilized fill; conducting treatability studies to determine the effectiveness of the treatment, and if treatment is not effective, issuing an ESD and disposing of the waste offsite; removing and disposing of offsite the underground gasoline tank; monitoring ground water quality; and implementing institutional controls including deed restrictions, and site access restrictions including fencing. The estimated present worth cost for this remedial action is $513,400, which includes an annual present worth O&M cost of $65,550.

PERFORMANCE STANDARDS OR GOALS: Action-specific soil clean-up goals are based on State and Federal standards, RCRA Land Disposal Restrictions, OSHA, RCRA Toxic Characteristic Leachate Procedure, and UST regulations, and include arsenic 50 mg/kg and cadmium 20 mg/kg.

RECORD OF DECISION
SHAW AVENUE DUMP
CHARLES CITY, IOWA

Declaration

1.0 Site Name and Location

Shaw Avenue Dump Site
Charles City, Floyd County, Iowa

1.1 Statement of Basis and Purpose

This decision document presents the selected remedial action for the chemical fill and contaminated soil at the Shaw Avenue Dump Site, located in Charles City, Floyd County, Iowa, and was developed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 (1990). This decision document explains the factual and legal basis for selecting the remedy for this Site.

The Iowa Department of Natural Resources (IDNR) concurs with the selected remedy. The remedial action decision is based on the Administrative Record, which is available for public review at the Charles City Public Library, 106 Milwaukee Mall, Charles City, Iowa, and at the U.S. Environmental Protection Agency (EPA) Regional Office located at 726 Minnesota Avenue, Kansas City, Kansas.

1.2 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.

1.3 Description of the Selected Remedy

EPA has decided to divide this Site into two operable units. Operable unit one will address the chemical fill and surrounding contaminated soil. Operable unit two will address contaminated ground water. The remedy involving the first operable unit is presented in this ROD. The remedy involving the second operable unit will be presented in a future ROD.

The chemical fill and surrounding contaminated soil present the principal threat at the Shaw Avenue Dump Site and are considered the source of contamination in the ground water. The major components of the selected remedy for soil, which is designed to address the chemical fill and soil contamination, include the following:

-Fixation/stabilization of chemical fill and contaminated soil;

-Installation of a low permeability cap to protect the fixated/stabilized material; and

-Ground water monitoring will be continued during and after implementation of the fixation/stabilization remedy to determine the effectiveness of the remedy in preventing leaching of contaminants to the ground water.

If treatability testing shows that stabilization/fixation is ineffective for the chemical fill and contaminated soil then this material will be excavated and removed to a RCRA approved landfill as described in alternative 7.1.3 in the Description of Alternatives contained in this ROD.

1.4 Declaration of Statutory Determinations

The selected remedy is protective of human health and the environment, complies with 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 the chemical fill and contaminated soil, and it satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as their principal element. The contingency remedy complies with all of the statutory requirements with the exception that under the current land disposal restrictions it does not require treatment to reduce toxicity, mobility, or volume. However, in May of 1992 the Land Disposal Restrictions will require treatment prior to disposal of these materials.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection for human health and the environment.

Martha R. Steincamp for 9/26/91

Morris Kay
Regional Administrator
U.S. EPA. Region VII

Date

DECISION SUMMARY

1.0 Site Name, Location and Description

The Shaw Avenue Dump Site (Site) is located on the southeastern edge of Charles City, Iowa, approximately 600 feet from the Cedar River, near the intersection of Shaw Avenue and Clark Avenue (Figures 1 and 2). The Site occupies approximately twenty-four acres of the Cedar River 100-year flood plain. The Site is owned by the City of Charles City. The Charles City waste water treatment plant (POTW) is immediately east of the Site.

The Site runs northeast to southwest with a length of approximately 2,000 feet and a width of approximately 525 feet. The Iowa Terminal Railroad tracks bound the Site to the west. The Site is fenced on the north and east sides and is bordered by the Cedar River to the south. Figure 3 presents the locations of private wells near the Site.

2.0 Site History and Enforcement Activities

Charles City purchased the northern portion of the Site in 1899 and continued to acquire sections of it until 1964. A municipal landfill was operated on the Site from sometime prior to 1949 until 1964 and the Site continues to be used for disposal of liming sludge from Charles City's POTW. The Site was also used by Salsbury Laboratories, Inc., (now Solvay Animal Health, Inc.), from 1949 to 1953 to dispose of chemical waste generated by chemical batch processing of arsenic and compounds used in Salsbury's production of animal pharmaceuticals. On December 31, 1989, Salsbury Laboratories, Inc. merged with Solvay Veterinary, Inc. to form Solvay Animal Health, Inc.

Liming sludge from the Charles City POTW was disposed of at the Site from 1949 to 1964. The City's POTW received liquid industrial waste from Salsbury during the period the City disposed of its sludge at the Site. Salsbury's liquid waste during this period included arsenic, nitrophenol, orthonitroaniline, nitrobenzene, and 1,1,2-trichloroethane. There is no evidence that anyone but Salsbury Laboratories sent hazardous waste to the City's POTW. Therefore, Salsbury's waste was present in the sludge disposed of by the City at the Site. The quantity of chemical waste disposed of by Salsbury at the Site is estimated to be between 14,000 and 28,000 cubic feet and the quantity of solid waste disposed of at the Site from the City's POTW for the period from 1949 to 1964 is estimated to be 10,000 tons.

The Site was identified as a potential hazardous waste site by the Iowa Department of Environmental Quality (IDEQ) in 1977. The IDEQ studied the Site and documented arsenic contamination in surface water in an abandoned gravel pit near the Site in several reports issued between 1977 to 1981.

The Site was placed on the National Priorities List (NPL) in July 1987. A Remedial Investigation/Feasibility Study (RI/FS) was initiated in July 1988 and field work was completed in June 1990. The RI report was finished in June 1990 the Risk Assessment was completed in April 1991 and the FS report was completed in June 1991.

3.0 Highlights of Community Participation

The Administrative Record and the Proposed Plan for the Shaw Avenue Dump Site were released to the public for comment on July 12, 1991. The RI and FS Reports were made available to the public in the Administrative Record at both an information repository maintained at the EPA Docket Room at the Region VII offices and at the Charles City Public Library, Charles City, Iowa. The notice of availability for these two documents was published in The Charles City Press on July 12, 1991. The public comment period on the Proposed Plan ran from July 12, 1991, to August 12, 1991. In addition, a public meeting was held in Charles City, on July 24, 1991. At this meeting, representatives from EPA, Iowa Department of Natural Resources (IDNR), Iowa Department of Health (IDOH) and the Agency for Toxic Substances and Disease Registry (ATSDR) presented information and answered questions about the Site and the remedial alternatives under consideration. Responses to the comments received during the public comment period are included in the Responsiveness Summary, which is part of this ROD. The decision for this Site is based on the Administrative Record.

4.0 Scope and Role of Response Action Within Site Strategy

As noted above, on July 12, 1991, EPA issued the Proposed Plan for the Shaw Avenue Dump Site. The Proposed plan presented EPA's preferred remedial alternative for both the chemical fill and surrounding contaminated soil as well as the contaminated ground water at the Site. EPA has reviewed all of the public comments received during the public comment period and on the basis of those comments has decided to separate the remedy for this Site into two operable units. Operable unit one will address the chemical fill and surrounding contaminated soil. Operable unit two will address contaminated ground water. This sequencing of the operable units will allow the chemical fill and contaminated soil to be addressed resulting in a significant risk reduction. Ground water monitoring will continue during and after implementation of the first operable unit. After ground water monitoring data is analyzed following implementation of the first operable unit the plans for the second operable unit will be finalized. This ROD contains EPA's selected remedy for operable unit one. At some point in the future, EPA will issue another Proposed Plan that will present EPA's preferred remedial alternative for operable unit two. At that time, the public will be given an opportunity to comment on all of the alternatives presented in the Proposed Plan.

As with many Superfund sites, the problems at the Shaw Avenue Dump Site are complex. The chemical fill and contaminated soil present the principal threat at the Site as a result of leaching of contaminants to ground water and the possible risk of exposure to future residents or onsite workers. The selected remedy uses fixation/stabilization to address the principal threat. The Remedial Investigation identified the source of contamination at the Site to be the chemical waste disposed of at the Site by Salsbury Laboratories. The threat posed by the present levels of arsenic in soil and ground water is of particular concern.

The response action selected in this ROD addresses the principal threat posed by the chemical fill and contaminated soil at the Site and is intended to constitute final action for the chemical fill and contaminated soil at this Site.

The cleanup objectives of this remedial action are to eliminate or reduce to an acceptable level the risks posed by exposure to the contaminated soil and chemical fill and to eliminate or reduce the potential migration of contaminants into ground water. To accomplish this objective the contaminated soil and chemical fill will be fixated/stabilized or excavated and removed to a RCRA landfill to prevent further releases of hazardous substances as well as exposure to the hazardous substances. These risks were identified by the baseline risk assessment performed for the Shaw Avenue Dump Site.

5.0 Summary of Site Characteristics

The nature and extent of contamination of chemical fill and soil at the Shaw Avenue Dump Site is summarized in this section. This summary is based primarily on data generated by the work performed pursuant to the RI/FS. Detailed information regarding the nature and extent of contamination is contained in the final RI report (June 1990), which is part of the administrative record for this Site.

5.1 Soil and Chemical Fill

The areal and vertical extent of chemical fill and associated soil contamination was estimated by analyzing samples from soil borings, monitoring wells and trenching conducted during the RI/FS. Chemical fill was identified in three waste cells around a city-owned maintenance facility located in the northern portion of the Site. The chemical fill is located approximately two to three feet below the ground surface and extends vertically to bedrock. The thickness of the chemical fill encountered ranges from .5 to 9.5 feet. The total volume of chemical fill was calculated to be 370 cubic yards with additional contamination in the adjacent soil.

The chemical fill exhibits characteristics of process wastes generated by Salsbury Laboratories from 1949 to 1953. Analyses of samples collected from the chemical fill during the RI revealed high levels of arsenic, cadmium, chromium, lead and volatile and semi-volatile organic compounds including methylene chloride, 1,1,2-trichloroethane, and orthonitroaniline as detailed in Table 4. Concentrations of metal contaminants were highest in the waste material itself, with lesser, but still elevated, concentrations in the soil around the chemical fill. The chemical fill and contaminated soil is considered to be the source of contamination in the ground water.

A 200 gallon underground gasoline storage tank is located in the vicinity of the chemical fill. The tank is owned by the City and used as a fuel source for City vehicles. It is considered to be a possible source of benzene, toluene, xylene, and manganese in soil and ground water.

The chemical fill is located in the alluvium that overlies the Upper Cedar Valley formation. The Cedar Valley is a limestone formation. An extremely fractured and weathered limestone layer exists at the surface of the Cedar Valley formation. The Upper Cedar Valley formation is hydrologically separated from the Lower Cedar Valley formation by a relatively impermeable shale unit. The Upper Cedar Valley aquifer underlies the entire Site. There is also an unconfined alluvial aquifer in the southern portion of the Site.

Analyses of surface soil samples showed high levels of polycyclic aromatic hydrocarbons (PAHs) and heavy metals including arsenic, beryllium, and cadmium as detailed in Table 2. Analyses of subsurface soil samples showed high levels of PAHs and metals including arsenic, cadmium, and lead as detailed in Table 3. The concentrations of PAHs are typical of those resulting from the burning of municipal wastes and the disposal of asphaltic materials and are in the area of the Site where municipal wastes were burned and asphaltic materials were disposed by the City. Additional sampling and analysis will be conducted during the remedial design to determine the extent of contamination in the surface soils since these concentrations were based on composite sampling.

5.2 Ground Water

Ground water flow direction in the Upper Cedar Valley aquifer is typically west to southwest along the northern and southwestern portions of the Site and to the south along the southeastern portion of the Site to the Cedar River. During periods of heavy snow melt or heavy precipitation, a temporary ground water flow divide is created in the northern portion of the Site and flow direction is both west/southwest and east/northeast. Ground water flow in the unconfined alluvial aquifer is generally towards the Cedar River. However, during periods of high river flow, the flow direction in the northern portion of the Site will reverse and the alluvial aquifer will be recharged by the Cedar River. The Cedar River is the discharge point for the unconfined alluvial aquifer and the Upper Cedar Valley aquifer.

Borings completed at the Site revealed several hydraulically separate water bearing units. These include a local perched aquifer at the northern end of the Site, an unconfined alluvium aquifer, an unconfined upper bedrock aquifer (the Upper Cedar Valley), and a lower bedrock aquifer (the Lower Cedar Valley). The Upper and Lower Cedar Valley formations are separated by the Chickasaw Shale which acts as a confining unit, preventing flow from the upper unit to the lower unit. An upward hydraulic head also prevents flow from the upper to the lower bedrock aquifer.

Fifteen monitoring well nests were installed at the Site during the RI/FS. The location of the well nests are illustrated in Figure 4. The investigations conducted during the RI identified distinct areas of ground water contamination at the Site. High levels of volatile organic compounds including vinyl chloride, 1,1-dichloroethene, 1,2-dichloroethane, and 1,1,2-trichloroethane were detected in ground water monitoring wells at the southern end of the Site. In the northern and central portions of the Site, the ground water was contaminated with heavy metals including arsenic. Benzene, toluene, and xylene were also detected in the northern portion of the site. The benzene, toluene and xylene may come from an underground storage tank located on the Site. A complete list of compounds detected in the ground water is presented in Table 1. EPA's selected remedial alternative for the contaminated ground water will be presented in a Proposed Plan to be issued some time in the future.

6.0 Summary of Site Risks

6.1 Overview of Baseline Risk Assessment

A baseline risk assessment was conducted as required by CERCLA to evaluate the potential impacts to human health and the environment posed by Site contaminants absent a remedial action (i.e., if the Site were not cleaned up). Both current and future land use scenarios were evaluated. An ecological assessment was also performed as a companion to the baseline human health risk assessment. This section summarizes the findings of the risk assessment. The complete risk assessment is presented in the RA Report which is contained in the Administrative Record. The risk assessment consisted of an identification of chemicals of potential concern, an exposure assessment, a toxicity assessment, and a risk characterization.

6.2 Contaminants of Concern

Contaminants of concern (COCs) are contaminants that have been detected at the Shaw Avenue Site that have inherent toxic or carcinogenic effects and which are likely to pose the greatest concern with respect to the protection of human health and the environment. Forty individual compounds in addition to a group of similar polycyclic aromatic hydrocarbons (PAHs) were identified as potential chemicals of concern in the soil, surface water, ground water, and chemical fill at the Shaw Avenue Dump Site. Toxicity information for all the chemicals of concern was evaluated including, where applicable, slope factors and criteria for non-carcinogenic effects.

The potential compounds of concern detected within each media of concern are listed in Tables 1-4. Sixteen of these compounds as well as several of the PAHs are human carcinogens.

Exposures to potential chemicals of concern were identified based on reasonable assumptions about current and future uses of the Shaw Avenue Dump Site. For current land use conditions, exposures were evaluated for current residents living adjacent to the Site and current workers at the Site. In the evaluation of future land use, scenarios involving residences built on the Site, workers at the Site and recreational uses were considered.

6.3 Toxicity Assessment

The toxicity assessment characterized available human health and environmental criteria for the contaminants of concern, and qualitatively related potential chemical exposure (dose) to expected adverse health effects (response). Included in this assessment are the pertinent standards, criteria, advisories and guidelines developed for the protection of human health and the environment. An explanation of how these values were derived and how they are applied is presented below.

Slope factors have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Slope factors, 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 slope factor. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Slope 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. Slope factors for contaminants of concern at the Site are presented in Table 5.

Reference doses (RfDs) have been developed by 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, that are likely to be without an appreciable risk of adverse health effects. 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. RfDs for contaminants of concern are presented in Table 5.

6.4 Exposure Assessment

The exposure assessment identified potential pathways and routes for contaminants of concern to reach the receptors and the estimated contaminant concentration at the points of exposure. Exposure pathways by which humans could be exposed to chemicals of concern were identified based on reasonable assumptions about current and future uses of the Site. Risks associated with direct contact with surface soils were evaluated for both workers and recreational users, since these represent both current and future land uses. Residential use was also considered to be a potential future land use. Possible routes of exposure include ingestion, inhalation and dermal from surface water, ground water, and soil.

Contaminant release mechanisms from environmental media, based on relevant hydrologic and hydrogeologic information (fate and transport, and other pertinent site-specific information, such as local land or water use) were also presented. Potential exposure pathways evaluated include ingestion of surface soils, direct contact with surface soils, inhalation of dust, ingestion of ground or surface water, inhalation of volatiles from surface or ground water, and direct contact with surface or ground water. Other routes include consumption of fish from the Cedar River or vegetables grown in contaminated soil. For each potentially significant exposure pathway, exposure assumptions were made for reasonable maximum exposures.

A reasonable maximum exposure (RME) represents a situation which is more conservative than an average case but is not a worst case scenario. As explained in guidance published by EPA in October 1988 for conducting remedial investigations and feasibility studies, the RME scenario is developed to reflect the types and extent of exposures that could occur based on the likely or expected use of the Site in the future.

6.5 Risk Characterization

The risk characterization quantifies present and/or potential future risks to human health that may result from exposure to the contaminants of concern found at the Site. The site-specific risk values were estimated by incorporating information from the toxicity and exposure assessments.

When sufficient data is available, two quantitative evaluations are made: the incremental risk to the individual resulting from exposure to a carcinogen; or, for noncarcinogens, a numerical index or ratio of the exposure dose level to an acceptable reference dose. A description of the evaluation is contained below.

6.5.1 Risks From Non-Carcinogenic Compounds

The EPA has developed standards, guidelines, and criteria that provide levels of intakes considered to protect human populations from possible adverse effects resulting from chemical exposures. A ratio of the estimated chemical intake to the Reference Dose (RfD) provides a numerical measure of the potential that adverse health effects may result. This ratio is referred to as the chronic hazard quotient (HQ). For noncarcinogenic risks, the term "significant" is used when the chronic HQ is greater than one. In the absence of federal standards, the HQ is compared to the most applicable criteria or guideline.

Calculated chemical intakes, as described previously, were compared to chemical intakes associated with the most applicable standard or guideline. The estimated chronic chemical intake, in mg/kg-day, is estimated using the exposure assumptions and actual site data. The chemical intake is then compared to the RfD (listed in Table 5 for contaminants of concern at this Site) to determine if chronic exposure to the contaminated medium presents a risk. Because certain standards are derived for protection against either subchronic or chronic exposures, chemical intakes for noncarcinogens were developed for subchronic and chronic exposures and the associated risks were assessed as appropriate.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the 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.

In general, hazard indices greater than one are associated with potentially increased health risk. The baseline risk assessment indicated total hazard indices ranging from less than one to 185. Indices were calculated for vinyl chloride, benzene, 1,1-dichloroethene, 1,2-dichloroethane, 1,1,2-trichloroethane, arsenic, beryllium, cadmium, manganese, nickel, toluene, and xylene. A summary of the noncarcinogenic hazard indices are presented in Table 6.

6.5.2 Risks From Carcinogenic Compounds

For carcinogens or suspected carcinogens, a quantitative risk assessment involves calculating risk levels considered to represent the probability or range of probabilities of developing additional incidences of cancer under the prescribed exposure conditions. Carcinogenic risk estimates, expressed as additional incidences of cancer, are determined by multiplying the slope factor by the projected exposure dose level. It is the slope factor, expressed in $(mg/kg/day)^{-1}$ which converts the estimated exposure dose level, expressed in (mg/kg/day), to incremental risk. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$). 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. EPA has determined that remedial actions should minimize the risk at the Site so that it falls within a range of 10^{-4} to 10^{-6}. The Agency considers this to be a generally acceptable risk range.

The carcinogenic risk assessment for the Site indicated that under reasonable maximum exposure scenarios cancer risks for future residential use range from $1x10^{-3}$ to $6x10^{-2}$ (one additional person out of a thousand to six additional persons out of a hundred are at risk of developing cancer). The risk assessment also indicated a cancer risk of $3x10^{-3}$ from the chemical fill for workers on the Site. A summary of the results of calculations of carcinogenic risks evaluated for the Site are presented in Table 6.

6.5.3 Environmental Evaluation

Environmental and ecological risks associated with the presence of contamination at the Site were also evaluated as part of the risk assessment and were determined to be minimal. The ecological portion of the Risk Assessment determined that there were no critical habitats or endangered species affected by contamination present at the Site. The impact on the Cedar River was determined to be minimal. The arsenic concentration in the River resulting from contamination at the site was estimated to be one part per million (ppm), which is below background and below the concentration contributed by a nearby site which is contributing a mean of twenty ppm to the River. There is currently no use of the contaminated ground water.

6.5.4 Uncertainties

Regardless of the type of risk estimate developed, it should be emphasized that all estimates of risk are based upon numerous assumptions and uncertainties. In addition to limitations associated with site-specific chemical data, other assumptions and uncertainties that affect the accuracy of the site-specific risk characterization result from the extrapolation of potential adverse human effects from animal studies, the extrapolation of effects observed at high dose to low dose effects, the modeling of dose response effects, and route-to-route extrapolation.

The use of acceptable levels (established standards, criteria, and guidelines) and unit cancer risks which are derived from animal studies introduce uncertainty into the risk estimates. In addition, the exposure parameters used in estimating chemical intakes are often associated with uncertainties. As such, these estimates should not stand alone from the various assumptions and uncertainties upon which they are based. In developing numerical indices of risk, an attempt is made to evaluate the effect of the assumptions and limitations on numerical estimates. When the assumptions and uncertainties outweigh the meaningfulness of a risk assessment, a qualitative assessment of risk is performed.

6.5.5 Conclusion

In conclusion, based on the results of the risk assessment, EPA has determined that actual or threatened releases of hazardous substances from this Site, if not remediated may present an imminent or substantial endangerment to public health, welfare, or the environment.

7.0 Description of Alternatives

7.1 Chemical Fill and Contaminated Soil

The baseline risk assessment for the chemical fill and contaminated soil at the Site indicated the potential for a significant health threat to humans. The chemical fill and contamination in the soil represents the principal threat at the Shaw Avenue Dump Site because it is the source of contamination in the ground water. A full range of remedial alternatives for contamination in soil and the chemical fill was evaluated in the FS and Proposed Plan. Based on public comment EPA has decided to divide the remedy for this Site into two operable units. Operable unit one will address the chemical fill and surrounding contaminated soil. Operable unit two will address contaminated ground water. The selected remedy for the first operable unit is presented in this ROD. The remedy involving the second operable unit will be presented in a future ROD. However, for informational purposes the ground water alternatives presented in the Proposed Plan are described in Section 7.2 of this ROD.

7.1.1 No Action

The National Contingency Plan requires that the "no action" alternative be evaluated for every Site. This alternative provides a baseline for comparing the effectiveness of the other remedial alternatives. Under this option, no further action would be taken at the Site to prevent exposure to contaminated soils or migration of contamination from the Site. The Site would remain in its present condition. There would be no costs associated with this alternative. This alternative would not comply with ARARs and would not be protective of human health and the environment.

7.1.2 Deed Restrictions, Access Control, Capping, and Monitoring

This alternative would include removal of the underground gasoline tank, installation of a Resource Conservation and Recovery Act (RCRA) cap over the chemical fill, implementation of deed restrictions, installation of a fence and markers around the chemical fill, and ground water monitoring. The RCRA cap would consist of (from bottom to top) a 2-foot compacted clay layer, a high-density polyethylene (HDPE) liner, a 1-foot drainage layer, a 2-foot fill layer, 6 inches of topsoil, and a vegetative cover. The RCRA cap would minimize infiltration of surface water through the fill, thereby, minimizing contaminant migration out of the chemical fill. Restrictions would be placed on the property deed to inform any future property owners of the presence of the chemical fill, limit future use of the Site, prevent the potential use of the ground water beneath the Site, and protect the integrity of the cap. A security fence and warning markers would be installed outside the boundaries of the cap covering the fill to prevent unauthorized Site entry. Ground water quality monitoring would be conducted to assess the effectiveness of the cap in preventing migration of the contaminants. This alternative would require long-term maintenance and monitoring. Site inspections would be required on a regular basis along with maintenance of the cap, including necessary repairs. Sampling of existing monitoring wells would be conducted to monitor ground water quality.

Institutional controls at the Site under this alternative would consist of deed restrictions placed on the landfill property. This would require the City of Charles City, the owners of the Site, to submit for recording by the Recorder of Deeds, Floyd County, State of Iowa a restrictive covenant which would run with the property comprising the Site and which would prohibit the construction, installation, maintenance, or use of any wells on the Site for the purposes of extracting water for human drinking, bathing, or swimming purposes or for the irrigation of food or feed crops as well as any construction or intrusive activities at the Site. The City would also submit for recording with the Recorder of Deeds, access easements, which would run with the property comprising the Site and which reserve such access as may be necessary for the City and Solvay to implement the remedial action and for conducting O&M. The City would also provide access to EPA to oversee these activities.

This alternative would not reduce the toxicity, mobility or volume of the chemical fill contaminants through treatment. Five-year reviews would be required to assess the effectiveness of the alternative because the contaminants would be left onsite.

No chemical or location-specific ARARs have been identified for this alternative. Major action-specific ARARs for this alternative include RCRA closure requirements (40 CFR Part 264), the underground storage tank regulations (40 CFR Part 280, Subpart G), OSHA, and the Iowa Rules for Determining Cleanup Actions and Responsible Parties (I.A.C., Chapter 567-133). This alternative would meet these ARARs.

Implementation of this alternative would take less than six months. The estimated capital cost and the present worth of the O&M costs, based on a 5 percent discount rate over a 30-year period, are $79,700 and $65,550, respectively, meaning the total estimated present worth cost for this alternative is $145,250.

7.1.3 Chemical Fill Excavation and Offsite Disposal

This alternative would consist of excavation and removal of the underground gasoline tank and excavation and disposal of the chemical fill material and contaminated subsurface soil. The excavated material would be disposed of at an offsite RCRA permitted disposal facility. The excavated area would then be backfilled with clean material.

This alternative would not reduce the toxicity, mobility, or volume of the contaminants because no treatment technology would be used. No chemical or location-specific ARARs have been identified for this alternative. Major action-specific ARARs for this alternative include the RCRA requirements located in 40 CFR Part 264, the underground storage tank regulations (40 CFR Part 280, Subpart G), OSHA, and the Iowa Rules for Determining Cleanup Actions and Responsible Parties (I.A.C., Chapter 567-133). All Department of Transportation regulations applicable to transportation of hazardous waste would have to be observed. This alternative would also have to meet RCRA Land Disposal Restrictions (40 C.F.R. Part 268) which require treatment of the hazardous waste prior to disposal in a RCRA-authorized hazardous waste landfill. The type of treatment would be dictated by requirements of the RCRA Land Disposal Restrictions. Under current regulations this material does not require treatment prior to disposal. However, in May of 1992 the Land Disposal Restrictions will require treatment prior to disposal of these materials.

Implementation of this alternative would take less than six months. No O&M costs would be associated with this chemical fill alternative because there would be no O&M for the soils. However, a five-year review and therefore, ground water monitoring would be required because of ground water contamination. The estimated capital costs and present worth of this alternative is $845,000.

7.1.4 Deed Restrictions, Access Control, In Situ Fixation/Stabilization, Capping, and Monitoring

This alternative would include in situ fixation/ stabilization of the chemical fill, construction of a low-permeability cap over the fixated/stabilized fill, implementation of deed restrictions, installation of a fence and markers around the capped fill, and monitoring of the ground water quality. In addition, the underground gasoline tank would be removed and disposed of.

In situ fixation/stabilization would be accomplished through the addition of a reagent (a cement-like material) to the wastes that mechanically locks the contaminants within the solidified matrix. The type and application rate of the reagent would be determined by a laboratory bench-scale study. The in situ fixation/stabilization would consist of mixing the reagent (generally in the form of a slurry) directly with the chemical fill and contaminated soil in situ. One method of mixing the materials which is appropriate for wastes that extend deeper than three to four feet involves adding the reagent to the waste in

1-foot increments. Upon fixation/stabilization of the 1-foot layer, the fixated material would be scraped to the side within the excavation and the process repeated on the next layer. When the last layer has been fixated/stabilized, all the treated material would be recompacted in the excavation.

Following fixation/stabilization, the soil mass would be covered to prevent human contact and to protect the fixated/stabilized mass. A low-permeability cap consisting of either a 2-foot clay layer covered by a 2-foot fill and vegetated layers or an 8-inch thick reinforced concrete slab would be placed over the waste. Following construction of the soil cap, vegetation would be established to prevent erosion. The best fixation/stabilization method would be determined during the laboratory bench-scale study.

Institutional controls at the Site under this alternative would consist of deed restrictions placed on the landfill property. This would require the City of Charles City, the owners of the Site, to submit for recording by the Recorder of Deeds, Floyd County, State of Iowa a restrictive covenant which would run with the property comprising the Site and which would prohibit the construction, installation, maintenance, or use of any wells on the Site for the purposes of extracting water for human drinking, bathing, or swimming purposes or for the irrigation of food or feed crops as well as any construction or intrusive activities at the Site. The City would also submit for recording with the Recorder of Deeds, access easements, which would run with the property comprising the Site and which reserve such access as may be necessary for the City and Solvay to implement the remedial action and for conducting O&M. The City shall also provide access for EPA to oversee these activities. A security fence and warning markers would be installed outside the boundaries of the capped and fixated/stabilized fill to prevent unauthorized Site entry.

Ground water quality monitoring would be conducted to assess the effectiveness of the fixation/stabilization in preventing migration of the contaminants.

This alternative would reduce the mobility of the chemical fill contaminants through treatment. However, the toxicity would not be reduced and the volume would actually increase as a result of the addition of the reagent. No chemical- or location-specific ARARs have been identified for this alternative. Major action-specific ARARs for this alternative are the underground storage tank regulations (40 CFR Part 280, Subpart G), OSHA, and the Iowa Rules for Determining Cleanup Actions and Responsible Parties (I.A.C., Chapter 567-133). This alternative would meet these ARARs. This alternative would require long-term maintenance and monitoring. Site inspections would be required on a regular basis along with maintenance of the cap. Sampling of existing monitoring wells would be conducted to monitor ground water quality.

Implementation of this alternative would take less than twelve months. The estimated capital costs and the present worth of the O&M costs, based on a 5 percent discount rate over a 30-year period, are $447,850 and $65,550, respectively, making the total estimated present worth cost for this alternative is $513,400.

Because this alternative would result in contamination remaining on the Site, CERCLA requires that the Site would be reviewed every five years.

7.2 Ground Water

The baseline risk assessment for the ground water at the Site indicated the potential for a significant health threat to humans. Therefore, a full range of remedial alternatives for contamination in the ground water was evaluated. These alternatives would have to meet all ARARs. The alternatives are described below. As noted above, after consideration of the public comments submitted in this matter, EPA has decided to separate the remedy for this Site into two operable units. The EPA preferred alternative for the operable unit involving ground water contamination will be presented in a Proposed Plan at some time in the future. The public will be given the opportunity to comment on the Proposed Plan. Although the ground water alternatives will not be implemented, they are reviewed briefly here. These alternatives are discussed in detail in the FS which is part of the Administrative Record for this Site.

7.2.1 No Action

The NCP requires that the no action alternative be evaluated for every site to provide a baseline for comparison to the other alternatives. Under the no action alternative, no action would be taken to prevent or reduce ground water contamination.

Ground water samples would be collected from existing onsite monitoring wells and analyzed for volatile organics and total metals. Sampling would be conducted on a quarterly basis during the first five years and would be subsequently conducted annually.

Because this remedy would result in hazardous substances remaining onsite above health-based levels, a review would be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Costs for the no action alternative would include costs for the collection and analysis of ground water samples for ten years. The total present worth of the no action alternative is estimated to be $34,000.

7.2.2 Ground Water Monitoring

Under this alternative, ground water quality samples would be collected from existing onsite monitoring wells and analyzed. The samples would be collected and analyzed on an annual, semiannual, quarterly, or monthly basis from monitoring wells, depending on well location and parameter of concern as proposed in Table 7. This is different than the ground water sampling under the no-action alternative which is simply the monitoring required to conduct a five year review. Because the contaminants would remain onsite, five-year reviews would also be required for this alternative.

Institutional controls at the Site under this alternative would be identical to those required for the chemical fill and contaminated soil alternatives.

Because this remedy would result in hazardous substances remaining onsite above health-based levels, a review would be conducted within five years after commencement of the remedial action to ensure that the remedy is providing adequate protection of human health and the environment.

Chemical-specific ARARs applicable to this alternative include the federal Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) and Iowa Rules for Determining Cleanup Actions and Responsible Parties (I.A.C., Chapter 567-133). These ARARs would have to be met before the Site could be deleted from the NPL.

Costs for this alternative would include the Operation and Maintenance (O&M) costs for the collection and analysis of ground water samples and the five-year reviews. The total present worth of this alternative, based on a five percent discount rate over 30 years, is estimated to be $65,550.

7.2.3 Ground Water Extraction and Treatment at the Publicly Owned Treatment Works (POTW)

This alternative would involve extraction of ground water from beneath and down gradient from the Shaw Avenue Dump Site to hydraulically contain the contaminant plume thereby preventing further migration of contaminants toward the Cedar River. Four bedrock extraction wells would be installed to remove ground water at a total extraction rate of 80 gallons per minute (gpm) or 115,200 gallons per day. Approximately 42 million gallons of ground water would be extracted each year. The extracted ground water would be pumped through a new force main to the Charles City POTW for treatment.

The POTW is designed to treat a wastewater flow of 2.44 million gallons per day (MGD), but is able to handle a maximum flow of 6.1 MGD. Treatment of wastewater at the POTW consists of the following operations: screening, flow monitoring and grit removal, settling in two primary clarifiers, biological degradation of organic compounds in a single-stage trickling filter, settling in a secondary clarifier, wastewater sampling at two sampling stations, and discharge of treated effluent to an outfall on the Cedar River. Sludge from the primary and secondary clarifiers would be further treated in two aerobic digesters. The trickling filter would be the primary means of treating ground water extracted from the Shaw Avenue Dump Site. It is not anticipated that the metals, specifically arsenic and magnesium, present in the ground water would be treated by the POTW.

This alternative would also involve establishing a hydraulic monitoring system, a ground water quality monitoring system, and a ground water extraction monitoring system at the Site. Hydraulic monitoring would involve the collection of water levels on a quarterly basis to plot ground water contours in order to define ground water flow patterns. The hydraulic monitoring would demonstrate the hydraulic containment provided by the ground water extraction system. Ground water quality monitoring would include the collection of ground water samples on an annual, semiannual, quarterly, or monthly basis from monitoring wells, depending on well location and parameter of concern. The goal of the ground water quality monitoring would be to assess the effectiveness of source control remediation, to monitor the progress of ground water remediation, and to determine the redistribution of contamination in response to the pumping of ground water. Ground water extraction monitoring would include collection and analysis of samples from extraction wells and the combined well influent to the POTW to assess treatment efficiency and to monitor the progress of ground water remediation.

Institutional controls at the Site under this alternative would be identical to those required for the chemical fill and contaminated soil alternatives.

This alternative would take twelve months to be operational. It is anticipated that the restoration of bedrock ground water would take more than 30 years. The capital cost of this alternative is estimated to be $168,100. The O&M costs are anticipated to be $53,000 each year. The total present worth of this alternative, assuming a 30-year remedial action, is estimated to be $990,800.

Because this remedy would result in hazardous substances remaining on-site above health-based levels, a review would be conducted within five years after commencement of the remedial action to ensure that the remedy is providing adequate protection of human health and the environment. These five-year reviews would also be used to assess the progress of ground water remediation.

The primary federal and state ARARs for this ground water alternative are chemical or action-specific regulations. The MCLs and MCLGs specified by the Safe Drinking Water Act (SDWA) are relevant and appropriate for remediation of ground water at the Site. Iowa Water Quality (I.A.C., Chapter 567-133) standards are applicable to contaminant levels present in the Cedar River from the recharge of contaminated ground water from the Site. The General Pretreatment Regulations for Existing and New Sources of Pollution [40 Code of Federal Regulations (CFR) 403.5] would be applicable to the discharge of ground water to the POTW. Discharge of treated effluent from the POTW would have to continue to comply with the City's National Pollutant Discharge Elimination System (NPDES) permit after discharge of ground water to the wastewater treatment plant began. The Occupational Safety and Health Act (OSHA) would be applicable during construction and operation of this alternative. This alternative would satisfy all ARARs, but does not satisfy the CERCLA preference for treatment. Pretreatment of the ground water for arsenic and manganese before discharging it to the POTW is necessary, because according to the EPA guidance "CERCLA Site Discharges to POTWs", a contaminant passes through the POTW untreated if a POTW does not specifically treat for that particular contaminant. Pretreatment is required even if the discharge limits (in this case, the limits stated in the POTW's NPDES permit) for this contaminant are not exceeded.

7.2.4 Ground Water Extraction, Pretreatment by Chemical Precipitation, and Treatment at the POTW

This ground water alternative would be identical to the ground water alternative described in Section 7.1.3 with the exception that the ground water would be pretreated before being discharged to the POTW. Chemical precipitation would be used to remove arsenic and manganese from the ground water prior to being discharged to the POTW. In this process, flocculent agents would be added to the ground water to aid in the formation of floc that are large enough to settle out of the ground water. An iron coprecipitation process would be used to treat the ground water because it has a greater removal efficiency that conventional alkaline precipitation. During this process, heavy metals are trapped in an insoluble iron matrix. Entrapment occurs when the heavy metals that are coprecipitated with iron are rapidly removed from the ground water. The ground water would be clarified before being discharged to the POTW. System components would include an equalization tank, a reactor module, a clarification and flocculation module, a sludge dewatering system, a polymer blending and addition system, and a bulk chemical handling, storage, and addition system. The process would produce approximately 19.6 pounds of sludge per day, or 3.6 tons per year, and may require disposal at a hazardous waste facility.

This alternative would take no longer than twelve months to be operational. It is anticipated that the restoration of bedrock ground water to a usable state would take more than 30 years. The capital cost of this alternative is estimated to be $294,100. The present worth of the O&M costs are anticipated to be $68,840 annually. The total present worth of this alternative, assuming a 30-year remedial action, is estimated to be $1,352,400.

Because this remedy would result in hazardous substances remaining onsite above health-based levels, a review would be conducted within five years after commencement of the remedial action to ensure that the remedy is providing adequate protection of human health and the environment. These five-year reviews would also be used to assess the progress of ground water remediation.

The primary federal and state ARARs for this ground water alternative are chemical or action-specific regulations. The MCLs and MCLGs specified by the SDWA are relevant and appropriate for remediation of ground water at the Site. Iowa Water Quality standards (I.A.C., Chapter 567-133) are applicable to contaminant levels present in the Cedar River from the recharge of contaminated ground water from the Site. The General Pretreatment Regulations for Existing and New Sources of Pollution (40 CFR 403.5) would be applicable to the discharge of ground water to the POTW. Discharge of treated effluent from the POTW would have to continue to comply with the NPDES permit currently held by the City's POTW after discharge of ground water to the wastewater treatment plant began. OSHA rules and regulations would be applicable during construction and operation of this alternative.

8.0 Summary of Comparative Analysis of Alternatives

Nine evaluation criteria have been developed by EPA to address CERCLA statutory requirements and technical, cost, and institutional considerations which the Agency has determined appropriate. The evaluation criteria serve as the basis for conducting detailed analysis during the FS and for subsequently selecting an appropriate remedial action. Attachment A provides a glossary of the evaluation criteria. This comparison will be conducted only for the chemical fill and contaminated soil alternatives since this ROD addresses that operable unit.

The preferred alternative for the cleanup of contaminated soils and chemical fill at the Shaw Avenue Dump Site is in situ fixation/stabilization and capping. Based on current information, this alternative appears to provide the best balance among the alternatives with respect to the evaluation criteria. The preferred alternative is described below in relation to the evaluation criteria and is compared to the other alternatives under each criterion.

8.1.1 Overall Protection of Human Health and Environment

The in situ fixation/stabilization alternative would be protective of human health and the environment. Fixation/ stabilization and capping of the contaminated soils and chemical fill would reduce direct contact exposure to protective levels and also minimize the potential for contaminant migration. Ground water monitoring would be conducted to assess the performance of this alternative in preventing contaminant migration.

With the exception of the no action alternative, all the other alternatives provide protection to human health and the environment by removing, reducing, or controlling risk through treatment, engineering controls, or institutional controls.

8.1.2 Compliance with ARARs

The fixation/stabilization alternative will comply with all federal and state ARARs, including the Iowa Responsible Parties Cleanup Regulations (I.A.C., Chapter 567-133) and OSHA.

All the other alternatives except for the no action alternative would comply with all identified ARARs.

8.1.3 Long-Term Effectiveness and Permanence

Implementation of the in situ fixation/stabilization and capping alternatives would effectively reduce the long-term risks associated with direct contact with the contaminated soil and chemical fill and potential contaminant migration at the Shaw Avenue Dump Site. Long-term controls would be required to ensure the integrity of the remedy. All of the soil/chemical fill alternatives, except no action, would be effective in reducing the long-term risks associated with direct contact with the contaminated soil and chemical fill and potential contaminant migration.

8.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Only the in situ fixation/stabilization alternative would employ treatment to reduce the mobility of the contaminants.

However, in situ fixation/stabilization would actually increase the volume of contaminated material. None of the alternatives would reduce the toxicity or volume of the contaminants in the chemical fill. In May of 1992, Land Disposal Restrictions will require treatment prior to disposal of these materials. Therefore, if the materials are excavated and removed pursuant to Alternative 7.1.3 after May of 1992, treatment would be required.

8.1.5 Short-Term Effectiveness

The short-term risks associated with the in situ fixation/stabilization alternative include worker exposure to contaminants and possible exposure of the public and workers at the site to fugitive dust and surface runoff. These potential exposures can be effectively minimized and controlled by compliance with the action-specific ARARs and the implementation of engineering controls such as dust suppressants and berms.

All the other soil/chemical fill alternatives (except the no-action alternative) would present the same short-term risks identified above in relation to onsite construction, excavation, and loading.

8.1.6 Implementability

Implementation of the in situ fixation/stabilization alternative would involve conventional techniques that are readily available, proven, and reliable. Bench scale treatability tests would be performed to determine the type and application rate of the fixation/stabilization reagent to be used. There are no anticipated significant administrative issues, such as permitting, that would affect the implementability of this alternative.

Implementation of the other alternatives would also involve conventional technologies that would not present any technical or administrative impediments.

8.1.7 Cost

The present worth of the soil/chemical fill alternative is approximately $513,400. The estimated present worth of the no-action alternative is $34,800. The present worth of the capping alternative is $145,250. The estimated present worth of the removal alternative is approximately $845,000.

8.1.8 State Acceptance

The State of Iowa supports the preferred alternative for the cleanup of contaminated soils and chemical fill at the Shaw Avenue Dump Site.

8.1.9 Community Acceptance

Community acceptance of the soil and chemical fill alternative of in situ fixation/stabilization has been evaluated following the Public Meeting held on July 24, 1991, and conclusion of the public comment period on August 12, 1991. The results of this evaluation are presented in the attached Responsiveness Summary.

8.2 Ground Water Alternatives

After consideration of the public comments, EPA has decided to separate the remedy for this Site into two operable units. Operable unit one will address the chemical fill and surrounding contaminated soil. Operable unit two will address the contaminated ground water. The remedy for operable unit one is presented in this ROD and the selected remedy for operable unit two will be presented in a Proposed Plan to be issued at some time in the future. The public will be given an opportunity to comment on the Proposed Plan. Since this ROD addresses the remedy for the chemical fill and contaminated soil the comparative analysis of the ground water alternatives is not presented here. This comparison is presented in detail in the FS and the Proposed Plan which is part of the Administrative Record for this Site.

9.0 Selected Remedy

Based on the Risk Assessment for the Site, EPA has determined that elevated levels of contaminants including arsenic exist at the Site above levels of concern for human health and the environment.

On the basis of an evaluation of the relative performance of each alternative utilizing the evaluation criteria contained in the NCP, the EPA has determined that the in situ fixation/ stabilization and capping alternative presents the best balance among the alternatives for remediation of the contaminated soils and chemical fill. This selected alternative will satisfy the statutory requirements in CERCLA Section 121, which states that the remedy should be protective of human health and the environment, be cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. However, the full effectiveness of the technology employed by the selected remedy cannot be determined until treatability studies are performed during the design phase. If it is determined through treatability testing that the technology will not be adequate, alternative 7.1.3 (Excavation and Offsite Removal) will be implemented. Alternative 7.1.3 complies with all the statutory requirements with the exception that under current regulations it would not require treatment. However, in May of 1992 the Land

Disposal Restrictions will require treatment prior to disposal of these materials. The fixation/stabilization remedy is the only remedy considered for operable unit one that utilizes treatment. A decision to change the remedy from fixation/stabilization to alternative 7.1.3 would be accomplished in an Explanation of Significant Differences which would be published in a local newspaper of general circulation.

This alternative will include in situ fixation/stabilization of the chemical fill, construction of a low-permeability cap over the fixated/stabilized fill, implementation of deed restrictions, installation of a fence and markers around the capped fill, and monitoring of the ground water quality. In addition, the underground gasoline tank would be removed and disposed of.

This alternative will fixate/stabilize all of the soils and chemical fill contaminated above health-based levels in the area of the three waste cells identified near the City's maintenance building. This will prevent and/or minimize hazardous waste leaching into the ground water, thereby reducing the potential for contaminant migration. Also, any contaminated surface soils will be fixated/stabilized at the same time.

The selected alternative will not pose any unacceptable short-term impacts to human health and the environment during its implementation.

In situ fixation/stabilization is accomplished through the addition of a reagent (a cement like material) to the wastes that mechanically locks the contaminants within the solidified matrix. Before implementation of this remedial alternative, a laboratory bench-scale study will be performed to determine the type and application rate of the fixation/stabilization reagent to be used. If the laboratory bench scale test indicates that fixation/stabilization is not effective on the wastes at the Shaw Avenue Dump Site, the contaminated chemical fill and soil will be excavated and disposed of at an offsite, RCRA permitted disposal facility. The best fixation/stabilization method will be determined during the laboratory bench-scale study. One method of mixing the materials which is appropriate for wastes that extend deeper than three to four feet involves adding the reagent to the waste in 1-foot increments. Upon fixation/stabilization of the 1-foot layer, the fixated material is scraped to the side within the excavation and the process is repeated on the next layer. When the last layer has been fixated/stabilized, all the treated material is recompacted in the excavation.

Following fixation/stabilization the soil mass will be covered to prevent direct contact and to protect the solidified mass. A low-permeability cap consisting of either a 2-foot clay layer covered by a 2-foot fill and vegetated layers or an 8-inch thick reinforced concrete slab would be placed over the waste.

Following construction of the soil cap, vegetation would be established to prevent erosion.

Institutional controls at the Site for the selected alternative would consist of deed restrictions placed on the landfill property. This would require the City of Charles City, the owners of the Site, to submit for recording by the Recorder of Deeds, Floyd County, State of Iowa, a restrictive covenant which would run with the property comprising the Site and which would prohibit the construction, installation, maintenance, or use of any wells on the Site for the purposes of extracting water for human drinking, bathing, or swimming purposes or for the irrigation of food or feed crops as well as any construction or intrusive activities at the Site. The City would also submit for recording with the Recorder of Deeds, access easements, which would run with the property comprising the Site and which reserve such access as may be necessary for the City and Solvay to implement the remedial action and for conducting O&M. The City shall also provide access for EPA to oversee these activities. A security fence and warning markers will be installed outside the boundaries of the capped and fixated/stabilized fill to prevent unauthorized Site entry.

The selected alternative will satisfy all federal and state ARARs. It will comply with I.A.C. Chapter 567-133 which requires remedial actions in the State of Iowa to address soil contamination which may adversely affect ground water, OSHA, and with the underground storage tank regulations (40 CFR Part 280, Subpart G). There are no chemical-specific or location-specific ARARs for the contaminants in the soil and the chemical fill. The selected alternative will also utilize permanent solutions and treatment technologies to the maximum extent practicable. The determination of the maximum extent to which permanent solutions and treatment can be practically used takes into consideration a number of factors including long-term and short-term effectiveness of the alternative, implementability, and cost.

Ground water quality monitoring will be conducted to assess the effectiveness of the fixation/stabilization in preventing migration of the contaminants. Sampling of existing monitoring wells will be conducted to monitor ground water quality. The selected alternative would reduce the mobility of the chemical fill contaminants through treatment. However, the toxicity would not be reduced and the volume would actually increase from the addition of the reagent. Because the contaminants will be left onsite, five-year reviews will be required by CERCLA to assess the effectiveness of the alternative in protecting human health and the environment. This alternative will require long-term maintenance and monitoring. Site inspections will be required on a regular basis along with maintenance of the cap.

Implementation of this alternative will take less than twelve months. The estimated capital costs and the present worth of the O&M costs, based on a 5 percent discount rate over a 30-year period, are $447,850 and $65,550, respectively. The total estimated present worth cost for this alternative is $513,400. See Table 9 for details.

Concentrations of contaminants in soil which would be protective of human health and the environment were determined in the baseline risk assessment for several contaminants of concern at the Shaw Avenue Dump Site. The protective concentrations are based on the conservative residential exposure scenarios for both an average and maximum case. The protective soil concentrations were determined to represent a reasonable maximum exposure. For arsenic and cadmium, soil cleanup levels are 50 parts per million (ppm) and 20 ppm, respectively. Therefore, all soil or chemical fill containing arsenic or cadmium above these levels will be fixated/stabilized to where they do not fail the Toxic Characteristic Leachate Procedure (TCLP).

10.0 Statutory Determinations

Under its legal authority, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action for this site must comply with applicable or relevant and appropriate environmental standards established under federal and state environmental laws, unless a statutory waiver is justified. The selected remedy also must be cost effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 Protection of Human Health and the Environment

The selected remedy protects human health and the environment through containment and treatment of the contaminants by fixation/stabilization of the contaminated soil and chemical fill into a solid matrix that will bind and/or entrap the contaminants thereby immobilizing them and preventing future releases.

Fixation/stabilization will also eliminate any threat posed by direct contact with the chemical fill or contaminated soil as well as threats posed to any future residential users of the Site or adjacent land areas. By preventing direct contact with the contaminants, and immobilizing the contaminants, the Hazard Indices (HI) and the Site related cancer risks would be reduced. There are no short-term threats associated with the selected remedies that cannot be readily controlled. In addition, the remedy is not anticipated to result in any adverse cross-media impacts.

The contingency remedy would also be protective of human health and the environment and eliminate any direct contact threats from the chemical fill and contaminated soil. There would be no short term threats associated with the contingency remedy.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Both the selected remedy and the contingency remedy will comply with all identified federal and state ARARS. There are no identified chemical-specific or location-specific ARARS.

Both alternatives for the chemical fill and contaminated soil comply with I.A.C Chapter 567-133 which requires remedial actions in the State of Iowa to address soil contamination that may adversely affect ground water.

10.3 Cost-Effectiveness

The selected remedy is cost effective because it has been determined to provide overall effectiveness proportional to its cost. The net present value of the remedy is approximately $513,000. The selected remedy is the least costly of remedies that were deemed to be equally protective of human health and the environment. The contingency remedy is the second most cost effective remedy that provides protection to human health and the environment equal to fixation/stabilization.

10.4 Utilization of Permanent Solutions and Alternative Treatment (or resource recovery) Technologies to the Maximum Extent Practicable

The EPA has determined that permanent solutions and treatment technologies are utilized in a cost-effective manner for the Shaw Avenue Dump Site by the selected remedy to the maximum extent possible. Further, of the alternatives that are protective of human health and the environment and comply with ARARs, the EPA and the State of Iowa have determined that the selected remedy provides the best balance in terms of long-term effectiveness and permanence, reduction in toxicity, mobility or volume achieved through treatment, short-term effectiveness, implementability, and cost. The EPA also factored in the statutory preference for treatment and considered input from the community in balancing the remedial alternatives.

The chemical fill/contaminated soil alternatives involving institutional controls with capping and excavation/offsite disposal do not satisfy the CERCLA preference for treatment. In terms of long-term effectiveness the institutional controls with capping and excavation/offsite disposal alternatives provide equal protection to human health and the environment. Therefore the selected remedy was determined to be the most appropriate solution for the contamination at the Shaw Avenue Dump Site.

Under current regulations the contingency remedy would not require treatment to reduce toxicity, mobility, or volume. However, in May of 1992 the Land Disposal Restrictions will require treatment prior to disposal of these materials.

10.5 Preference for Treatment as a Principal Element

The selected remedy addresses the principal threat of the chemical fill and contaminated soil by fixation/stabilization. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied. The contingency remedy would not currently satisfy the preference for treatment. However, in May of 1992, the Land Disposal Restrictions will require treatment prior to disposal of these materials pursuant to Alternative 7.1.3.

11.0 Documentation of Significant Changes

The Proposed Plan for the Shaw Avenue Dump Site was released for public comment on July 12, 1990. It identified EPA's preferred remedial alternatives to be extraction, pretreatment and discharge to and treatment by the POTW for the ground water and fixation/stabilization of chemical fill and surrounding contaminated soil and capping the Site. The EPA reviewed all comments received during the public comment period and after consideration of these comments decided to implement the remedy at the Site through two operable units. The first operable unit will address the chemical fill and surrounding contaminated soil and the second operable unit will address the contaminated ground water.

EPA has selected the fixation/stabilization alternative as the remedy for operable unit one. EPA has decided, after consideration of the public comments, that at some point in the future it will issue another Proposed Plan that will contain EPA's preferred alternative for operable unit two. At that time, the public will be given the opportunity to comment on EPA's preferred alterative as well as the other alternatives considered by EPA.

ATTACHMENT A

GLOSSARY OF EVALUATION CRITERIA

The following criteria were developed by EPA to address CERCLA statutory requirements and technical, cost, and institutional considerations. The evaluation criteria serve as the basis for conducting detailed analyses during the FS and for subsequently selecting an appropriate remedial action.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternatives are assessed to determine if they can provide adequate protection from risks above health-based levels posed by contamination present at the Shaw Avenue Dump Site by eliminating, reducing, or controlling exposures.

COMPLIANCE WITH ARARs

The alternatives are assessed to determine if they attain applicable or relevant and appropriate requirements (ARARs) or comply with other federal and state environmental and public health laws, or provide grounds for invoking a waiver.

LONG-TERM EFFECTIVENESS AND PERMANENCE

The magnitude of risk remaining after implementation of the alternatives is evaluated. The adequacy and reliability of controls used to manage treatment residuals or untreated wastes that remain at the Shaw Avenue Dump Site are also assessed.

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

The degree to which the alternatives employ treatment that reduces toxicity, mobility, or volume through treatment is assessed.

SHORT-TERM EFFECTIVENESS

The alternatives are evaluated regarding their effects on human health and the environment during implementation of the alternative. The amount of time until protectiveness is achieved is also an assessment factor.

IMPLEMENTABILITY

The technical and administrative feasibility of implementing an alternative and the availability of services and materials required to implement an alternative are evaluated.

COST

Direct and indirect capital costs and operation and maintenance costs incurred over the life of the project are identified.

STATE ACCEPTANCE

Technical and administrative issues and concerns the state may have regarding the alternative are assessed.

COMMUNITY ACCEPTANCE

The issues and concerns of the public regarding the alternatives are assessed.

ATTACHMENT B

FIGURES

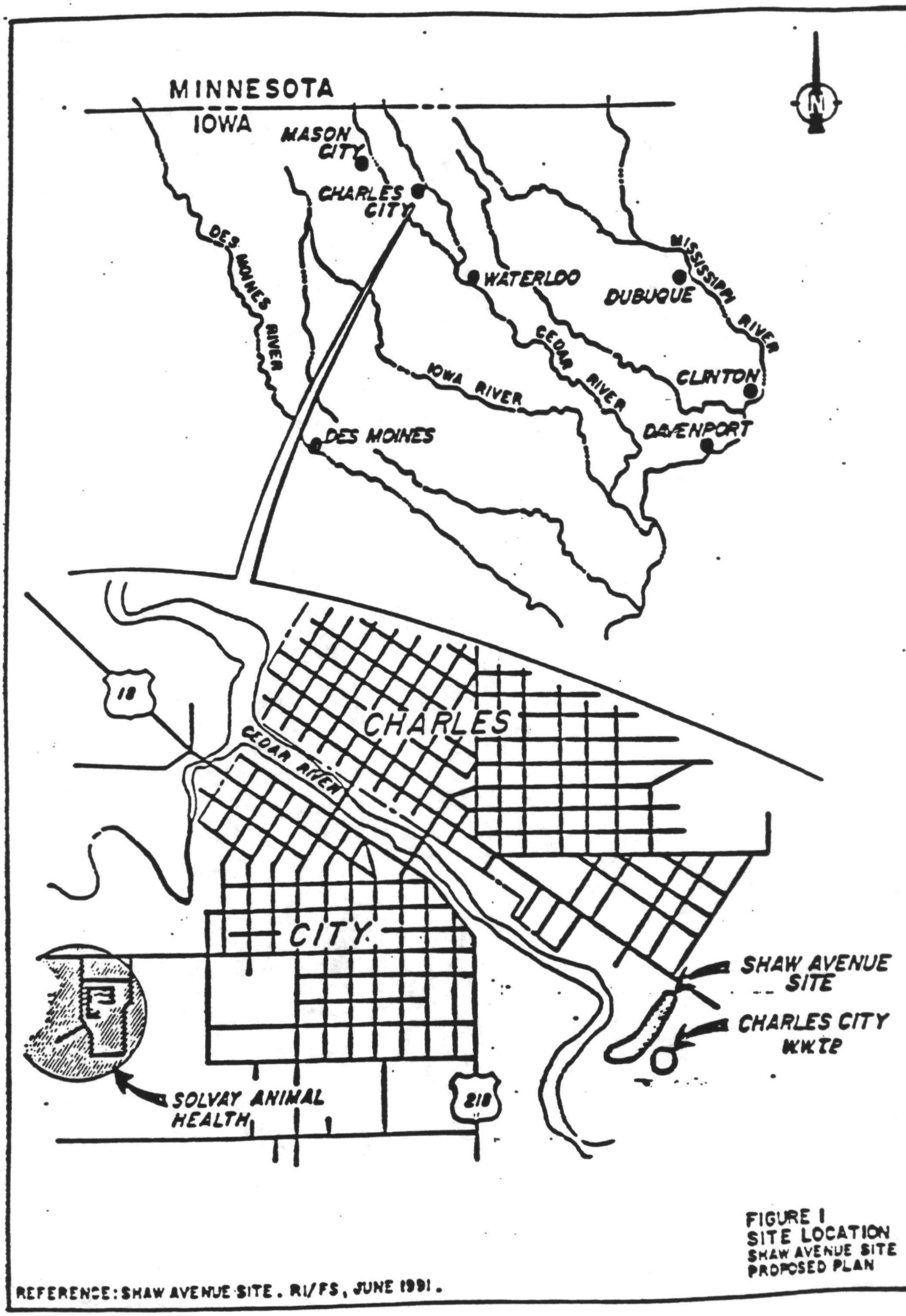
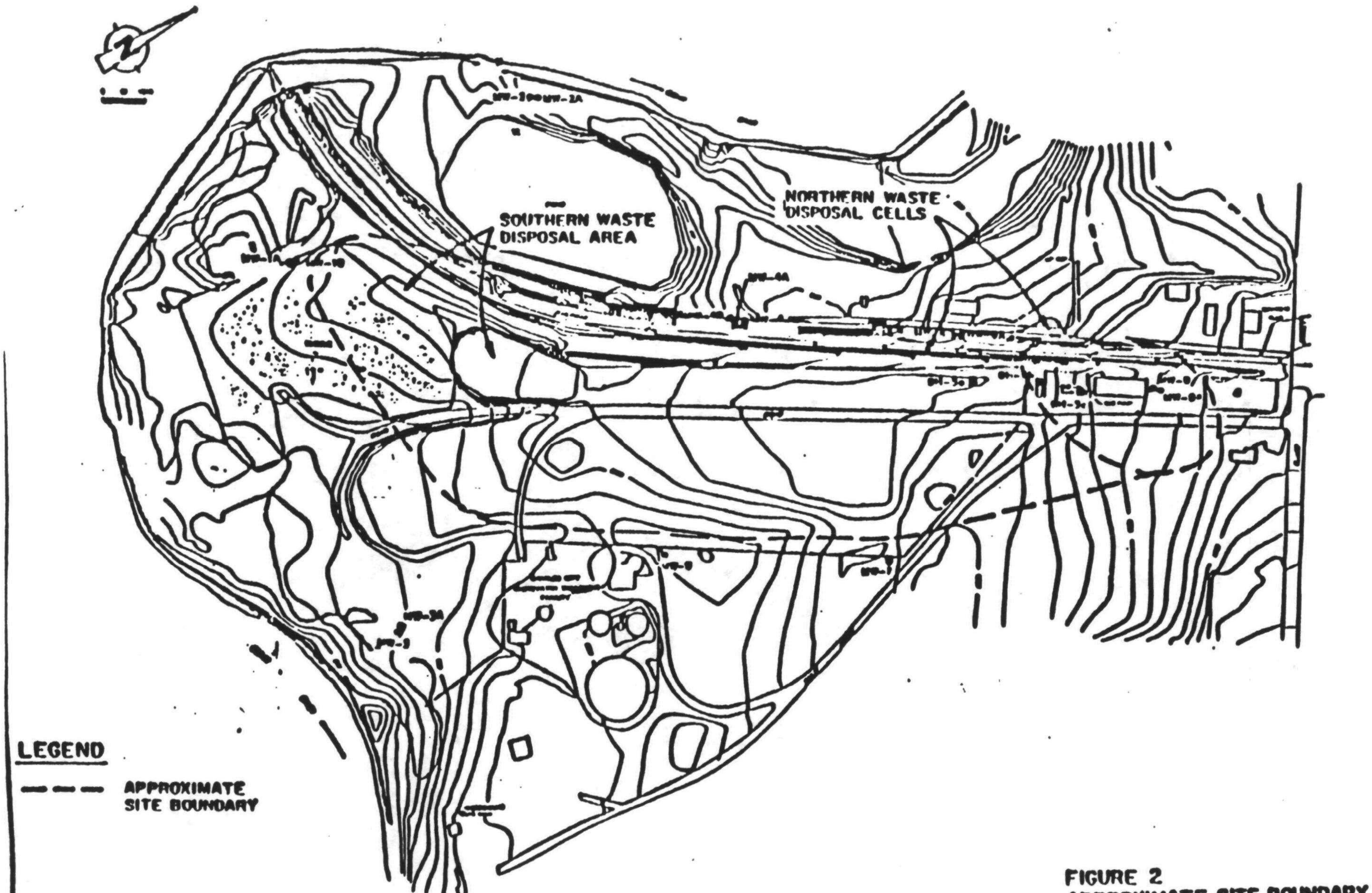


FIGURE 1
SITE LOCATION
SHAW AVENUE SITE
PROPOSED PLAN

REFERENCE: SHAW AVENUE SITE. RI/FS, JUNE 1991.



SOURCE: EUGENE A. HICKOK AND ASSOCIATES REPORT 1977

FIGURE 2
APPROXIMATE SITE BOUNDARY
SHAW AVENUE SITE
PROPOSED PLAN

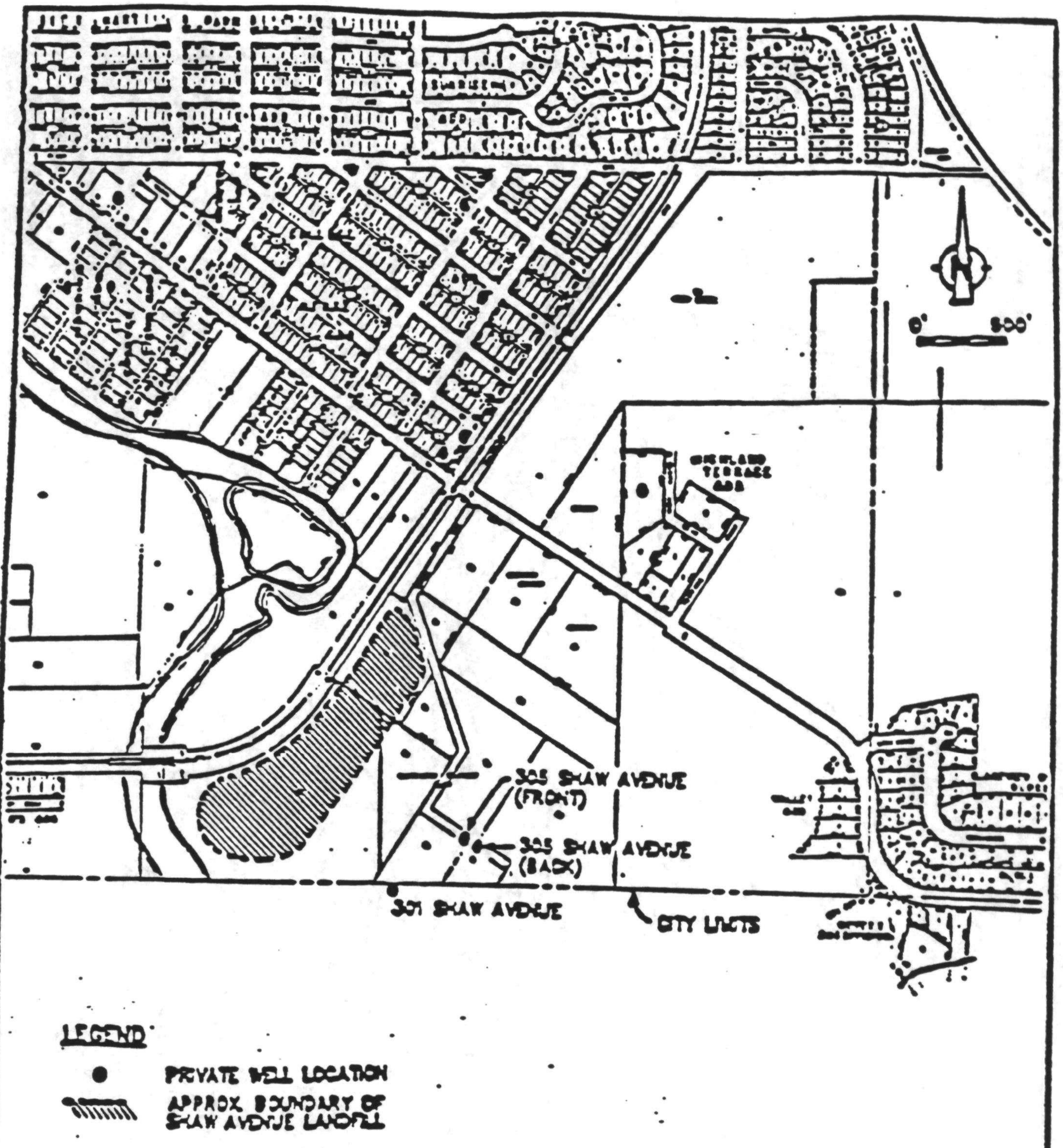


FIGURE 3
PRIVATE WELL LOCATIONS
SHAW AVENUE SITE
PROPOSED PLAN

REFERENCE: SHAW AVENUE SITE. RI/FS, JUNE 1991.

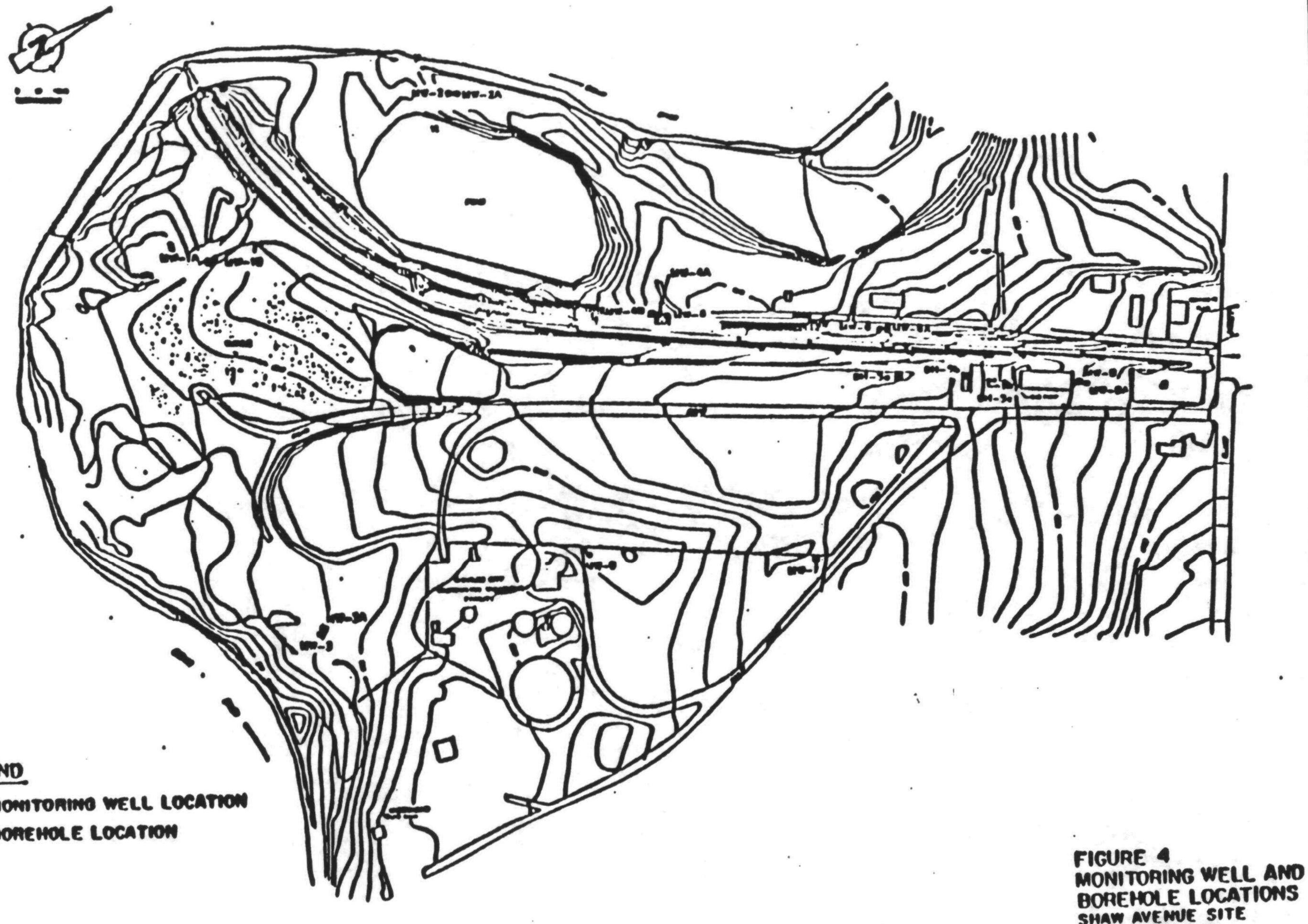


FIGURE 4
MONITORING WELL AND
BOREHOLE LOCATIONS
SHAW AVENUE SITE
PROPOSED PLAN

ATTACHMENT C

TABLES

Table 1
Potential Chemicals of Concern - Ground Water
Shaw Avenue Dump Site

	Frequency	Range (µg/l)	Arithmetic Mean (1,2) (µg/l)	Maximum (µg/l)	MCL (5) (µg/l)	MCLG (5) (µg/l)	Iowa Action Level (µg/l)
Vinyl Chloride	8/115	5 - 408	12.5	408	2	0	0.015 (3)
1,1-Dichloroethene	17/115	2.5 - 166	6.2	166	7	7	7 (4)
1,2-Dichloroethane	7/115	2.5 - 44.7	3.2	44.7	5	0	0.4 (3)
1,1,2-Trichloroethane	12/115	2.5 - 64.5	4.1	64.5	--	--	3 (4)
Benzene	6/101	2.5 - 3180	139.2	3180	5	0	1 (3)
Toluene	6/101	2.5 - 2600	110	2600	1000	1000	1000 (4)
Xylene	6/101	2.5 - 1610	81	1610	10000	10000	10000 (4)
2-Nitroaniline	7/120	25 - 1600	47.1	1600	--	--	--
Arsenic	33/118	2.5 - 23000	585.6	23000	50	50	0.03 (3)
Cadmium	7/118	2.5 - 64.8	3.7	64.8	5	5	5 (4)
Manganese	88/118	7.5 - 3120	353.2	3120	--	--	--

Notes:
(1) Non-detects were assumed to equal the detection limit when calculating mean concentrations for wells which also exhibited positive detections.
(2) Non-detects were assumed to equal half the detection limit when calculating mean concentrations for wells which also exhibited positive detections.
(3) Iowa action level is based on the Negligible Risk Level (NRL) which is the one in a million cancer risk level.
(4) Iowa action level is based on the Lifetime Health Advisory Level (HAL).
(5) Federal maximum contaminant level (MCL) and maximum contaminant level goal (MCLG).

Table 2
Potential Chemicals of Concern - Surface Soil
Shaw Avenue Dump Site

	Area 1 (mg/kg)	Area 2 (mg/kg)	Area 2 (Dup) (mg/kg)	Area 3 (mg/kg)	Area 4 (mg/kg)	Frequency	Range (mg/kg)	Arithmetic Mean (1,2) (mg/kg)	Maximum (mg/kg)	95th Upper Confidence (mg/kg)
Arsenic	12	5.9	6.2	1.7	4.4	4/4	1.7 - 12	6.1	12	11
Beryllium *	2.1 ND	2 ND	4.4 J	2 ND	2 ND	1/4	2 - 39.6	11.6	39.6	38
Cadmium *	2.1 ND	2 ND	4.2 J	2 ND	2 ND	1/4	2 - 37.8	11	37.8	29
Cobalt *	5.7	5 ND	42 J	5 ND	5 ND	2/4	5 - 378	110	378	293
Nickel	12	7.1	54 J	7.3	10	4/4	7.3 - 54	21	54	43
	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Phenanthrene	65 ND	170	71	65 ND	10	2/4	10 - 170	69	170	111
Fluoranthene	130 ND	100	130 ND	130 ND	210	2/4	130 - 210	153	210	199
Pyrene	130 ND	100	130	130 ND	210	2/4	130 - 210	163	210	203
Benzo(a)anthracene	65 ND	67	65 ND	65 ND	130	2/4	65 - 130	86	130	117
Chrysene	65 ND	67	65 ND	65 ND	140	2/4	65 - 140	84	140	122

Notes:

(1) Non-detect values were assumed equal to the detection limit when calculating the mean concentration.
(2) For duplicate samples, the higher concentration of the two samples was used to calculate the mean concentration.
J - The associated numerical value is an estimated quantity.
ND - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.
* - The surface soil results reflect the results of a composite of nine samples for each area. EPA Region VII has taken the position that the results of any of the surface soil samples in that area may be at a value of nine times the reported value. Therefore, for this evaluation, the maximum concentration is the measured concentration for beryllium, cadmium, and cobalt multiplied by nine.

Table 3
Potential Chemicals of Concern - Subsurface Soil
Shaw Avenue Dump Site

	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (Dup) (mg/kg)	[illegible] (mg/kg)	[illegible] (mg/kg)	Frequency	Range (mg/kg)	Arithmetic Mean (1,2) (mg/kg)	Maximum (mg/kg)	95th Upper Confidence (mg/kg)
Arsenic	19	21	350	120	135 J	14.2	5/5	14.2 - 350	107	350	231
Cadmium	2 ND	2 ND	39 J	0.5 J	1.1	2.2 ND	2/5	1.1 - 39	9.3	39	23
Copper	31	4.5	4.9	4.4	104 J	41 J	5/5	4.5 - 104	49	104	100
Lead	130	29	20	22	323	131 J	5/5	22 - 323	127	323	230
Manganese	200 J	400 J	290 J	370 J	100 J	407 J	5/5	100 - 400	301	400	433
Zinc	410 J	20 J	60 J	37 J	302 J	299 J	5/5	20 - 410	221	410	382
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Fluorene	20000	370 ND	300 ND	370 ND	760 ND	730 ND	1/5	300 - 20000	4440	20000	11103
Phenanthrene	100000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 100000	37040	100000	93299
Anthracene	80000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 80000	16040	80000	51390
Fluoranthene	190000	370 ND	300 ND	370 ND	930	1000 ND J	3/5	300 - 190000	38530	190000	110763
Pyrene	200000	370 ND	300 ND	370 ND	870	730 ND	2/5	300 - 200000	40440	200000	110922
Benzo(a)anthracene	90000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 90000	19700	90000	90000
Chrysene	100000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 100000	20440	100000	98372
Bis(2-ethylhexyl)phthalate	19000 ND J	370 ND J	300 ND J	800 J	700 ND	730 ND	1/5	300 - 19000	4332	19000	11370
Benzo(b)fluoranthene	94000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 94000	19240	94000	90000
Benzo(k)fluoranthene	85000	370 ND	300 ND	370 ND	910	730 ND	2/5	300 - 85000	17400	85000	69072
Benzo(a)pyrene	82000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 82000	16840	82000	47907
Indeno(1,2,3-cd)pyrene	47000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 47000	9840	47000	27990
Dibenzo(a,h)anthracene	21000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 21000	4840	21000	17000
Benzo(g,h,i)perylene	51000	370 ND	300 ND	370 ND	700 ND	730 ND	1/5	300 - 51000	10840	51000	29005

Notes:
(1) Non-detect values were assumed equal to the detection limit when calculating the mean concentration.
(2) For duplicate samples, the higher concentration of the two samples was used to calculate the mean concentration.
J - The associated numerical value is an estimated quantity.
ND - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.

Table 4
Potential Chemicals of Concern - Chemical Fill
Shaw Avenue Dump Site

	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (Dup) (mg/kg)	[illegible] (mg/kg)	[illegible] (Dup) (mg/kg)	[illegible] (mg/kg)	[illegible] (Dup) (mg/kg)	Frequency	Range (mg/kg)	Arithmetic Mean (1,2) (mg/kg)	Maximum (mg/kg)	95th Upper Confidence (mg/kg)
Aluminum	749	179	691		301		813	1770	5/5	179 - 1770	695	1770	972
Antimony	4070	10200	430		13500		7700	6110	5/5	430 - 16700	6990	16700	13907
Arsenic	264000	31500 J	80700		241000		90300	80000 J	5/5	31500 - 264000	135000	264000	220530
Barium	21.3	20	23.7		83.6		31.5	37.6	5/5	21.3 - 83.6	38	83.6	60
Cadmium	1300	91.7	775		1260		590	360 J	5/5	91.7 - 1300	653	1300	1150
Calcium	270000 J	80500 J	13900 J		215000 J		80400 J	91800 J	5/5	13900 - 270000	122240	270000	220823
Chromium	2.8	12	45.8		6.7		17.2	14.0	5/5	2.8 - 45.8	17	45.8	38
Cobalt	0.97 ND	1.3 ND	1.3 ND		0.92 ND		5.5	4.9	1/5	0.92 - 5.5	2	5.5	4
Copper	10.0 J	102 J	45.9 J		63 J		691 J	557 J	5/5	10.0 - 691	204	691	600
Iron	1410	4770	2120		1860		4700 J	14500 J	5/5	1410 - 14500	4997	14500	9019
Lead	30.7	711	47.9		310		391	230 J	5/5	30.7 - 711	300	711	559
Magnesium	1579	302	314		647		845	1100	5/5	314 - 1570	815	1570	1200
Manganese	507	87.7	73.6		141		700	235 J	5/5	87.7 - 507	190	507	300
Mercury	0.10 ND	2.7	0.20 ND		0.2 ND		2	1.3	2/5	0.10 - 2.7	1	2.7	2
Nickel	6.6	9.6	30.1		35.6		100	173	5/5	6.6 - 100	56	100	119
Potassium	199	402	170		241		245	300	5/5	170 - 402	270	402	300
Silver	9.1	2.2 ND	1.0 ND		7.6		3 ND	2.7 J	5/5	1.0 - 9.1	5	9.1	8
Sodium	815	1320	887		2090		1290	114.0	5/5	815 - 2090	1270	2090	1717
Thallium	3.7	11.3	1.1 ND		2.3		17.0	9.6	4/5	1.1 - 17.0	6	17.0	11
Vanadium	2 U	1.0	6.2		1.3 ND		11.2	6.6	3/5	1.3 - 11.2	5	11.2	8
Zinc	140	30.9 ND	95.6		304		857	882 J	5/5	30.9 - 882	292	882	588
Cyanide	--	10.2	4		1.9		1.3 ND	1.6	3/4	1.3 - 10.2	4	10.2	8
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Nitrobenzene	31000 ND	9900000 ND	1900000 J		460000 ND R		610000 ND	5100000 ND R	1/4	31000 - 5500000	3132750	5500000	5807598
2-Nitrophenol	31000 ND	9900000 ND	200000 ND R		1300000 J		610000 ND	5100000 ND	1/4	31000 - 9900000	2707750	9900000	5762070
2-Nitroaniline	330000 J	5300000 J	200000 ND J		3900000 J		5900000 J	9300000 J	4/5	200000 - 9300000	3890000	9300000	8874100
4,4'-DDT	90 ND J	1300 ND J	8100 J		270 ND J		600 ND J	560 ND J	1/5	90 - 8100	1609.0	8100	5047

Notes:

(1) Non-detect values were assumed equal to the detection limit when calculating the mean concentration.
(2) For duplicate samples, the higher concentration of the two samples was used to calculate the mean concentration.
J - The associated numerical value is an estimated quantity.
R - The data is unusable (compound may or may not be present).
ND - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.
U - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.

POOR QUALITY ORIGINAL

Table 4 (Continued)
Potential Chemicals of Concern - Chemical Fill
Shaw Avenue Dump Site

	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (Dup) (mg/kg)	[illegible] (mg/kg)	[illegible] (Dup) (mg/kg)	[illegible] (mg/kg)	[illegible] (Dup) (mg/kg)	Frequency	Range (mg/kg)	Arithmetic Mean [1,2] (mg/kg)	Maximum (mg/kg)	95th Upper Confidence (mg/kg)
Methylene Chloride	19 ND	100 ND J	23	12 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 140	41.8	140	69
Acetone	32 J	140 ND R	20 ND	100 R	10 ND	10 ND R	31 ND J	20 ND J	1/4	10 - 32	17.25	32	30
1,1-Dichloroethene	10 ND J	91 J	210	70 J	27 J	9 ND J	16 ND	13 ND	3/5	10 - 210	70.8	210	143
Chloroform	10 ND	69 ND J	17	11 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 69	24.3	69	46
1,2-Dichloroethane	10 ND	69 ND J	25	9 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 69	25.0	69	47
1,1,2-Trichloroethane	10 ND	370 J	510	210 J	81	170 J	47	21	4/5	10 - 510	182.6	510	338
Benzene	10 ND	69 ND J	150	62 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 150	50.0	150	103
Tetrachloroethene	10 ND	69 ND J	28	14 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 69	28	69	47
Toluene	10 ND	69 ND J	79	40 J	9 ND	46 J	16 ND	13 ND	2/5	10 - 79	38.0	79	60
Chlorobenzene	10 ND	69 ND J	200	80 J	9	9 J	16 ND	13 ND	2/5	9 - 200	66.0	200	133
Ethylbenzene	10 ND	69 ND J	300	270 J	10	23 J	16 ND	13 ND	2/5	10 - 300	90.0	300	234
Xylene (total)	10 ND	600 J	600	550 J	110	100 J	22	13 ND	4/5	10 - 600	282.0	600	522

Notes:

[1] Non-detect values were assumed equal to the detection limit when calculating the mean concentration.
[2] For duplicate samples, the higher concentration of the two samples was used to calculate the mean concentration.
J - The associated numerical value is an estimated quantity.
R - The data is unusable (compound may or may not be present).
ND - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.
U - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.

Table 5
Toxicity Values for Chemicals of Concern
Shaw Avenue Dump Site

Chemicals	Oral Slope (kg-day/mg)	Oral RfD (mg/kg-day)	Reference	Inhalation Slope (kg-day/mg)	Inhalation RfD (mg/kg-day)	Reference
Aluminum						
Antimony		4.0E-04	IRIS			
Arsenic	1.8E+00	1.0E-03	CRA/HEAST	5.0E-01		HEAST
Barium		7.0E-02	IRIS		1.0E-04	HEAST
Beryllium	4.3E+00	5.0E-03	HEAST/IRIS	8.4E+00		HEAST
Cadmium		5.0E-04	IRIS	6.1E+00		HEAST
Calcium						
Chromium (VI)		5.0E-03	IRIS	4.1E-01		IRIS
Cobalt						
Copper		3.7E-02	(a)			
Iron						
Lead	4.0E-02	1.4E-03	EPA III/(b)	4.0E-02	4.3E-04	EPA III
Magnesium						
Manganese		1.0E-02	IRIS		3.0E-04	HEAST
Mercury		3.0E-04	HEAST			
Nickel		2.0E-02	HEAST	8.4E-01		HEAST
Potassium						
Silver		3.0E-03	IRIS			
Sodium						
Thallium						
Vanadium		7.0E-03	HEAST			
Zinc		2.0E-02	HEAST			
Cyanide		2.0E-03	IRIS			
4,4'-DDT	3.4E-01	5.0E-04	IRIS	3.4E-01		IRIS
Methylene Chloride	7.5E-03	6.0E-02	IRIS	1.4E-02		IRIS
Vinyl Chloride	2.3E+00		HEAST	2.9E-01		HEAST
Acetone		1.0E-01	IRIS			
1,1-Dichloroethene	6.0E-01	9.0E-03	IRIS	1.2E+00		IRIS
Chloroform	6.1E-03	1.0E-02	IRIS	8.1E-02		IRIS
1,2-Dichloroethane	9.1E-02		IRIS	9.1E-02		IRIS
1,1,2-Trichloroethane	5.7E-02	4.0E-03	IRIS	5.7E-02		IRIS
Benzene	2.9E-02		IRIS	2.9E-02		IRIS
Tetrachloroethene	5.1E-02	1.0E-02	HEAST/IRIS	3.3E-03		HEAST

<u>Notes:</u>

IRIS - Integrated Risk Information System
HEAST - Health Effect Assessment Summary Tables, Third Quarter FY 90
(a) - Estimated RfD calculated from the proposed drinking water standard of 1.3 mg/l.
(b) - RfD calculated by BVWST for this assessment based on previous proposed MCLG of 0.02 mg/l. (This is not an EPA verified RfD.)

Table 5 (Continued)
Toxicity Values for Chemicals of Concern
Shaw Avenue Dump Site

Chemicals	Oral Slope (kg-day/mg)	Oral RfD (mg/kg-day)	Reference	Inhalation Slope (kg-day/mg)	Inhalation RfD (mg/kg-day)	Reference
Toluene		2.0E-01	IRIS		5.7E-01	IRIS
Chlorobenzene		2.0E-02	IRIS			
Ethylbenzene		1.0E-01	IRIS			
Xylene (Mixed)		2.0E+00	IRIS		8.6E-02	HEAST
Nitrobenzene		5.0E-04	IRIS			
2-Nitrophenol						
2-Nitroaniline						
Fluorene		4.0E-02	HEAST			
Phenanthrene						
Antracene		3.0E-01	IRIS			
Fluoranthene		4.0E-02	IRIS			
Pyrene		3.0E-02	IRIS			
Benzo(a)anthracene						
Chrysene						
Bis(2-ethylhexyl)phthalate	1.4E-02	2.0E-02	IRIS			
Benzo(b)fluorasthene						
Benzo(k)fluoranthene						
Indeno(1,2,3-cd)pyrene						
Benzo(a)pyrene						
Dibenzo(a,h)anthracene						
Benzo(g,h,i)perylene						

POOR QUALITY ORIGINAL

Notes:

IRIS - Integrated Risk Information System
HEAST - Health Effect Assessment Summary Tables, Third Quarter FY 90
(a) - Estimate RfD calculated from the proposed drinking water standard of 1.3 mg/l.
(b) - RfD calculated by BNWST for this assessment based on previous proposed MCLG of 0.02 mg/l. (This is not an EPA verified RfD.)

Table 6
Risk Characterzation Summary (1)
Shaw Avenue Dump Site

Residents, Trespassers, and Recreation Scenarios

Scenario			Chronic Hazard Index (by age group)			Excess Cancer Risk Lifetime
			0-1	1-6	6-30	
Current	Resident/Trespasser (2)		<1	<1	<1	9E-06
Future	Resident/ Flow Unit (3)	Bedrock A	81.31	76.98	23.19	3E-02
		Bedrock B	185.64	178.85	54.49	6E-02
		Bedrock C	64.14	60.81	18.28	5E-02
		Bedrock D	3.12	3.32	<1	1E-03
		Bedrock E	2.49	2.72	<1	1E-03
		Bedrock F	3.09	3.29	<1	1E-03
		Bedrock G	25.89	31.09	9.86	1E-02
		Alluvium B	3.49	3.67	<1	1E-03
		Alluvium C	4.74	4.84	1.25	2E-03
		Alluvium D	0.472	4.83	1.25	3E-03
		Alluvium E	3.67	3.83	<1	1E-03
		Alluvium F	3.28	3.47	<1	1E-03
	Recreation (4)		<1	<1	<1	7E-05

Worker Scenarios

Scenarios/Media		Chronic Hazard Index	Excess Cancer Risk Lifetime
Current	Surface Soil	<1	6E-05
	Subsurface Soil	<1	1E-05
Future	Surface Soil	<1	1E-05
	Subsurface Soil	1.21	1E-03

Notes:

(1) Shaded areas represent a risk: chronic hazard index greater than 1 or excess cancer risk of greater than 1E-06.

(2) Chronic hazard index and excess cancer risks for the current resident/trespasser use scenario represent the combined risks associated with exposure to the surface soil, surface water and ground water.

(3) Chronic hazard index and excess cancer risks for the future residential use scenario represent the combined risks associated with exposure to the surface soil, surface water and the ground water from the flow unit listed.

(4) Chronic hazard index and excess cancer risks for the future recreation use scenario represent the combined risks associated with exposure to the surface soil and surface water.

TABLE 7

PROPOSED MONITORING PROGRAM
SHAW AVENUE SITE

Monitoring Well	Parameters/Frequency				
	Vinyl Chloride 1,1-Dichloroethene 1,2-Dichloroethane 1,1,2-Trichloroethane	*Benzene Toluene Xylene*	*2-Nitroaniline*	*Arsenic*	*Manganese*
Bedrock Wells					
MW1	S/A	–	–	S/A	A
MW2	S/A	–	–	S/A	A
MW3	–	–	–	S/A	A
MW4	–	–	–	S/A	A
MW6	–	S/A	S/A	S/A	A
MW7	–	–	–	S/A	A
MW9	–	–	–	S/A	A
MW10	–	–	–	S/A	A
MW11	–	–	–	S/A	A
MW12	–	–	–	S/A	A
MW13	–	S/A	–	S/A	A
MW14	–	S/A	–	S/A	A
MW15	–	–	–	S/A	A
MW16	–	S/A	–	S/A	A
MW17	–	S/A	–	S/A	A
MW18	–	–	–	S/A	A
Overburden Wells					
MW1A	A	–	–	A	A
MW1B	A	–	–	A	A
MW2A	A	–	–	A	A
MW3A	–	–	–	A	A
MW4A	–	–	–	A	A
MW4B	–	–	–	A	A
MW6A	–	–	–	A	A
MW12A	–	–	–	A	A
MW15A	–	–	–	A	A
MW15B	–	–	–	A	A
MW17A	–	–	–	A	A
Extraction/Treatment System					
EW-1 (Proposed)	Q/A	Q/A	Q/A	Q/A	A
EW-2 (Proposed)	Q/A	Q/A	Q/A	Q/A	A
EW-3 (Proposed)	Q/A	Q/A	Q/A	Q/A	A
EW-4 (Proposed)	Q/A	Q/A	Q/A	Q/A	A
Treatment Influent	M	M	M	M	M
Pretreatment Effluent (2) (if selected)	M (1)	M (1)	M (1)	M (1)	M (1)

Notes:

A = Sample annually.
S/A = Sample semi-annually for two years, annually thereafter.
Q/A = Sample quarterly for two years, annually thereafter.
M = Sample monthy for two years, quarterly thereafter
(1) = Sample weekly for first quarter.
(2) = Final effluent sampling conducted as part of POTW NPDES monitoring.

TABLE 8

CHEMICAL FILL REMEDIAL
COST ESTIMATE
DEED RESTRICTIONS
ACCESS CONTROL, IN-SITU
FIXATION/SOLIDIFICATION, CAPPING
AND MONITORING
SHAW AVENUE SITE

		Estimated Cost (1)			
Item	*Description*	*Capital Cost*	*Annual Cost (2)*	*Present Worth of Annual Cost*	*Total Present Worth*
1.	Deed restrictions	$ 6,250	$ 0	$ 0	$ 6,250
2.	Excavate Underground Gasoline Tank	$ 4,900	$ 0	$ 0	$ 4,900
3.	In Situ Fixation/ Solidification	$ 406,400	$ 0	$ 0	$ 406,400
4.	Cap (includes access control)	$ 30,300	$ 2,000	$ 30,750	$ 61,050
5.	5-Year Review ($10,000/5 years)	$ 0	$ 2,265	$ 34,800	$ 34,800
	Subtotals	$ 447,850	$ 4,265	$ 65,550	
	TOTAL IMPLEMENTATION COST FOR ALTERNATIVE CF5				$ 513,400

Notes:

(1) See Appendix E for detailed cost.
(2) Average annual costs over 30 years, actual costs may vary for specific years.