United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R07-91/046
May 1991

EPA

Superfund Record of Decision:

EI Dupont De Nemours (County Rd X23), IA

50272-101

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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 E.I. DuPont De Nemours (County RD X23) site is a paint waste disposal site 3.5 miles south of West Point in Lee County, Iowa. The site is divided into two subsites, McCarl and Baier, which are three-fourths of a mile apart. Land in the area is agricultural, residential, and woodlands, and the nearest residence is located 500 feet from the McCarl subsite. The site overlies two water-bearing units, separated by 75 feet of very low permeable clay. The Baier subsite was used as the primary disposal site, and the McCarl subsite was used when weather did not allow access to the Baier site. From 1949 to 1953, an estimated 48,000 to 72,000 55-gallon waste drums were disposed of at the two sites. Paint waste was generally placed in trenches and burned, resulting in an estimated 4,500 to 7,000 tons of ash remaining onsite. Paint cans, ash-like material, and sludge casting were also visible on the surface of the site. In 1983, an EPA investigation of the Baier Farm detected levels of metals and organics in excess of soil background levels. In addition, ground water monitoring wells, installed during 1985 and 1986, detected metal concentrations above MCLs. A 1989 investigation identified the source of contamination as paint disposed of onsite. Removal from the Baier site was scheduled for July 1989 by a

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - E.I. Dupont De Nemours (County Rd X23), IA
First Remedial Action - Final
Contaminated Media: soil, debris
Key Contaminants: metals (cadmium, chromium, lead, selenium)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 60
	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)

Unilateral Administrative Order from EPA to DuPont, but deferred by a February 1990 amendment. This Record of Decision (ROD) addresses the soil, debris, and ground water, as a final remedy. The ground water was determined to be of little threat and is not further addressed by this ROD. The primary contaminants of concern affecting the soil and debris at both subsites are metals including cadmium, chromium, lead and selenium.

The selected remedial action for the site includes stabilizing/solidifying the contaminated soil at both subsites, and covering the stabilized mass with clean soil and vegetation; removing and disposing offsite all surface debris not amenable to solidification at an authorized RCRA landfill; monitoring ground water; and implementing institutional controls including deed restrictions. The estimated present worth cost for this remedial action is $1,400,000. There are no O&M costs associated with this remedial action.

<u>PERFORMANCE STANDARDS OR GOALS</u>: Chemical-specific soil clean-up goals are based on health-based criteria, and include lead 350 ug/kg, selenium 10 ug/kg, and cadmium 20 ug/kg.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

5/27/91

MEMORANDUM

SUBJECT: Record of Decision for DuPont County Road X23 Superfund Site

FROM: David Wagoner
Director, Waste Management Division

TO: Morris Kay
Regional Administrator

This Record of Decision package presents a proposed remedy for the solidification/stabilization of contaminated soil at the DuPont County Road X23 Superfund Site in Lee County, Iowa. This will be the final remedy for this Site.

The major component of the proposed remedy includes the removal of surface waste, the solidification/stabilization of approximately 15,000 cubic yards of contaminated soil, covering the stabilized material with soil, and continued monitoring.

No action was proposed as the remedy for ground water based on the lack of exposure pathways. This decision was based on the very low yield of the water bearing unit at the site, and the presence of a thick confining layer below the water bearing unit.

This action has been coordinated with the Office Regional Counsel, the Office of Public Affairs, the Congressional and Intergovernmental Liaison, and the Agency for Toxic Substances and Disease Registry (ATSDR).

The Iowa Department of Natural Resources has concurred on the proposed remedy.

On December 27, 1991, the remedy selection authority for the DuPont County Road X23 Site was delegated to you by Don R. Clay, Assistant Administrator. I recommend approval of the proposed remedy.

Attachment

RECORD OF DECISION
E. I. DU PONT DE NEMOURS AND COMPANY COUNTY ROAD X23 SITE
WEST POINT, LEE COUNTY, IOWA

Declaration

1.0 Site Name and Location

E. I. du Pont de Nemours and Company County Road X23 Site
Lee County, Iowa

1.1 Statement of Basis and Purpose

This decision document presents the selected remedial action for the E. I. DuPont de Nemours and Company County Road X23 Site, located in West Point, Lee 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 concurs with the selected remedy. The information supporting this remedial action decision is contained in the Administrative Record for this site, which is available for public review at the Idol Rashid Memorial Branch of the Fort Madison Public Libraries, 3421 Avenue L, Fort Madison, Iowa, and at the Environmental Protection Agency 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 a current or potential threat to public health, welfare, or the environment.

1.3 Description of the Selected Remedy

1.3.1 Ground Water

The selected remedy for ground water is no action. This is based on the conclusion that no completed human or sensitive environmental exposure pathway exists for ground water. Depth to the groundwater at this site is approximately 30 feet below ground surface. The uppermost water-bearing unit at the site is considered unusable as a ground water-producing aquifer due to the extremely low yield from the unit, the low permeability of the unit and the presence of a confining unit below the water-bearing unit. However, monitoring of the ground water will be continued.

1.3.2 Soil

Heavy metals contamination in the soil represents the principal threat at the County Road X23 Site based on the risk to sensitive populations, the risk posed through possible ingestion of vegetables grown in contaminated soil, and the risk for possible future residents. The major components of the selected remedy for soil, which is designed to address heavy metal and volatile organic contamination, include the following:

- Surface debris removal;
- Stabilization/Solidification of contaminated soil; and
- Installation of top cover to protect stabilized soil.

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, and it satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as their principal element.

Because this remedy will result in hazardous substances remaining on site 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 of human health and the environment.

Morris Kay — 5-28-91
Regional Administrator — Date
U.S. EPA. Region VII

DECISION SUMMARY

1.0 Site Name, Location and Description

The E. I. du Pont de Nemours and Company County Road X23 Site is located in rural Lee County, Iowa, approximately 3.5 miles south from West Point as shown in Figure 1. The Site consists of two subsites, the McCarl Subsite and the Baier Subsite. The Baier Subsite is located in the North East quarter of the South West quarter of Section 28, Township 68 North, Range 5 West (Figure 1) and includes property owned by Richard Fedler. The McCarl Site is located in the South East quarter of the South West quarter of Section 22, Township 68 North, Range 5 West (Figure 1). The two subsites are approximately three fourths of a mile apart. The land adjacent to the sites is used for agricultural or residential purposes. Other adjacent land is left in a wooded state. The nearest residences are approximately 500 feet from the McCarl Subsite.

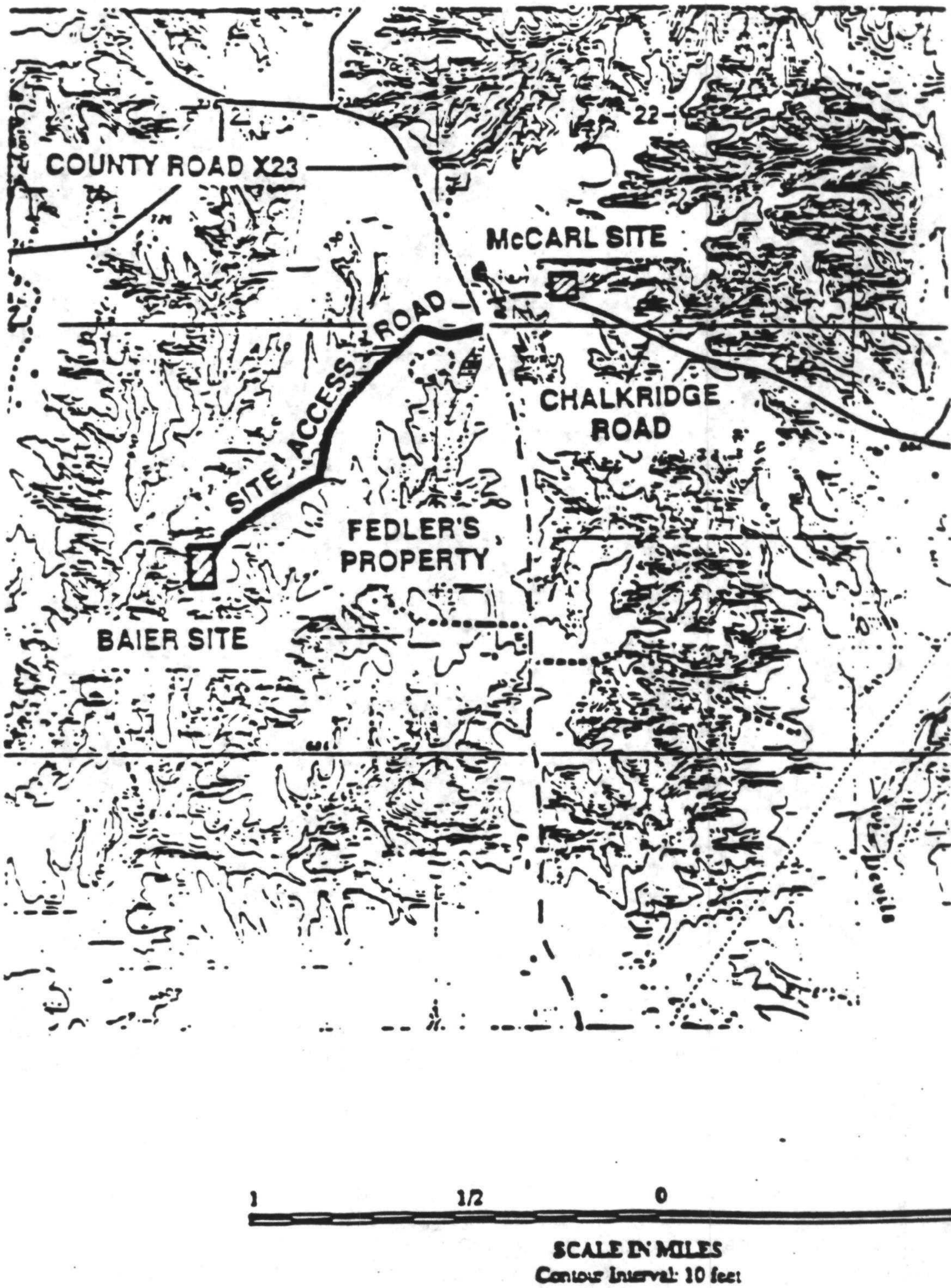
2.0 Site History and Enforcement Activities

DuPont hired a contractor to haul and dispose of paint wastes from their Fort Madison plant during the period 1949-53. An estimated 48,000 to 72,000 55-gallon drums of waste were disposed of at the two subsites. The Baier Farm was the primary disposal site. In inclement weather when the Baier Farm was inaccessible, the McCarl Site was used. The McCarl Site was purchased by DuPont in 1986. The paint waste was placed in trenches and burned. An estimate for complete burning indicates that 4,500 to 7,000 tons of ash might remain on the sites.

The Baier Farm was listed as a potentially, uncontrolled, hazardous waste site in the Eckhardt Subcommittee Report in November 1979.

A hazard ranking system (HRS) package for the E.I. du Pont de Nemours and Company County Road X23 Superfund Site (the "County Road X23 Site" or the "Site") documented a score of 46.01. The Site was proposed to be included on the National Priorities List (NPL) in the June 1988, 7th update. This listing became final on the NPL in August 1990.

A field investigation of the Baier Farm was conducted by the Field Investigation Team (FIT) in April 1983. Soil sample analysis found seven priority pollutant metals in concentrations exceeding background. Also detected were six priority pollutant organics in soil samples.



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SCALE IN MILES

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National Geodetic Vertical Datum of 1929

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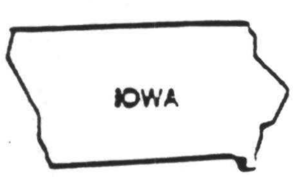


WEST POINT QUADRANGLE
IOWA-LEE CO
7.5 MINUTE SERIES (TOPOGRAPHIC)

SITE LOCATION MAP	1
COUNTY ROAD X-23 WEST POINT, IA	

On March 28, 1984, EPA sent a CERCLA 104(e) information request letter to DuPont regarding the Baier Farm. DuPont's response indicated another possible waste site at the McCarl property on Chalkridge Road.

In July of 1985 FIT oversaw the installation of three ground water monitoring wells at the Baier Farm. Analyses of ground water samples collected from the wells showed elevated levels of metals. A second round of sampling of these wells in 1986 resulted in similar findings. Downstream surface water samples showed elevated concentrations of metals.

FIT conducted the Site Investigation for the McCarl subsite in July 1986, including the installation and sampling of three ground water monitoring wells. Analysis of soil samples from the investigation showed concentrations in excess of background for metals. Analysis of ground water samples showed concentrations in excess of Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for several metals.

A Special Notice letter to initiate negotiations regarding Remedial Investigation/Feasibility Study (RI/FS) negotiations was sent to DuPont on January 31, 1989.

On June 19, 1989, EPA sent DuPont a 104(e) letter asking for data from work conducted at the Site by DuPont's consultant during May 1989.

After RI/FS negotiations concluded unsuccessfully, the EPA issued a Unilateral Administrative Order to DuPont on July 5, 1989. This order required a removal action at the Baier subsite and an RI/FS for both subsites. An amendment to the Unilateral Order on February 7, 1990, deferred the requirement for the removal.

The RI/FS was completed in September 1990. The final RI/FS report was completed January 15, 1991. The results of the investigations are discussed in Section 5.0.

3.0 Highlights of Community Participation

The RI/FS Report and the Proposed Plan for the County Road X23 Site were released to the public for comment on April 11, 1991. These two documents were made available to the public in both the Administrative Record and an information repository maintained at the EPA Docket Room at the Region VII offices and at the Idol Rashid Memorial Branch Public Library, Fort Madison, Iowa. The notice of availability for these two documents was published in the <u>Fort Madison Daily Democrat</u> on April 12, 1991. A public comment period on the documents was held from April 11, 1991, to May 11, 1991. In addition, a public meeting was held on April 18, 1991. At this meeting, representatives from EPA, Iowa Department of Natural Resources (IDNR), and Iowa Department of Health (IDOH) answered questions about the Site and the remedial alternatives under consideration. Responses to the comments received during this 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 with many Superfund sites, the problems at the County Road X23 Site are complex. The selected response addresses the principal threat due to soil contamination. Based on investigations of the site during 1989 and the Remedial Investigation, the source of contamination at the site was identified to be paint waste disposed of at the site by DuPont. Of particular concern is the presence of (threat posed by) the heavy metal contaminants in soil at present levels of concentrations if the site is used for residential or agricultural purposes. The ground water alternative is no action based on the conclusion that no completed exposure pathway exists for the ground water. This is due to the extremely low yield from the contaminated upper water-bearing unit at the site, the low permeability of the unit, and the presence of a confining unit below the water-bearing unit. However, monitoring of the ground water will be continued.

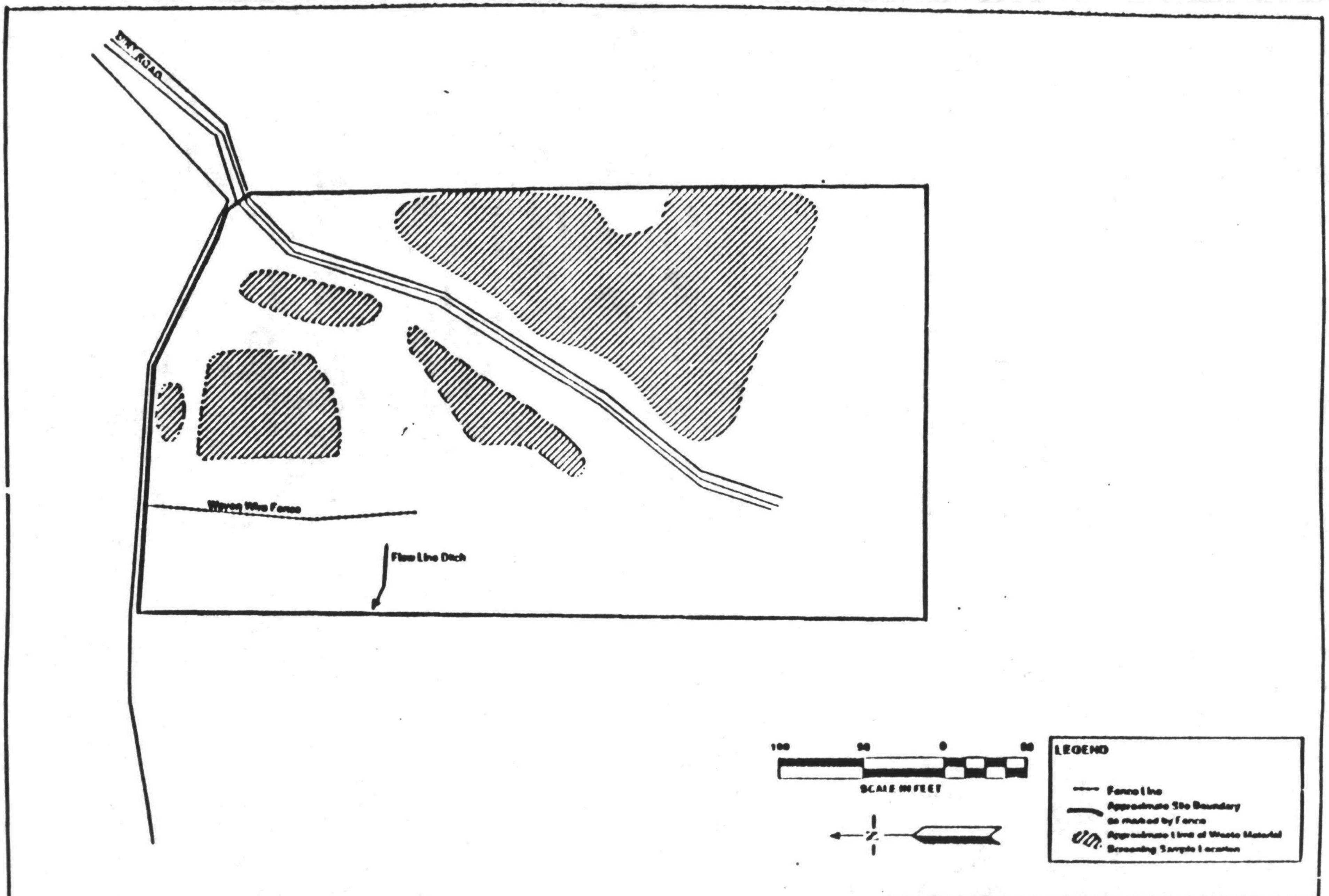
The response actions selected in this ROD address all principal threats posed by this site and are intended to constitute final action for this site.

5.0 Summary of Site Characteristics

The nature and extent of contamination of ground water and soil at both subsites is summarized below. This summary is based primarily on data generated by the work performed by DuPont in May through August of 1989 and in the RI. Detailed information regarding the nature and extent of contamination can be found in the Final RI Report (January 16, 1991).

5.1 Baier Subsite

The approximate areal and vertical extent of disposed waste material was estimated by probing with a hand auger during the May 1989 investigation. Figure 2 shows the approximate areal extent. Depths to the contact between the waste and native soil ranged from approximately two inches below grade to greater than 36 inches below grade. Samples collected from the waste material showed high levels of lead, cadmium, chromium, selenium, and zinc (Table 1). Concentrations of metals contaminants were highest in the



BAIER SITE WASTE DISPOSAL AREAS

COUNTY ROAD X-23 SITE
LEE COUNTY, IA

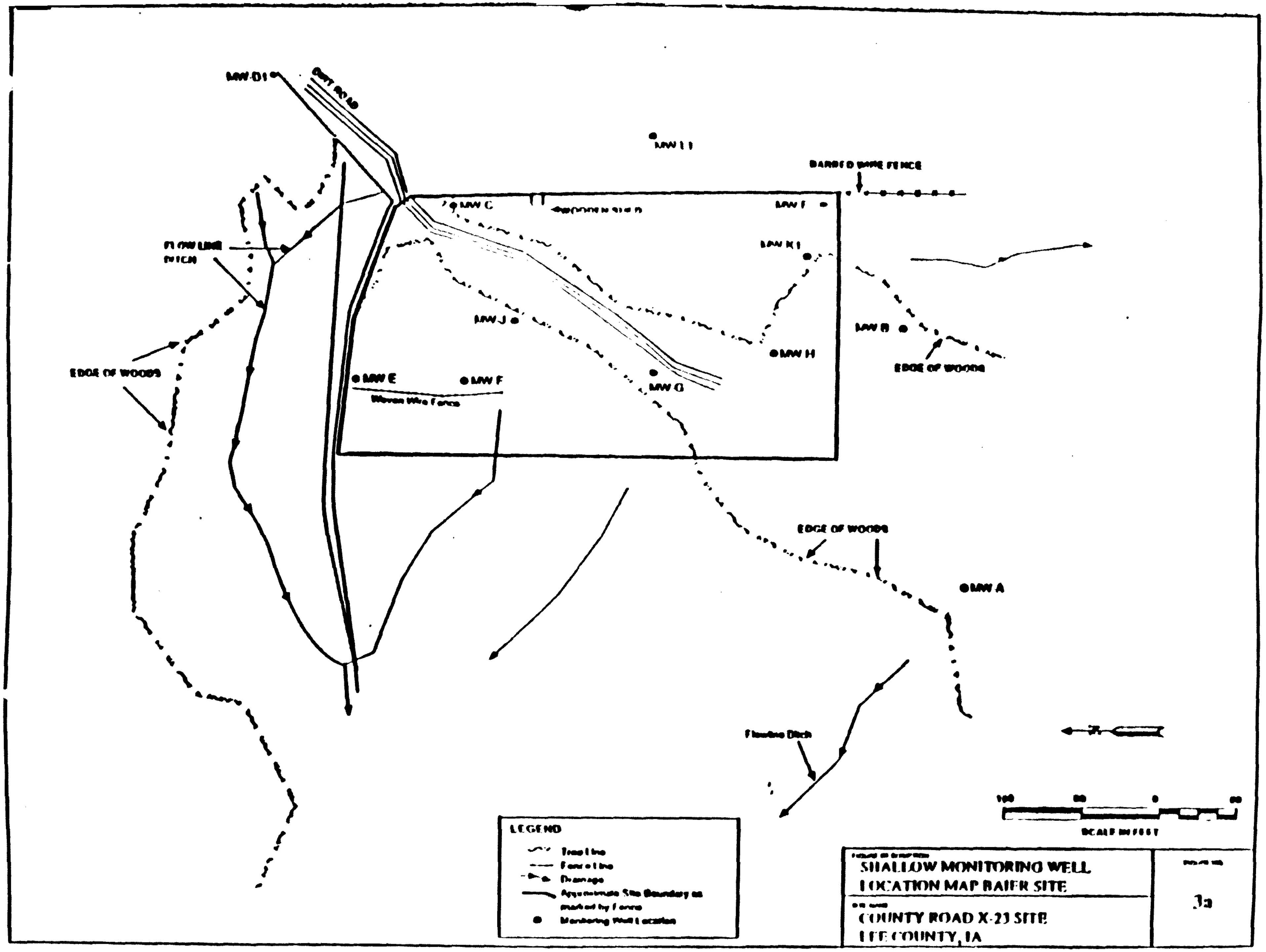
2

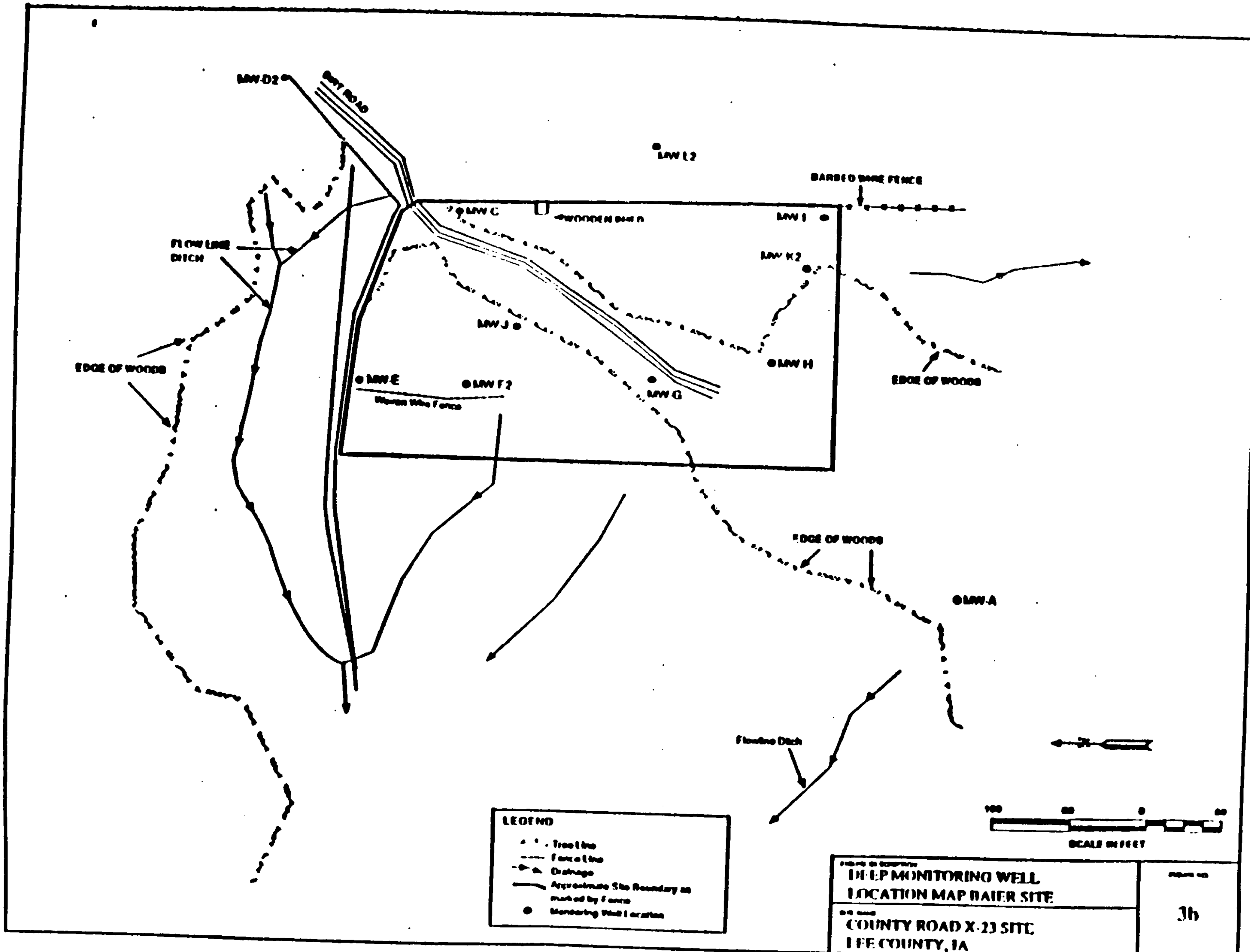
waste material itself, with lesser, but still elevated, concentrations limited to the upper two to three feet below the interface between the waste and native soil. Elevated concentrations of several volatile organic compounds were also detected in the waste material. Evidence of migration of volatile and semi-volatile organic contamination was noted as deep as 18 feet below the waste/native soil contact (Tables 2, 3). The RI focused on characterizing the horizontal and vertical extent of contamination outside of the waste disposal areas. Generally, this investigation showed that contamination was limited to within 50 feet of the areas of waste disposal. Contamination in these areas were generally restricted to the upper four feet of soil. Sampling did show elevated concentrations of metals (only) in several drainage ditches leading from the subsite. Contamination was limited to within 50 feet of the ditch heads. Heavy metals contamination in the soil represents the principal threat at the Baier Subsite based on the risk to sensitive populations, the risk posed through possible ingestion of vegetables grown in contaminated soil, and the risk to possible future residents.

Based on borings completed at the subsite, two hydraulically separate water-bearing units have been identified. MW-A, MW-B, MW-C, MW-D1, MW-E, MW-F, MW-G, MW-H, MW-I, MW-J, MW-K1 and MW-L1 are all monitoring wells completed in the upper water-bearing zone, which is located from 20 to 70 feet below ground surface. See Figures 3A and 3B for well locations. MW-D2, MW-F2, MW-K2 and MW-L2 are monitoring wells completed in the lower, unconsolidated water-bearing zone, which is approximately 130 to 140 feet below ground surface. Analytical results for samples collected to date indicate that contamination is limited to the upper-most water-bearing zone and has not migrated to the deeper water-bearing unit. The primary reason for this appears to be the presence of a thick (over 75 feet) low-permeability clay till layer between the upper and lower, unconsolidated water-bearing zones, which significantly limits the movement of water between those zones.

Analytical results for samples collected from the upper-most water-bearing zone showed significant volatile organic compound contamination in MW-F with lesser concentrations of organics in MW-A and MW-G. Elevated concentrations of total metals were detected in most of the shallow wells. Elevated levels of contaminants were not detected in wells completed in the deeper unconsolidated water bearing zone.

Due to the low yield and low permeability of the upper water-bearing unit, and the confining layer separating the water-bearing units, it was determined that a completed exposure pathway for ground water does not exist at the site for humans or environmentally sensitive receptors.


MW-D1
DIRT ROAD
BARBED WIRE FENCE
MW C
WOODEN SHED
MW K1
FLOW LINE DITCH
MW J
MW H
MW B
EDGE OF WOODS
EDGE OF WOODS
MW E
MW F
Woven Wire Fence
MW G
EDGE OF WOODS
MW A
Flowline Ditch
SCALE IN FEET
LEGEND
Tree Line
Fence Line
Drainage
Approximate Site Boundary as marked by Fence
Monitoring Well Location
SHALLOW MONITORING WELL LOCATION MAP BAIER SITE
COUNTY ROAD X-23 SITE
LEE COUNTY, IA
3a

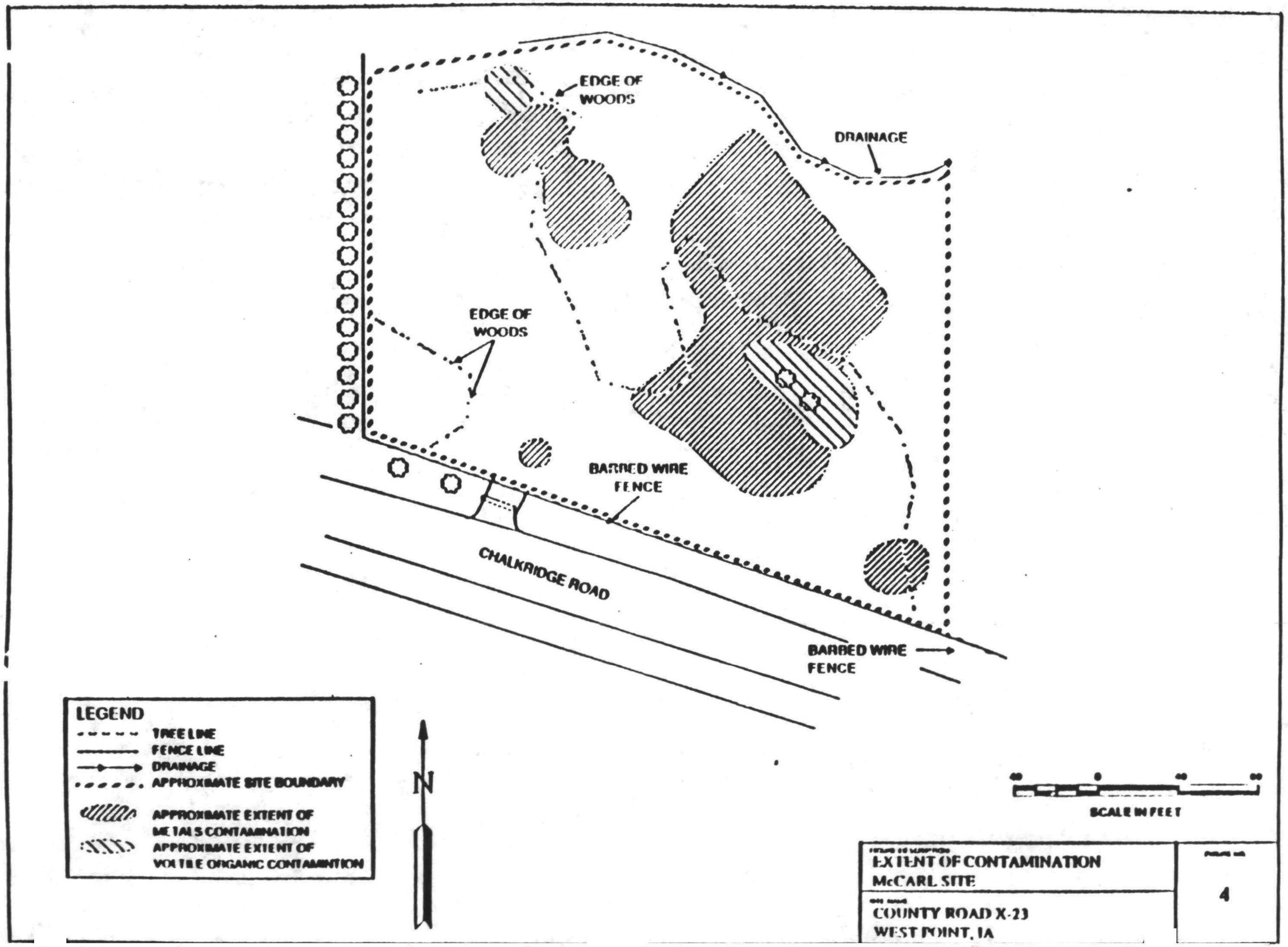

MW-D2
DIRT ROAD
MW L2
BARBED WIRE FENCE
MW C
WOODEN SHED
MW I
FLOW LINE
DITCH
MW K2
EDGE OF WOODS
MW J
MW H
EDGE OF WOODS
MW E
MW F2
Woven Wire Fence
MW G
EDGE OF WOODS
MW A
Flowline Ditch
LEGEND
Tree Line
Fence Line
Drainage
Approximate Site Boundary as marked by Fence
Monitoring Well Location
SCALE IN FEET
DEEP MONITORING WELL
LOCATION MAP BAIER SITE
COUNTY ROAD X-23 SITE
LEE COUNTY, IA
3b

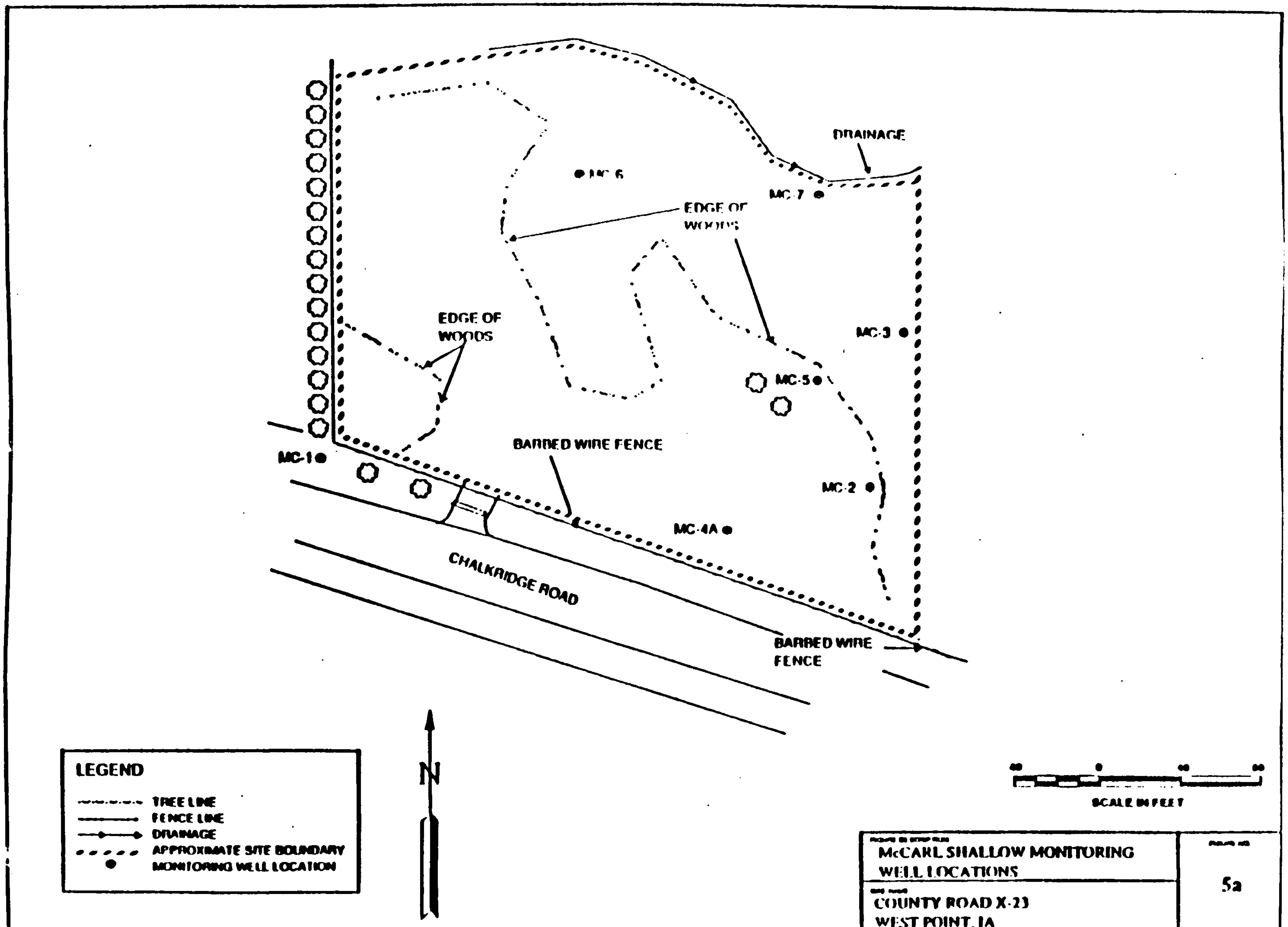
5.2 McCarl Subsite

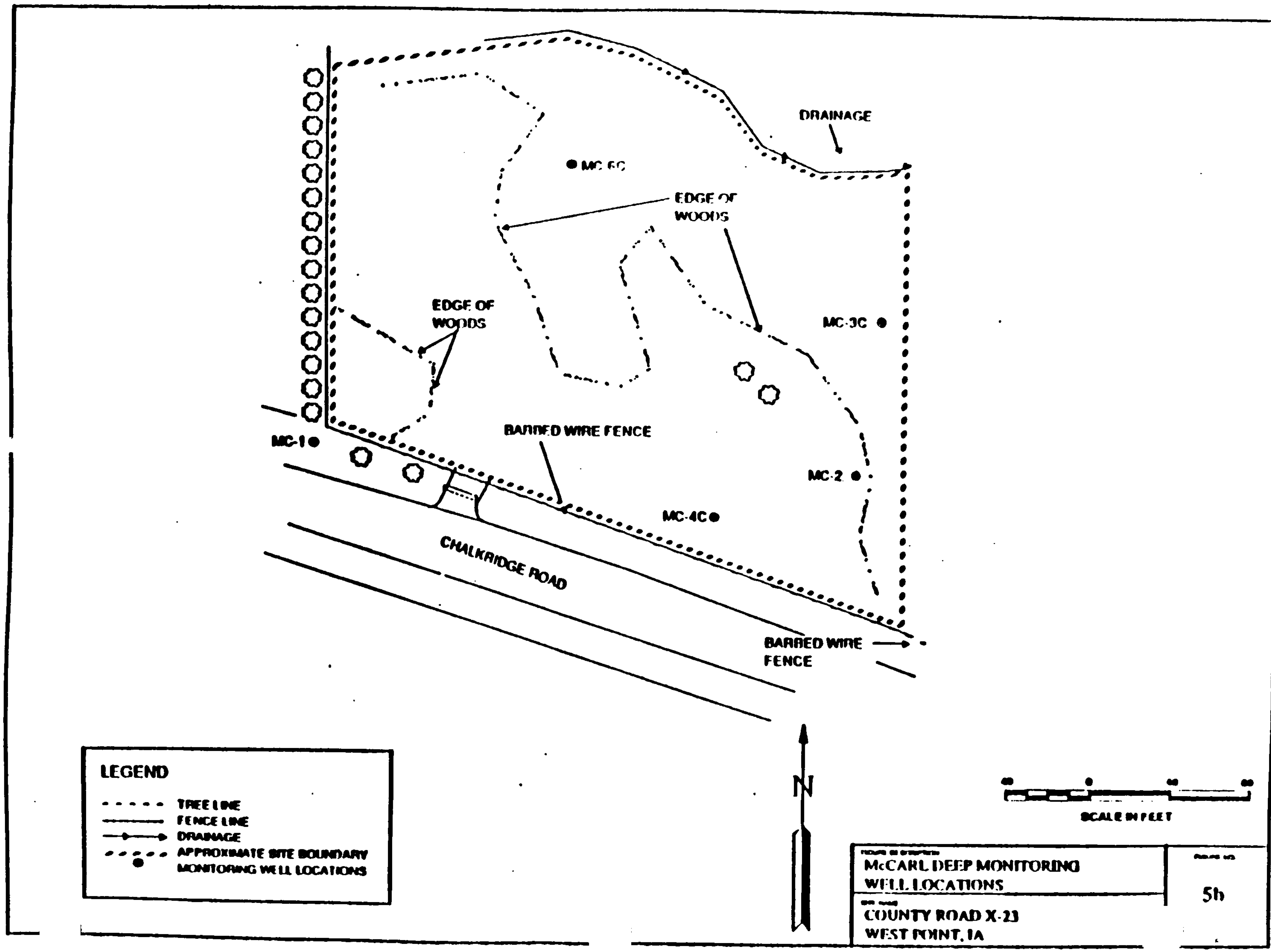
Visual observations made during auguring and test pit excavations at the McCarl Subsite in May 1989 showed that the amounts of disposed paint wastes were much smaller than at the Baier Subsite. While some paint cans, ash-like material, and sludge castings can be seen at the Subsite, there do not appear to be concentrated, significant areas of waste disposal as was observed at the Baier Subsite. Soil samples collected during pre-remedial and RI field investigations indicated concentrations of cadmium, chromium, selenium, lead, and zinc above naturally occurring background ranges (Table 4). For illustrative purposes, Figure 4 shows where these metals were above background concentrations. Generally, elevated concentrations are limited to the upper four feet of soil. Sampling of drainage paths leading from the Subsite indicate that elevated concentrations of heavy metals are not migrating off site in significant concentrations. Sampling also indicated very limited volatile and semi-volatile organic contamination of soil at the subsite (Tables 5, 6). The areas of volatile organic contamination at the Subsite are indicated by the dashed lines on Figure 4. The volatile organic contamination was generally limited to the upper six feet of soil. Similar to the Baier Subsite, heavy metals contamination in the soil represents the principal threat at the McCarl Subsite based on the risk to sensitive populations, the risk posed through possible ingestion of vegetables grown in contaminated soil, and the risk to possible future residents.

The hydrogeology at the McCarl subsite is similar to that described for the Baier subsite. There are two unconsolidated water-bearing units at the site separated by a relatively thick layer of low-permeability clay till that significantly limits the movement of water between the two. As at the Baier subsite, elevated levels of contaminants do not appear to be present in the lower water-bearing zone. Wells MC-3C, MC-4C, and MC-6C are completed in this zone. See Figures 5A and 5B for well locations. Wells MC-1, MC-2, MC-3, MC-4A, MC-5, MC-6, and MC-7 are all completed in the upper-most water-bearing zone present at the subsite. Elevated levels of total metals were present in all wells except MC-1 and MC-4A, which are hydraulically upgradient of the subsite. The direction of ground water flow in this shallow zone is to the north-northeast.

The analysis for the ground water exposure pathway is the same as at the Baier site. Due to the low yield and low permeability of the upper water-bearing unit and the confining layer separating the water-bearing units, a completed exposure pathway for ground water does not exist at the site.


EDGE OF WOODS
DRAINAGE
EDGE OF WOODS
BARBED WIRE FENCE
CHALKRIDGE ROAD
BARBED WIRE FENCE
LEGEND
TREE LINE
FENCE LINE
DRAINAGE
APPROXIMATE SITE BOUNDARY
APPROXIMATE EXTENT OF METALS CONTAMINATION
APPROXIMATE EXTENT OF VOLTILE ORGANIC CONTAMINTION
N
SCALE IN FEET
EXTENT OF CONTAMINATION
McCARL SITE
COUNTY ROAD X-23
WEST POINT, IA
4


DRAINAGE
MC-6
MC-7
EDGE OF WOODS
EDGE OF WOODS
MC-3
MC-5
BARBED WIRE FENCE
MC-1
MC-2
MC-4A
CHALKRIDGE ROAD
BARBED WIRE FENCE
LEGEND
TREE LINE
FENCE LINE
DRAINAGE
APPROXIMATE SITE BOUNDARY
MONITORING WELL LOCATION
N
SCALE IN FEET
McCARL SHALLOW MONITORING WELL LOCATIONS
COUNTY ROAD X-23
WEST POINT, IA
5a



DRAINAGE
MC-6C
EDGE OF WOODS
EDGE OF WOODS
MC-3C
BARBED WIRE FENCE
MC-1
MC-4C
MC-2
CHALKRIDGE ROAD
BARBED WIRE FENCE
LEGEND
TREE LINE
FENCE LINE
DRAINAGE
APPROXIMATE SITE BOUNDARY
MONITORING WELL LOCATIONS
N
SCALE IN FEET
McCARL DEEP MONITORING WELL LOCATIONS
COUNTY ROAD X-23
WEST POINT, IA
5h

6.0 Summary of Site Risks

6.1 Overview of Baseline Risk Assessment

A baseline risk assessment was conducted by DuPont to evaluate the potential impacts to human health posed by site contaminants in the absence of 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. EPA conducted a supplemental risk assessment which looked at future residential land use scenarios. This section summarizes the findings of these risk assessments regarding risks to human health and the environment from exposure to contaminants in the soil and ground water at both subsites. The complete risk assessment is presented in the RI Report and the Supplemental Risk Assessment. Both documents are in the Administrative Record. Both risk assessments consisted of an identification of chemicals of potential concern, exposure assessment, toxicity assessment, and risk characterization.

Contaminants of concern (COCs) are contaminants that have been detected at either subsite 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. At the Baier subsite fourteen compounds were identified in soil as being of potential concern. Two of these are human carcinogens. At the McCarl subsite, a total of sixteen compounds were identified as being of potential concern. Two of these are human carcinogens. See Table 6.1 below. Toxicity information for all the chemicals of concern was evaluated including, where applicable, cancer potency factors and criteria for non-carcinogenic effects. For lead, a blood level in children below which adverse effects are unlikely to occur was identified.

Table 6.1
Contaminants of Concern

Baier Site

inorganics	volatile organics	semi-volatile organics
cadmium	ethylbenzene	napthalene
chromium	toluene	2-methyl napthalene
lead	xylenes	bis(2-ethylhexyl)phthalate
zinc	4-methyl-2-pentanone	
arsenic*	1,1,1-trichloroethane	
selenium		

McCarl Site

inorganics	volatile organics	semi-volatile organics
cadmium	ethylbenzene	napthalene
chromium	toluene	2-methyl napthalene
lead	4-methyl-2-pentanone	
zinc	xylenes	
arsenic*		bis(2-ethylhexyl)phthalate
selenium		
barium		
copper		
manganese		

6.2 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.

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

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 is 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.

6.3 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 subsites. Direct contact with the surface soils was evaluated for hikers, hunters, and a farmer, assuming these represent both current and future land uses. Residential use was also considered to be a potential future land use.

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 and direct contact with surface soils. The exposure pathway of consumption of small game from the site was also considered. 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. The EPA has established a unique procedure for evaluating risk due to exposure to lead, which is a compound of concern at both subsites. The EPA has developed the Uptake/Biokinetic (UBK) model to estimate blood lead levels resulting from exposures to lead. Derived blood lead levels are then compared to 10 ug lead/dL blood, which the EPA considers unlikely to result in adverse effects.

6.4 Risk Characterization

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

When sufficient data are 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.

6.4.1 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. When federal standards do not exist, 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 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 hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

In general, hazard indices greater than one are associated with potentially increased health risk. The baseline risk assessment indicated total hazard indices of 15.4 and 3.9 for the Baier and McCarl subsites, respectively. These calculated indices are associated with the future land use scenario in which children are exposed to contaminated surface soil via ingestion and direct dermal contact. Cadmium and chromium are the compounds primarily responsible for this risk. The risk assessment also indicated that hazard indices of 19.6 and 6.4 for the Baier and McCarl subsites, respectively, are associated with potential future adult resident ingestion of vegetables grown in cadmium- and selenium-contaminated soils. A summary of the noncarcinogenic hazard indices are presented in Tables 7 through 10.

6.4.2 **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 cancer potency by the projected exposure dose level. It is the carcinogenic potency 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 risk to fall within a range of 10^{-4} to 10^{-6}. In other words, the Agency believes this to be a generally acceptable level of risk.

The carcinogenic risk assessment for the site concluded that under reasonable maximum exposure scenarios there are no carcinogenic risks associated with waste disposal at the Site. A summary of the results of calculations of carcinogenic risks evaluated for the site are presented in Tables 11 and 12.

6.4.3 **Risks From Lead**

Lead is also a carcinogen but EPA believes that toxic effects for sensitive populations will occur at lower levels than those which will produce carcinogenic effects. The EPA has established 10 micrograms of lead per deciliter (ug/dL) as a blood lead level in children which is unlikely to result in adverse health effect. Levels above 10 ug/dL are believed to result in adverse neurobehavioral effects in exposed children. Therefore, the EPA assesses potential health risk from lead by comparing estimated blood lead levels to the acceptable level of 10 ug/dL. If blood lead levels exceed 10 ug/dL a health risk is deemed to exist. Mean lead blood levels predicted by DuPont among resident children at the subsites are presented in Table 13. At the Baier subsite, mean blood levels were predicted to markedly exceed 10 ug/dL. At the McCarl subsite, DuPont predicted that a mean blood lead of 7.6 ug/dL would result.

6.4.4 Risks from Exposure to Ground Water

To determine potential effects on human health, pathways by which humans could be exposed were identified based on reasonable assumptions regarding current and future uses of the site. Based on this pathways analysis, it was determined that no exposure would result from ground water in those zones contaminated by contaminants from the site. This was based on the low ground water yield from these zones and the impermeability of the glacial till that makes up the majority of this zone.

6.4.5 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.

6.4.6 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 introduces 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.

6.4.7 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 by the preferred alternative or one of the other active measures considered may present a current or potential threat to public health, welfare, or the environment.

7.0 Description of Alternatives

A total of eight alternatives were evaluated in detail for remediation of the site. One alternative addresses ground water contamination. The remaining alternatives address soil contamination.

7.1 Ground Water

The baseline risk assessment conducted for ground water indicated that ground water contamination posed no threat to human health because there was no completed exposure pathway at the facility. This conclusion was based on the low yield from the contaminated water-bearing unit at the site and the presence of a confining unit below the water-bearing unit. This confining layer is 75 feet thick and consists of a low permeability glacial clay till. The yield from the water-bearing unit is in the gallons-per-hour range: household uses requires a minimum yield in the gallons-per-minute range. On the basis of these two factors, therefore, only the no action alternative is described below.

7.1.1 No Action

The no action alternative would not involve any action to prevent or reduce exposures to ground water contamination as the likelihood of such exposures has been judged to be remote. Monitoring will be conducted to verify that no exposures resulting from the conditions at the site occur in the future.

Ground water samples will be collected from existing on-site monitoring wells and analyzed for volatile organics and total metals. Sampling will initially be conducted on a quarterly basis during the first year and would be subsequently be conducted on a semi-annual basis for the next four years.

During the statutory five-year review, the five years of ground water monitoring data and other information, including site conditions will be evaluated. If, upon completion of the five-year review, it is determined that the site does not present a threat to health or the environment monitoring could be terminated and the site deleted from the NPL.

If the five-year review indicates continued monitoring is necessary to ensure that no exposures occur, monitoring will be continued for an additional five years and a second review performed.

If, however, the five-year review indicated that exposures are occurring, the need for remedial action including treatment or other controls will be evaluated.

There are no federal or state ARARS for the no action alternative. Compliance with federal and state ARARS is not required as no remedial action is necessary to protect human health and the environment.

Costs for the no action alternative would include costs for the collection and analysis of ground water samples. The total present worth of the no action alternative, assuming a ten year monitoring program as described above, is estimated to be $194,000.

7.2 <u>Soil Remedial Alternatives</u>

The baseline risk assessment for soils indicated the potential for a significant health threat to humans. Heavy metals contamination in the soil represents the principal threat at the County Road X23 Site based on the risk to sensitive populations, the risk posed through possible ingestion of vegetables grown in contaminated soil, and the risk for possible future residents. Therefore, a full range of alternatives for metals contamination in soil was evaluated as described below.

7.2.1 <u>No Action (Alternative 1)</u>

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.

7.2.2 Institutional Controls (Alternative 2)

This alternative would include implementation of access restrictions (fencing) and deed restrictions to limit and/or control future use of the site. This alternative would not meet the Iowa ARAR requiring Responsible Party Cleanup Actions (I.A.C. Chapter 567-133) to address soil contamination which may affect ground water, nor would it meet the CERCLA preference for treatment to reduce the toxicity, mobility, or volume of hazardous waste.

Because this alternative would result in contamination remaining on the site, CERCLA requires that the site be reviewed every five years. If justified by the review, remedial actions would be implemented at that time to remove or treat the wastes. It would also not meet Iowa's requirements for closure of existing solid waste landfills (I.A.C.Chapter 567-103).

7.2.3 Institutional Controls, Clay and Soil Cap (Alternative 3)

Under this alternative access restrictions (fencing), deed restrictions, and a compacted clay cap would be utilized. The clay cap would meet requirements of the State of Iowa for closure of existing solid waste landfills (I.A.C. Chapter 567-103) and all other identified ARARs.

Specifically, in this alternative a two-foot clean soil cover would be established over the two-foot compacted clay cap. The clay would be compacted to a permeability of 10^{-7} centimeters per second or less. Following construction of the cap, vegetation would be established to prevent erosion. Restrictions on the use and development of the site would be required to ensure the integrity of the cap.

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.

The time required to implement the capping remedy is estimated to be approximately 18 months. The present worth cost is estimated at approximately $1,800,000. The major capital cost component is cap construction at $710,000.

Because this alternative would result in contamination remaining on the site, CERCLA requires that the site be reviewed every five years. If justified by the review, remedial actions would be implemented at that time to remove or treat the wastes.

7.2.4 Institutional Controls, Multi-Media Cap (Alternative 4)

This alternative involves the use of institutional controls and a multi-media cap. The multi-media cap would consist of alternating layers of compacted clay, geotextile materials, and a clean cover soil. The multi-media cap would be less susceptible to damage and would be more protective than the clay and soil cap discussed in 4.3. The multi-media cap would also be more effective in isolating contaminants from exposure to the environment. This alternative would meet identified ARARs.

Following construction of the cap, vegetation would be established to prevent erosion. Restrictions on the use and development of the site would be required to ensure the integrity of the cap.

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. A Five-Year Review, as discussed in 7.2.3, would also be required.

The time required to implement the multi-media capping remedy is estimated to be approximately 18 months. The present worth cost of the alternative is estimated to be approximately $2,000,000. The major capital cost component is cap construction at $920,000.

7.2.5 Excavation, Off-Site Disposal in RCRA Landfill (Alternative 5)

Contaminated soil would be excavated and transported to a RCRA-authorized landfill. Following excavation, the site would be graded and vegetation would be established to prevent erosion. All Department of Transportation regulations applicable to transportation of hazardous waste would be observed. It is estimated that 14,200 cubic yards of soil would be removed from the site. This alternative would have to meet RCRA Land Disposal Restrictions.

The time required to implement the off-site disposal remedy is estimated to be approximately 150 days. The present worth cost is estimated at approximately $8,000,000.

7.2.6 Excavation, Treatment, Off-Site RCRA Landfill (Alternative 6)

This alternative is the same as 4.5 except treatment of the hazardous waste is added before disposal in a RCRA-authorized hazardous waste landfill. The type of treatment would likely be dictated by requirements of the RCRA Land Disposal Restrictions. This alternative would have to meet all ARARs.

The time to complete this alternative is the same as alternative 4.5 since all treatment would be off-site. The present worth cost is approximately $10,700,000.

7.2.7 Stabilization/Solidification (Alternative 7)

This alternative involves the in situ (in place) stabilization/solidification of the contaminated soil. Initially, surface debris not amenable to solidification would be removed from the site and transported to an RCRA authorized hazardous waste landfill. Then, solidifying agents (cement-like materials) and water would be injected into the contaminated soil, which would be mixed with large augers to obtain a uniform mixture. The mixture would set up into a solidified matrix. Following stabilization/solidification the soil mass would be covered with clean soil to prevent human and environmental contact and to protect the solidified mass. This alternative would meet all ARARs.

Following construction of the soil cover, vegetation would be established to prevent erosion. Restrictions on the use and development of the site would be required to ensure the integrity of the cover and the solidified soil mass.

This alternative would require long-term maintenance and monitoring. Site inspections would be required on a regular basis along with maintenance of the cover. Sampling of existing monitoring wells would be conducted to monitor ground water quality.

The time required to implement the in situ stabilization/solidification remedy is estimated to be approximately twelve to thirty-six months. The present worth cost is estimated at approximately $1,400,000. The major cost component is the construction at $1,200,000.

Because this alternative would result in contamination remaining on the site, CERCLA requires that the site be reviewed every five years. If justified by the review, remedial actions would be implemented at that time to remove or treat the wastes.

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.

The preferred alternative for the cleanup of contaminated soils at the County Road X23 Site is in situ solidification/stabilization. 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 Ground Water

8.1.1 Overall Protection of Human Health and Environment

Utilizing the baseline risk assessment, EPA has determined that ground water contamination does not pose a threat to human health or the environment. Therefore, no remedial action is necessary to protect human health and the environment. EPA's decision is the result of consideration of the following factors: the very low yield from the contaminated water-bearing unit at the site, and the presence of a 75 foot thick confining layer below the water-bearing unit. Monitoring will be conducted to verify that no exposure to risks posed by conditions at the site occur in the future. Compliance with federal and state ARARs is not required as no remedial action is necessary to protect human health or the environment. Furthermore, development and camparison of remedial alternatives is not necessary, because no unacceptable risks are presented by the groundwater.

8.2 Soil

8.2.1 Overall Protection of Human Health and Environment

The preferred alternative for soil is to stabilize/solidify all contaminated soils with contaminant concentrations above the cleanup levels specified earlier. Stabilization/solidification of the contaminated soils would reduce direct contact exposure to protective levels and also minimize the potential for contaminant migration.

With the exception of the no action alternative, all of the alternatives provide protection of human health and the environment by removing, reducing, or controlling risk through treatment, engineering controls, or institutional controls. The no-action alternative will not be evaluated further since it is not protective of human health and the environment.

8.2.2 Compliance With ARARS

The preferred alternative will comply with all federal and state ARARS. There are no relevant chemical- or location-specific ARARS. Major action-specific ARARS which the preferred alternative will comply with include: RCRA, Iowa Responsible Parties Cleanup Regulations (Title X, Chapter 133), DOT Regulations for transport of hazardous materials, and the Occupational Safety and Health Act.

The institutional controls alternative would not comply with ARARs. The other alternatives would have complied with their respective ARARs which include regulations from RCRA, including the Land Disposal Restrictions, and the Clean Air Act.

8.2.3 Long-Term Effectiveness and Permanence

The implementation of the stabilization/solidification alternative for all soil above cleanup concentrations would effectively eliminate the long-term risks associated with direct contact and potential contaminant migration at the County Road X23 Site. The mobility of the contaminants would be reduced through bonding to the solidified matrix and through reduction in the surface area exposed to ground or surface water. By providing treatment to reduce mobility with maintenance and monitoring, the preferred alternative should adequately prevent migration and direct contact. Long-term controls would be required to ensure the integrity of the alternative.

The Alternatives Two, Three and Four would reduce but not eliminate long-term risks at the Site. Long-term controls would be required to ensure the integrity of the cap. Alternative Five would eliminate the on-site long-term risks associated with the contaminated soil. Alternative Four would not eliminate the long-term risk associated with the contaminants themselves, but would eliminate the long-term risk at the site.

8.2.4 Reduction of Toxicity, Mobility, or Volume

The preferred alternative would employ treatment to reduce the mobility of the hazardous constituents in the soil. The toxicity would not be affected.

Alternatives Two, Three, Four and Five would not satisfy the CERCLA preference to reduce toxicity, mobility, or volume through treatment. Alternative Six would reduce the toxicity, mobility, or volume depending on the treatment option selected.

8.2.5 Short-Term Effectiveness

The short-term risks associated with the preferred alternative include surface runoff and worker exposure to contaminants as well as possible exposure to fugitive dust. These potential exposures can be effectively minimized and controlled by compliance with the action-specific ARARS and implementing engineering controls such as dust suppressants.

There would be no short term impacts associated with the institutional controls alternative. All the other alternatives would present the same short-term risks identified above in relation to on-site construction, excavation and loading. As noted above, compliance with ARARS and implementation of engineering controls would effectively minimize and control the exposures.

8.2.6 Implementability

Implementation of the preferred alternative would involve conventional solidification technologies that are proven and reliable. There are no anticipated significant administrative issues, such as permitting, that should affect the implementability of this alternative.

Implementation of the other alternatives would also involve conventional technologies that should not represent any technical or administrative impediments to their implementation.

8.2.7 Cost

The present worth cost of the preferred alternative would be approximately $1.4 million. The present worth cost of Alternatives Three and Four would be approximately $1.8 to 2.0 million. The present worth cost of Alternative Five would be approximately $8.0 million and Alternative Six would cost approximately $10.7 million.

8.2.8 State Acceptance

The State of Iowa concurs with EPA on the preferred alternative for the cleanup of contaminated soils at the County Road X23 Site.

8.2.9 Community Acceptance

Community acceptance of the stabilization/solidification alternative has been evaluated following the Public Meeting held on April 18, 1991, and conclusion of the public comment period on May 11, 1991. The results of this evaluation are presented in the attached Responsiveness Summary.

9.0 Selected Remedy

9.1 Ground Water

Based on the Baseline Risk Assessment and Supplemental Risk Assessment, EPA determined that ground water contamination does not present a threat to human health and, therefore, no remedial action is necessary. EPA's decision was based on consideration of the following factors: the low yield of the water-bearing unit at the site and the presence of a thick (75-foot) confining layer below the water-bearing unit. Monitoring will be conducted to verify that no exposures to risks posed by site conditions occur in the future. Compliance with federal and state ARARs is not required as no remedial action is necessary to protect human health or the environment. Furthermore, development and comparison of remedial alternatives is not necessary, because no unacceptable risks are presented by the groundwater.

9.2 Soil

Based on an evaluation of the relative performance of each alternative with respect to the evaluation criteria, EPA has determined that stabilization/solidification presents the best balance among the alternatives considered for cleanup of contaminated soils.

EPA believes that this alternative would satisfy the statutory requirements in CERCLA Section 121, which are: to be protective of human health and the environment; to comply with federal and state requirements that are legally applicable or relevant and appropriate for the alternative; to be cost-effective; and to utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The preferred alternative would stabilize/solidify all soils contaminated above health based levels into a solid monolith such that hazardous waste would be unable to leach into the ground water. All surface waste materials not amenable to the technology would be removed and disposed of at an off-site RCRA hazardous waste landfill prior to the in situ stabilization/solidification. These actions would eliminate the potential for contaminant migration. Following stabilization/solidification the monolith would be topped with a soil cover to protect the monolith and prevent direct contact. The protective cover would be graded and planted with vegetation to prevent erosion. Restrictions on the use and development of the site would be required to ensure the integrity of the cover and the solidified soil mass. Additionally, the preferred alternative would not pose any unacceptable short-term risks during the implementation of the remedy. Finally, the preferred alternative is the lowest cost for cleanup of contaminated soils of all the protective alternatives evaluated for this Site.

The preferred alternative would 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. The preferred alternative would 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 utilized takes into consideration a number of factors including long-term and short-term effectiveness of the alternative, implementability, and cost.

Protective contaminant concentrations were determined for several contaminants of concern at the 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. DuPont has proposed a cleanup level for lead in soil of 350 parts per million(ppm). The UBK model confirms that this level would be protective of over 95% of potentially exposed children (the sensitive subpopulation). For chromium, the protective contaminant concentration was developed by estimating the concentration that would result in a hazard quotient of 1.0 for each exposure pathway (i.e., dermal exposure, ingestion, etc.). The resulting cleanup level was 150 ppm. For cadmium and selenium, cleanup levels were proposed by the Agency for Toxic Substances and Disease Registry. These levels are 20 ppm and 10 ppm, respectively.

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 stabilization/solidification of the contaminated soil into a solid matrix that will bind and/or entrap the contaminants thereby immobilizing them and preventing any future releases.

Stabilization/solidification will also eliminate any direct contact threat, and threats posed to future residential or agricultural users of the site or adjacent land areas. No site contaminant related cancer risks were identified. By preventing direct contact and immobilizing the contaminants, the Hazard Indices (HI) would be reduced to less than one. This level of HI is within an acceptable range. There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

The preferred alternative would comply with all federal and state ARARS. There are no identified chemical-specific or location-specific ARARS.

The preferred alternative would 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, with the net present value being approximately $1.4 million. The selected remedy is the least costly of remedies that were judged to provide equal protection of human health and the environment. This included all remedies except the no-action and institutional controls alternatives for contaminated soil.

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

The State of Iowa and the EPA have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the DuPont County Road X23 Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the State of Iowa and EPA have determined that this 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. Also, the State and EPA considered the statutory preference for treatment as a principal element, and considered input from the community and the state.

This alternative reduces the mobility of contaminants by treatment, complies with ARARs, provides short-term effectiveness, and protects human health and the environment equally as well as Alternative Six. Alternatives Two, Three, Four and Five do not meet the preference for treatment. In terms of long-term effectiveness Alternative Seven provides protection equal to or exceeding all other alternatives. Also, Alternative Seven will be easier to implement administratively because it requires less coordination with relevant agencies. The selected remedy is reliable and can be implemented quickly once treatability testing is completed with less difficulty and at less cost than other treatment alternatives. It is therefore determined to be the most appropriate solution for the contaminated soil at the DuPont County Road X23 Site.

10.5 Preference for Treatment as a Principal Element

By treating the contaminated soil to stabilize/solidify it, the selected remedy addresses the principal threat of future direct contact and ingestion/inhalation of contaminated soil. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

11.0 Documentation of Significant Changes

The Proposed Plan for the E.I. du Pont De Nemours and Company County Road X23 Superfund Site was released for public comment on April 11, 1990. The Proposed Plan identified Remedial Action Alternative Seven, Stabilization/Solidification, as the preferred alternative. The EPA reviewed all comments received during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was identified in the Proposed Plan, were necessary.

TABLE 1
Chemicals of Potential Concern in Surficial Soil
(mg/kg)

BAIER SUB-SITE

Analyte	Range			Mean	Median
Arsenic	2.70	-	23.40	7.12	4.55
Cadmium	5.40	-	510.00	171.48	171.75
Chromium	15.10	-	1830.00	706.68	695.50
Selenium	0.75	-	53.50	22.37	16.8
Lead	60.00	-	38950.00	17012.90	19200
Zinc	105.00	-	29800.00	9461.40	578

SOURCE Tables 2-4 and 2-5, Removal Action Work Plan, Baier Site, October 27, 1989 and Table 4.1-12, Final Remedial Investigation Report for Baier Site and McCart Site, January 16, 1991.

[illegible]

Table 2
Volatile Organics
Baier Site
Soil Samples
May 1990
(mg/kg)

Analyte	RANGE	MEAN	MEDIAN
Toluene	(0.5)ND—4.8	1.401	1.0
Ethylbenzene	(0.5)ND-14	6.492	7.3
Total Xylene	(0.5)ND-67	34.738	44
Acetone	(1.1)ND-12	4.0	2.1
Methylene Chloride	(1.9)ND	0.95	0.95
2-Butanone	1.3BJ-(3.9)ND	1.625	1.625

Notes: ND( ) - not detected at concentration indicated in parenthesis.
J - indicates an estimated value.
B - indicates analyte found in the associated blank as well as the sample.
- Mean and median calculated by using one foot of the detection limits for samples where no compound was detected.
- Only detected volatile organics are listed. All samples analyzed for CLP volatile organics per the contract laboratory statement of work.

Table 3
Semi-Volatiles
Baier Site
Soil Samples
May 1990
(mg/kg)

Analyte	RANGE	MEAN	MEDIAN
Benzoic Acid	0.17J-6.0J	1.565	1.0
bis(2-Ethylhexyl)Phthalate	0.14J-(1.5)ND	0.321	0.1975
Napthalene	0.19J-6.50J	148.669	4.345
2-Meythynapthalene	0.048J-(1500)ND	150.865	30.25
Di-n-Butylphthalate	0.064BJ-(15)ND	0.272	0.087
Di-n-Octylphthalate	(0.38)ND-(0.41)ND	0.1975	0.1975

Notes: ND( ) - not detected at concentration indicated in parenthesis.
J - indicates an estimated value.
B - indicates analyte found in the associated blank as well as the sample.
- Mean and median calculated by using one-half of the detection limits for samples where no compound was detected.

TABLE 4
Chemicals of Potential Concern in Surficial Soil
(mg/kg)

McCARL SUB-SITE

Analyte	Range			Mean	Median
Arsenic	3.20	-	16.5	6.69	5.8
Barium	473.00	-	7410.0	2686.81	2140
Cadmium	1.90	-	443.0	43.16	24.6
Chromium	17.20	-	407.0	105.64	87.1
Copper	10.50	-	1410.0	135.23	62.5
Lead	281.00	-	3560.0	1314.04	1280
Manganese	604.00	-	2560.0	1321.41	1260
Selenium	0.22	-	177.0	11.43	4.5
Zinc	357.00	-	6020.0	1949.96	1660

SOURCE: Table 4.3-8, Final Remedial Investigation Report for the Baier Site and the McCarl Site, January 16, 1991.

ND - Not Detected at concentration noted.
B - Reported value is less than the contract required detection limit (CRDL) but greater than the instrument detection limit (IDL).

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Table 5
Volatile Organics
McCarl Site
Soil Samples
May 1990
(mg/kg)

Analyte	RANGE	MEAN	MEDIAN
Toluene	(0.32)ND-15	4.328	0.75
Ethylbenzene	0.048-36	11.791	5.7
Total Xylene	1.8-200	65.225	21.0
Acetone	(0.032)ND-(0.8)ND	6.765	2.445
Methylene Chloride	0.016-(0.4)ND	0.27	0.016
2-Butanone	0.048J-8.6BJ	3.237	0.9
4-Methy-2-Pentanone	0.072-(1.6)ND	.557	0.8

Notes: ND( ) - not detected at concentration indicated in parenthesis.
J - indicates an estimated value.
B - indicates analyte found in the associated blank as well as the sample.
- compounds identified during a re-analysis of a diluted sample.
- compounds whose concentrations exceed the calibration range of the GC/MS instrument for this specific analysis.
- Mean and median calculated by using one foot of the detection limits for samples where no compound was detected.

JE1\E:ARCS\2218\TBPK428 WK1

Table 6
Semi-Volatiles
McCarl Site
Soil Samples
May 1990
(mg/kg)

Analyte	RANGE	MEAN	MEDIAN
Benzoic Acid	0.12J-(1.9)ND	0.426	0.30
bis(2-Ethylhexyl)Phthalate	0.086J-(25)ND	0.265	0.23
Napthalene	0.14J-(25)ND	3.335	0.35
2-Meythynapthalene	0.81J-(25)ND	3.55	0.61
Pentachlorophenol	0.17J-(1.6)ND	0.735	0.735
Di-n-Butylphthalate	(0.40)ND-(0.42)ND	0.205	0.205

Notes: ND( ) - not detected at concentration indicated in parenthesis.
J - indicates an estimated value.
B - indicates analyte found in the associated blank as well as the sample.
- Mean and median calculated by using one-half of the detection limits for samples where no compound was detected.

TABLE 7

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES
FOR CURRENT SITE VISITORS

BAIER SUBSITE

Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
CURRENT HUNTER				
Exposure Pathway: Ingestion of Soil				
Arsenic	3.9×10^{-8}	No	1×10^{-3}	0.00004
Cadmium	7.3×10^{-7}	No	1×10^{-3}	0.0007
Chromium VI	3.6×10^{-6}	No	5×10^{-3}	0.0007
Selenium	1.1×10^{-7}	No	3×10^{-3}	0.00004
			Subtotal (Pathway)	0.002
Exposure Pathway: Dermal Contact with Soil				
Arsenic	4.8×10^{-9}	Yes	9×10^{-4}	0.000005
Cadmium	8.8×10^{-8}	Yes	6×10^{-5}	0.002
Chromium VI	4.4×10^{-7}	Yes	1×10^{-4}	0.004
Selenium	1.4×10^{-8}	Yes	2×10^{-3}	0.000006
			Subtotal(Pathway)	0.006
		Current Hunter Total Chronic Hazard Index		0.008
CURRENT HIKER (CHILD)				
Exposure Pathway: Ingestion of Soil				
Arsenic	1.0×10^{-6}	No	1×10^{-3}	0.001
Cadmium	1.9×10^{-5}	No	1×10^{-3}	0.02
Chromium VI	9.4×10^{-5}	No	5×10^{-3}	0.02
Selenium	1.0×10^{-5}	No	3×10^{-3}	0.001
			Subtotal (Pathway)	0.042
Exposure Pathway: Dermal Contact with Soil				
Arsenic	1.2×10^{-8}	Yes	9×10^{-4}	0.00002
Cadmium	2.3×10^{-7}	Yes	6×10^{-5}	0.006
Chromium VI	1.2×10^{-6}	Yes	1×10^{-4}	0.02
Selenium	3.6×10^{-8}	Yes	2×10^{-3}	0.00002
			Subtotal (Pathway)	0.026
		Current Hiker (child) Total Chronic Hazard Index		0.06

TABLE 7

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES
FOR CURRENT SITE VISITORS

BAIER SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
CURRENT JUVENILE HUNTER				
Exposure Pathway: Ingestion of Soil				
Arsenic	5.5×10^{-7}	No	1×10^{-3}	0.0006
Cadmium	1.0×10^{-5}	No	1×10^{-3}	0.01
Chromium VI	5.0×10^{-5}	No	5×10^{-3}	0.01
Selenium	1.0×10^{-5}	No	3×10^{-3}	0.0005
			Subtotal (Pathway)	0.021
Exposure Pathway: Dermal Contact with Soil				
Arsenic	6.7×10^{-8}	Yes	9×10^{-4}	0.00007
Cadmium	1.2×10^{-6}	Yes	6×10^{-5}	0.02
Chromium VI	6.1×10^{-6}	Yes	1×10^{-4}	0.06
Selenium	2.0×10^{-7}	Yes	2×10^{-3}	0.00008
			Subtotal (Pathway)	0.08
		Current Juvenile Hunter Total Chronic Hazard Index		0.10
CURRENT HIKER (EDIBLES)				
Exposure Pathway: Ingestion of Soil				
Arsenic	3.8×10^{-7}	No	1×10^{-3}	0.0004
Cadmium	7.0×10^{-6}	No	1×10^{-3}	0.007
Chromium VI	3.4×10^{-5}	No	5×10^{-3}	0.007
Selenium	1.1×10^{-6}	No	3×10^{-3}	0.0004
			Subtotal (Pathway)	0.015
Exposure Pathway: Dermal Contact with Soil				
Arsenic	7.6×10^{-9}	Yes	9×10^{-4}	0.000008
Cadmium	1.4×10^{-7}	Yes	6×10^{-5}	0.002
Chromium VI	7.1×10^{-7}	Yes	1×10^{-4}	0.007
Selenium	2.2×10^{-8}	Yes	2×10^{-3}	0.000009
			Subtotal (Pathway)	0.009
		Current Hiker (Edibles) Total Chronic Hazard Index		0.02

TABLE 7

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES
FOR CURRENT SITE VISITORS

BAIER SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
CURRENT HIKER (YEAR ROUND)				
Exposure Pathway: Ingestion of Soil				
Arsenic	2.8×10^{-7}	No	1×10^{-3}	0.0003
Cadmium	5.2×10^{-6}	No	1×10^{-3}	0.005
Chromium VI	2.6×10^{-5}	No	5×10^{-3}	0.005
Selenium	8.2×10^{-7}	No	3×10^{-3}	0.0003
			Subtotal (Pathway)	0.01
Exposure Pathway: Dermal Contact with Soil				
Arsenic	3.4×10^{-8}	Yes	9×10^{-4}	0.00004
Cadmium	6.4×10^{-7}	Yes	6×10^{-5}	0.01
Chromium VI	3.2×10^{-6}	Yes	1×10^{-4}	0.03
Selenium	1.0×10^{-7}	Yes	2×10^{-3}	0.00004
			Subtotal (Pathway)	0.04
	Current Hiker (Year Round) Total Chronic Hazard Index			0.05
CURRENT FARMER				
Exposure Pathway: Ingestion of Soil				
Arsenic	1.7×10^{-6}	No	1×10^{-3}	0.002
Cadmium	3.1×10^{-5}	No	1×10^{-3}	0.03
Chromium VI	1.6×10^{-4}	No	5×10^{-3}	0.03
Selenium	4.9×10^{-6}	No	3×10^{-3}	0.002
			Subtotal (Pathway)	0.06
Exposure Pathway: Dermal Contact with Soil				
Arsenic	3.4×10^{-8}	Yes	9×10^{-4}	0.00004
Cadmium	6.4×10^{-7}	Yes	6×10^{-5}	0.01
Chromium VI	3.2×10^{-6}	Yes	1×10^{-4}	0.03
Selenium	1.0×10^{-7}	Yes	2×10^{-3}	0.00004
			Subtotal (Pathway)	0.04
		Current Farmer Total Chronic Hazard Index		0.10

TABLE 6

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES
FOR CURRENT SITE VISITORS

McCARL SUBSITE

Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
CURRENT HUNTER				
Exposure Pathway: Ingestion of Soil				
Arsenic	2.5×10^{-8}	No	1×10^{-3}	0.00002
Barium	1.3×10^{-5}	No	5×10^{-2}	0.0002
Cadmium	4.0×10^{-7}	No	1×10^{-3}	0.0004
Chromium VI	5.5×10^{-7}	No	5×10^{-3}	0.0001
Copper	1.3×10^{-6}	No	4×10^{-2}	0.00003
Manganese	4.3×10^{-6}	No	2×10^{-1}	0.00002
Selenium	1.5×10^{-7}	No	3×10^{-3}	0.00005
Zinc	8.7×10^{-6}	No	2×10^{-1}	0.00004
			Subtotal (Pathway)	0.002
Exposure Pathway: Dermal Contact with Soil				
Arsenic	3.0×10^{-9}	Yes	9×10^{-4}	0.000003
Cadmium	4.9×10^{-8}	Yes	6×10^{-5}	0.0008
Chromium VI	6.6×10^{-8}	Yes	1×10^{-4}	0.0007
Copper	1.6×10^{-7}	Yes	2×10^{-2}	0.000008
Manganese	5.2×10^{-7}	Yes	6×10^{-3}	0.00009
Selenium	1.8×10^{-8}	Yes	2×10^{-3}	0.000008
Zinc	1.1×10^{-6}	Yes	1×10^{-1}	0.000009
			Subtotal (Pathway)	0.002
		Current Hunter Total Chronic Hazard Index		0.003
CURRENT HIKER (CHILD)				
Exposure Pathway: Ingestion of Soil				
Arsenic	6.5×10^{-7}	No	1×10^{-3}	0.0006
Barium	3.3×10^{-4}	No	5×10^{-2}	0.007
Cadmium	1.0×10^{-5}	No	1×10^{-3}	0.01
Chromium VI	1.4×10^{-5}	No	5×10^{-3}	0.003
Copper	3.4×10^{-5}	No	4×10^{-2}	0.0008
Manganese	1.1×10^{-4}	No	2×10^{-1}	0.0006
Selenium	3.9×10^{-6}	No	3×10^{-3}	0.001
Zinc	2.3×10^{-4}	No	2×10^{-1}	0.001
			Subtotal(Pathway)	0.03

TABLE 8

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES
FOR CURRENT SITE VISITORS

McCARL SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
Exposure Pathway: Dermal Contact with Soil				
Arsenic	7.9×10^{-9}	Yes	9×10^{-4}	0.00001
Cadmium	1.2×10^{-7}	Yes	6×10^{-5}	0.003
Chromium VI	1.7×10^{-7}	Yes	1×10^{-4}	0.002
Copper	4.1×10^{-7}	Yes	2×10^{-2}	0.00002
Manganese	1.4×10^{-6}	Yes	6×10^{-3}	0.0003
Selenium	4.7×10^{-8}	Yes	2×10^{-3}	0.00003
Zinc	2.8×10^{-6}	Yes	1×10^{-1}	0.00003
			Subtotal (Pathway)	0.005
		Current Hiker (child) Total Chronic Hazard Index		0.04
CURRENT JUVENILE HUNTER				
Exposure Pathway: Ingestion of Soil				
Arsenic	3.5×10^{-7}	No	1×10^{-3}	0.0004
Barium	1.8×10^{-4}	No	5×10^{-2}	0.004
Cadmium	5.6×10^{-6}	No	1×10^{-3}	0.006
Chromium VI	7.6×10^{-6}	No	5×10^{-3}	0.002
Copper	1.5×10^{-5}	No	4×10^{-2}	0.0004
Manganese	6.0×10^{-5}	No	2×10^{-1}	0.0003
Selenium	2.1×10^{-6}	No	3×10^{-3}	0.0007
Zinc	1.2×10^{-4}	No	2×10^{-1}	0.0006
			Subtotal (Pathway)	0.01
Exposure Pathway: Dermal Contact with Soil				
Arsenic	4.2×10^{-8}	Yes	9×10^{-4}	0.00005
Cadmium	6.8×10^{-7}	Yes	6×10^{-5}	0.01
Chromium VI	9.3×10^{-7}	Yes	1×10^{-4}	0.009
Copper	2.2×10^{-6}	Yes	2×10^{-2}	0.0001
Manganese	7.3×10^{-6}	Yes	6×10^{-3}	0.001
Selenium	2.5×10^{-7}	Yes	2×10^{-3}	0.0001
Zinc	1.5×10^{-5}	Yes	1×10^{-1}	0.0001
			Subtotal (Pathway)	0.02
		Current Juvenile Hunter Total Chronic Hazard Index		0.03

TABLE 8

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES
FOR CURRENT SITE VISITORS

McCARL SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
CURRENT HIKER (EDIBLES)				
Exposure Pathway: Ingestion of Soil				
Arsenic	2.4×10^{-7}	No	1×10^{-3}	0.0002
Barium	1.2×10^{-4}	No	5×10^{-2}	0.002
Cadmium	3.8×10^{-6}	No	1×10^{-3}	0.004
Chromium VI	5.2×10^{-6}	No	5×10^{-3}	0.001
Copper	1.2×10^{-5}	No	4×10^{-2}	0.0003
Manganese	4.1×10^{-5}	No	2×10^{-1}	0.0002
Selenium	1.4×10^{-6}	No	3×10^{-3}	0.0005
Zinc	8.4×10^{-5}	No	2×10^{-1}	0.0004
			Subtotal (Pathway)	0.009
Exposure Pathway: Dermal Contact with Soil				
Arsenic	4.9×10^{-9}	Yes	9×10^{-4}	0.000005
Cadmium	7.8×10^{-8}	Yes	6×10^{-5}	0.001
Chromium VI	1.1×10^{-7}	Yes	1×10^{-4}	0.001
Copper	2.5×10^{-7}	Yes	2×10^{-2}	0.00001
Manganese	8.4×10^{-7}	Yes	6×10^{-3}	0.0001
Selenium	2.9×10^{-8}	Yes	2×10^{-3}	0.00001
Zinc	1.7×10^{-6}	Yes	1×10^{-1}	0.00002
			Subtotal (Pathway)	0.002
		Current Hiker (Edibles) Total Chronic Hazard Index		0.01
CURRENT HIKER (YEAR ROUND)				
Exposure Pathway: Ingestion of Soil				
Arsenic	1.8×10^{-7}	No	1×10^{-3}	0.0002
Barium	9.1×10^{-5}	No	5×10^{-2}	0.002
Cadmium	2.9×10^{-6}	No	1×10^{-3}	0.003
Chromium VI	3.9×10^{-6}	No	5×10^{-3}	0.0008
Copper	9.3×10^{-6}	No	4×10^{-2}	0.0002
Manganese	3.1×10^{-5}	No	2×10^{-1}	0.0002
Selenium	1.1×10^{-6}	No	3×10^{-3}	0.0004
Zinc	6.3×10^{-5}	No	2×10^{-1}	0.0003
			Subtotal (Pathway)	0.007

TABLE 8

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES
FOR CURRENT SITE VISITORS

McCARL SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
Exposure Pathway: Dermal Contact with Soil				
Arsenic	2.2×10^{-8}	Yes	9×10^{-4}	0.00002
Cadmium	3.5×10^{-7}	Yes	6×10^{-5}	0.006
Chromium VI	4.8×10^{-7}	Yes	1×10^{-4}	0.005
Copper	1.1×10^{-6}	Yes	2×10^{-2}	0.00006
Manganese	3.8×10^{-6}	Yes	6×10^{-3}	0.0006
Selenium	1.3×10^{-7}	Yes	2×10^{-3}	0.00005
Zinc	7.7×10^{-6}	Yes	1×10^{-1}	0.00007
			Subtotal (Pathway)	0.01
		Current Hiker (Year Round) Total Chronic Hazard Index		0.02
CURRENT FARMER				
Exposure Pathway: Ingestion of Soil				
Arsenic	1.1×10^{-6}	No	1×10^{-3}	0.001
Barium	5.5×10^{-4}	No	5×10^{-2}	0.01
Cadmium	1.7×10^{-5}	No	1×10^{-3}	0.02
Chromium VI	2.4×10^{-5}	No	5×10^{-3}	0.005
Copper	5.6×10^{-5}	No	4×10^{-2}	0.001
Manganese	1.9×10^{-4}	No	2×10^{-1}	0.0009
Selenium	6.4×10^{-6}	No	3×10^{-3}	0.002
Zinc	3.8×10^{-4}	No	2×10^{-1}	0.002
			Subtotal (Pathway)	0.04
Exposure Pathway: Dermal Contact with Soil				
Arsenic	2.2×10^{-8}	Yes	9×10^{-4}	0.00002
Cadmium	3.5×10^{-7}	Yes	6×10^{-5}	0.006
Chromium VI	4.8×10^{-7}	Yes	1×10^{-4}	0.005
Copper	1.1×10^{-6}	Yes	2×10^{-2}	0.00006
Manganese	3.8×10^{-6}	Yes	6×10^{-3}	0.0006
Selenium	1.3×10^{-7}	Yes	2×10^{-3}	0.00005
Zinc	7.7×10^{-6}	Yes	1×10^{-1}	0.00007
			Subtotal (Pathway)	0.01
		Current Farmer Total Chronic Hazard Index		0.05

TABLE 9

SUMMARY OF SUBCHRONIC AND CHRONIC HAZARD INDEX ESTIMATES
FOR FUTURE ONSITE RESIDENTS

BAIER SUBSITE

Chemical	SDI/CDI (mg/kg-day)	SDI/CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
FUTURE CHILD RESIDENT				
Exposure Pathway: Ingestion of Soil				
Arsenic	8.1×10^{-5}	No	1.0×10^{-3}	0.08
Cadmium	2.0×10^{-3}	No	1.0×10^{-3}	2.03
Chromium VI	7.9×10^{-3}	No	2.0×10^{-2}	0.40
Selenium	2.6×10^{-4}	No	3.0×10^{-3}	0.09
Zinc	1.8×10^{-1}	No	2.0×10^{-1}	0.91
			Subtotal (Pathway)	3.51
Exposure Pathway: Dermal Contact with Soil				
Arsenic	7.8×10^{-5}	Yes	9.0×10^{-4}	0.09
Cadmium	2.0×10^{-4}	Yes	6.0×10^{-5}	3.27
Chromium VI	7.6×10^{-4}	Yes	4.0×10^{-4}	7.65
Selenium	2.5×10^{-4}	Yes	2.4×10^{-3}	0.10
Zinc	8.8×10^{-2}	Yes	1.2×10^{-1}	0.73
			Subtotal (Pathway)	11.84
	Future Child Resident: Total Subchronic Hazard Index			15.4
FUTURE ADULT RESIDENT				
Exposure Pathway: Ingestion of Soil				
Arsenic	9.2×10^{-6}	No	1.0×10^{-3}	0.01
Cadmium	2.3×10^{-4}	No	1.0×10^{-3}	0.23
Chromium VI	9.1×10^{-4}	No	5.0×10^{-3}	0.18
Selenium	3.8×10^{-5}	No	3.0×10^{-3}	0.01
Zinc	2.1×10^{-2}	No	2.0×10^{-1}	0.10
			Subtotal (Pathway)	0.53
Exposure Pathway: Dermal Contact with Soil				
Arsenic	2.5×10^{-5}	Yes	9.0×10^{-4}	0.03
Cadmium	6.3×10^{-5}	Yes	6.0×10^{-5}	1.05
Chromium VI	2.4×10^{-4}	Yes	1.0×10^{-4}	2.45
Selenium	8.0×10^{-5}	Yes	2.4×10^{-3}	0.03
Zinc	2.8×10^{-2}	Yes	1.2×10^{-1}	0.24
			Subtotal (Pathway)	3.80

TABLE 9

SUMMARY OF SUBCHRONIC AND CHRONIC HAZARD INDEX ESTIMATES
FOR FUTURE ONSITE RESIDENTS

BAIER SUBSITE
(Continued)

Chemical	SDI/CDI (mg/kg-day)	SDI/CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
Exposure Pathway: Ingestion of Homegrown Vegetables				
Cadmium	1.9×10^{-2}	No	1.0×10^{-3}	19.0
Selenium	1.8×10^{-3}	No	3.0×10^{-3}	0.58
			Subtotal (Pathway)	19.58
		Future Adult Resident Total Chronic Hazard Index		23.9

TABLE 10

SUMMARY OF SUBCHRONIC AND CHRONIC HAZARD INDEX ESTIMATES FOR FUTURE ONSITE RESIDENTS

McCARL SUBSITE

Chemical	SDI/CDI (mg/kg-day)	SDI/CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
FUTURE CHILD RESIDENT				
Exposure Pathway: Ingestion of Soil				
Arsenic	5.6×10^{-5}	No	1.0×10^{-3}	0.06
Barium	2.4×10^{-2}	No	5.0×10^{-2}	0.49
Cadmium	5.4×10^{-4}	No	1.0×10^{-3}	0.54
Chromium VI	9.9×10^{-4}	No	2.0×10^{-2}	0.05
Copper	1.7×10^{-3}	No	4.0×10^{-2}	0.04
Manganese	1.0×10^{-2}	No	1.0×10^{-1}	0.11
Selenium	1.7×10^{-4}	No	3.0×10^{-3}	0.06
Zinc	1.7×10^{-2}	No	2.0×10^{-1}	0.09
			Subtotal (Pathway)	1.44
Exposure Pathway: Dermal Contact with Soil				
Arsenic	5.4×10^{-5}	Yes	9.0×10^{-4}	0.06
Cadmium	5.2×10^{-5}	Yes	6.0×10^{-5}	0.86
Chromium VI	9.6×10^{-5}	Yes	4.0×10^{-4}	0.96
Copper	1.6×10^{-3}	Yes	2.0×10^{-2}	0.08
Manganese	1.0×10^{-3}	Yes	3.0×10^{-3}	0.34
Selenium	1.7×10^{-4}	Yes	2.4×10^{-3}	0.07
Zinc	8.3×10^{-3}	Yes	1.2×10^{-1}	0.07
			Subtotal (Pathway)	2.44
	Future Child Resident Total Subchronic Hazard Index			3.9
FUTURE ADULT RESIDENT				
Exposure Pathway: Ingestion of Soil				
Arsenic	6.3×10^{-6}	No	1.0×10^{-3}	0.01
Barium	2.8×10^{-3}	No	5.0×10^{-2}	0.06
Cadmium	6.1×10^{-5}	No	1.0×10^{-3}	0.06
Chromium VI	1.1×10^{-4}	No	5.0×10^{-3}	0.02
Copper	2.0×10^{-4}	No	4.0×10^{-2}	0.00
Manganese	1.2×10^{-3}	No	1.0×10^{-1}	0.01
Selenium	2.0×10^{-5}	No	3.0×10^{-3}	0.01
Zinc	2.0×10^{-3}	No	2.0×10^{-1}	0.01
			Subtotal (Pathway)	0.18

TABLE 10

SUMMARY OF SUBCHRONIC AND CHRONIC HAZARD INDEX ESTIMATES
FOR FUTURE ONSITE RESIDENTS

McCARL SUBSITE
(Continued)

Chemical	SDI/CDI (mg/kg-day)	SDI/CDI Adjusted for Absorption	RfD (mg/kg-day)	Hazard Quotient
Exposure Pathway: Dermal Contact with Soil				
Arsenic	1.7×10^{-5}	Yes	9.0×10^{-4}	0.02
Cadmium	1.7×10^{-5}	Yes	6.0×10^{-5}	0.28
Chromium VI	3.1×10^{-5}	Yes	1.0×10^{-4}	0.31
Copper	5.3×10^{-4}	Yes	2.0×10^{-2}	0.03
Manganese	3.3×10^{-4}	Yes	3.0×10^{-3}	0.11
Selenium	5.4×10^{-5}	Yes	2.4×10^{-3}	0.02
Zinc	2.7×10^{-3}	Yes	1.2×10^{-1}	0.02
			Subtotal (Pathway)	0.79
Exposure Pathway: Ingestion of Homegrown Vegetables				
Cadmium	5.0×10^{-3}	No	1.0×10^{-3}	5.02
Selenium	1.2×10^{-3}	No	3.0×10^{-3}	0.39
			Subtotal (Pathway)	5.41
	Future Adult Resident Total Chronic Hazard Index			6.4

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

BAIER SUBSITE

Chemical	CDI (mg/kg-day)	SF (mg/kg-day)	Weight of Evidence	SF Source	Chemical-Specific Risk	Total Pathway Risk	Total Exposure Risk
CURRENT SITE VISITOR - HUNTER							
Exposure Pathway: Ingestion of Soil							
Arsenic	1.6×10^{-8}	1.75	A	IRIS	3×10^{-8}	3×10^{-8}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	1.9×10^{-9}	1.94	A	SF_{oral} / GI absorption	4×10^{-9}	4×10^{-9}	
					Total Hunter Cancer Risk		3×10^{-8}
CURRENT SITE VISITOR - HIKER (CHILD)							
Exposure Pathway: Ingestion of Soil							
Arsenic	1.6×10^{-7}	1.75	A	IRIS	3×10^{-7}	3×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	2.0×10^{-9}	1.94	A	SF_{oral} / GI absorption	4×10^{-9}	4×10^{-9}	
					Total Hiker (Child) Cancer Risk		3×10^{-7}

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

BAIER SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	SF (mg/kg-day)	Weight of Evidence	SF Source	Chemical-Specific Risk	Total Pathway Risk	Total Exposure Risk
CURRENT SITE VISITOR - JUVENILE HUNTER							
Exposure Pathway: Ingestion of Soil							
Arsenic	2.2×10^{-7}	1.75	A	IRIS	4×10^{-7}	4×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	2.7×10^{-8}	1.94	A	SF_{oral} / GI absorption	5×10^{-8}	5×10^{-8}	
					Total Juvenile Hunter Cancer Risk		4×10^{-7}
CURRENT SITE VISITOR - HIKER (EDIBLES)							
Exposure Pathway: Ingestion of Soil							
Arsenic	1.5×10^{-7}	1.75	A	IRIS	3×10^{-7}	3×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	3.1×10^{-9}	1.94	A	SF_{oral} / GI absorption	6×10^{-9}	6×10^{-9}	
					Total Hiker (Edibles) Cancer Risk		3×10^{-7}

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

BAIER SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	SF (mg/kg-day)	Weight of Evidence	SF Source	Chemical-Specific Risk	Total Pathway Risk	Total Exposure Risk
CURRENT SITE VISITOR - HIKER (YEAR ROUND)							
Exposure Pathway: Ingestion of Soil							
Arsenic	1.1×10^{-7}	1.75	A	IRIS	2×10^{-7}	2×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	1.4×10^{-8}	1.94	A	SF_{oral} / GI absorption	3×10^{-8}	3×10^{-8}	
				Total Hiker (Year Round) Cancer Risk			2×10^{-7}
CURRENT SITE VISITOR - FARMER							
Exposure Pathway: Ingestion of Soil							
Arsenic	6.8×10^{-7}	1.75	A	IRIS	1×10^{-6}	1×10^{-6}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	1.4×10^{-8}	1.94	A	SF_{oral} / GI absorption	3×10^{-8}	3×10^{-8}	
				Total Farmer Cancer Risk			1×10^{-6}

TABLE 11

SUMMARY OF CANCER RISK ESTIMATES

BAIER SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	SF (mg/kg-day)	Weight of Evidence	SF Source	Chemical-Specific Risk	Total Pathway Risk	Total Exposure Risk
FUTURE ONSITE CHILD RESIDENT							
Exposure Pathway: Ingestion of Soil							
Arsenic	6.9×10^{-6}	1.75	A	IRIS	1×10^{-5}	1×10^{-5}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	8.9×10^{-6}	1.94	A	SF_{oral} / GI absorption	2×10^{-5}	2×10^{-5}	
				Total Onsite Child Resident Cancer Risk			3×10^{-5}
FUTURE ONSITE ADULT RESIDENT							
Exposure Pathway: Ingestion of Soil							
Arsenic	4.0×10^{-6}	1.75	A	IRIS	7×10^{-6}	7×10^{-6}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	1.1×10^{-5}	1.94	A	SF_{oral} / GI absorption	2×10^{-5}	2×10^{-5}	
				Total Onsite Adult Cancer Risk			3×10^{-5}

TABLE 12

SUMMARY OF CANCER RISK ESTIMATES

McCARL SUBSITE

Chemical	CDI (mg/kg-day)	SF (mg/kg-day)	Weight of Evidence	SF Source	Chemical-Specific Risk	Total Pathway Risk	Total Exposure Risk
CURRENT SITE VISITOR - HUNTER							
Exposure Pathway: Ingestion of Soil							
Arsenic	1.0×10^{-8}	1.75	A	IRIS	2×10^{-8}	2×10^{-8}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	1.2×10^{-9}	1.94	A	SF_{oral} / GI absorption	2×10^{-9}	2×10^{-9}	
					Total Hunter Cancer Risk		2×10^{-8}
CURRENT SITE VISITOR - HIKER (CHILD)							
Exposure Pathway: Ingestion of Soil							
Arsenic	1.0×10^{-7}	1.75	A	IRIS	2×10^{-7}	2×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	1.3×10^{-9}	1.94	A	SF_{oral} / GI absorption	2×10^{-9}	2×10^{-9}	
					Total Hiker (Child) Cancer Risk		2×10^{-7}

TABLE 12

SUMMARY OF CANCER RISK ESTIMATES

McCARL SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	SF (mg/kg-day)	Weight of Evidence	SF Source	Chemical-Specific Risk	Total Pathway Risk	Total Exposure Risk
CURRENT SITE VISITOR - JUVENILE HUNTER							
Exposure Pathway: Ingestion of Soil							
Arsenic	1.4×10^{-7}	1.75	A	IRIS	2×10^{-7}	2×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	1.7×10^{-8}	1.94	A	SF_{oral} / GI absorption	3×10^{-8}	3×10^{-8}	
					Total Juvenile Hunter Cancer Risk		2×10^{-7}
CURRENT SITE VISITOR - HIKER (EDIBLES)							
Exposure Pathway: Ingestion of Soil							
Arsenic	9.6×10^{-8}	1.75	A	IRIS	2×10^{-7}	2×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	2.0×10^{-9}	1.94	A	SF_{oral} / GI absorption	4×10^{-9}	4×10^{-9}	
					Total Hiker (Edibles) Cancer Risk		2×10^{-7}

TABLE 12

SUMMARY OF CANCER RISK ESTIMATES

McCARL SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	SF (mg/kg-day)	Weight of Evidence	SF Source	Chemical-Specific Risk	Total Pathway Risk	Total Exposure Risk
CURRENT SITE VISITOR - HIKER (YEAR ROUND)							
Exposure Pathway: Ingestion of Soil							
Arsenic	7.2×10^{-8}	1.75	A	IRIS	1×10^{-7}	1×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	8.7×10^{-9}	1.94	A	SF_{oral} / GI absorption	1×10^{-8}	2×10^{-7}	
					Total Hiker (Year Round) Cancer Risk		1×10^{-7}
CURRENT SITE VISITOR - FARMER							
Exposure Pathway: Ingestion of Soil							
Arsenic	4.3×10^{-7}	1.75	A	IRIS	8×10^{-7}	8×10^{-7}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	8.7×10^{-9}	1.94	A	SF_{oral} / GI absorption	2×10^{-8}	2×10^{-8}	
					Total Farmer Cancer Risk		8×10^{-7}

TABLE 12

SUMMARY OF CANCER RISK ESTIMATES

McCARL SUBSITE
(Continued)

Chemical	CDI (mg/kg-day)	SF (mg/kg-day)	Weight of Evidence	SF Source	Chemical-Specific Risk	Total Pathway Risk	Total Exposure Risk
FUTURE ONSITE CHILD RESIDENT							
Exposure Pathway: Ingestion of Soil							
Arsenic	4.8×10^{-6}	1.75	A	IRIS	8×10^{-6}	8×10^{-6}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	6.1×10^{-6}	1.94	A	SF_{oral} / GI absorption	1×10^{-5}	1×10^{-5}	
				Total Onsite Child Resident Cancer Risk			2×10^{-5}
FUTURE ONSITE ADULT RESIDENT							
Exposure Pathway: Ingestion of Soil							
Arsenic	2.7×10^{-6}	1.75	A	IRIS	5×10^{-6}	5×10^{-6}	
Exposure Pathway: Dermal Contact with Soil							
Arsenic	7.4×10^{-6}	1.94	A	SF_{oral} / GI absorption	1×10^{-5}	1×10^{-5}	
					Total Onsite Adult Cancer Risk		2×10^{-5}

TABLE 13
SUMMARY OF BLOOD LEAD LEVELS
FUTURE RESIDENT CHILDREN

	95% UCL Soil Concentrations (mg/kg)	Mean Blood Lead Level (ug/dL)
Baier Subsite	42397	39.3
McCarl Subsite	3192	7.6

Blood lead levels were derived utilizing the following equation:

$$Pb_{blood} = C_{soil} \times SI \times AF \times BKSF + Pb_{background}$$

Where:

C_{soil}	=	soil lead concentration
SI	=	soil ingestion rate (0.010 g/day)
AF	=	gastrointestinal absorption factor (0.20)
BKSF	=	biokinetic slope factor (0.20)
$Pb_{background}$	=	background blood lead level (5 ug/dL)

Estimates of blood lead levels using the EPA's currently available Uptake/Biokinetic (UBK) model (Version 4.0) indicated that greater blood lead levels at the McCarl subsite (a mean of 8.8 ug/dL) would result among future resident children. Blood lead levels at the Baier subsite could not be estimated because the EPA's UBK (Version 4.0) model is appropriate for estimating blood lead levels in children only when soil lead concentrations are less than 2000 mg/kg.