EPA/ROD/R05-99/517
1999

EPA Superfund
Record of Decision:

US ARMY SOLDIER SUPPORT CTR
EPA ID: IN4210090003
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FORT BENJAMIN HARRISON, IN
03/14/1999

U.S. Army Transition Activity
Former Fort Benjamin Harrison

RECORD OF DECISION
FOR
SEVENTEEN NO FURTHER ACTION SITES
IN THE FINAL PHASE II
ENVIRONMENTAL INVESTIGATION

Former Fort Benjamin Harrison
Lawrence Indiana

March 1999

U.S. Army Transition Activity
Former Fort Benjamin Harrison

RECORD OF DECISION
FOR
SEVENTEEN NO FURTHER ACTION SITES
IN THE
FINAL PHASE II
ENVIRONMENTAL INVESTIGATION

FORMER FORT BENJAMIN HARRISON
LAWRENCE, INDIANA

March 1999

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DECLARATION FOR THE RECORD OF DECISION

STATEMENT OF BASIS AND PURPOSE

With this Record of Decision (ROD), the U.S. Army designates that no further action (NFA) is required for Environmental Investigation (EI) Sites 1, 3, 4, 5, 6, SM18, SM19, SM25b, SM25c, SM25f, SM25h, SM25i, SM25j, SM27, 30, 31 and 32 at the former Fort Benjamin Harrison in the City of Lawrence, Marion County, Indiana. The determination to take no action is chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, and consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

SITE NAME AND LOCATION

Seventeen No Further Action Sites
Former Fort Benjamin Harrison
City of Lawrence, Indiana

EI Site 1	-	Auto Craft Shop, Building 705, Glenn Road, Fort Harrison State Park.
EI Site 3	-	Former Post Exchange Gasoline Station, Building 619, east of 5801 Lawton Loop East.
EI Site 4	-	Directorate of Installation Support Engineering/Maintenance, Building 26, 9110 Otis Avenue.
EI Site 5	-	Electrical Shop, Building 4, 5511 North Post Road.
EI Site 6	-	Former Coal Storage Yard, Building 2, 9015 East 56th Street.
EI Site SM18	-	Pesticide Mixing and Storage Area, Building 27, east of 9110 Otis Avenue.
EI Site SM19	-	Pesticide Mixing and Storage Area, Building 514, The Fort Golf Course.
EI Site SM25b,c	-	Historic Military Sites, WWI-era Dump, The Fort Golf Course.
El Site SM25f	-	Historic Military Site, World War II-Era Dump, north of 5759 Wheeler Road.
EI Site SM25h	-	Historic Military Site, west of Building 518, Fort Harrison State Park.
EI Site SM25i	-	Historic Military Site used around World War I (1908+), west of 5810 Lawton Loop West.
EI Site SM25j	-	Historic Military Site, WWI-Era Dump, west of 5720 Lawton Loop West.
EI Site SM27	-	Former Sewage Treatment Plant, north of Building 509, 9400 block of East 59th Street, Fort Harrison State Park.
EI Site 30	-	Beaumont Triangle Area used for open storage of coal, 56th Street and Brooks Boulevard.

EI Site 31	-	Former Salvage Yard, northwest of Building 518, Fort Harrison State Park.
EI Site 32	-	Greene Avenue POL Areas (three areas formerly associated with the storage and handling of petroleum products), intersection of 56th Street and Post Road.

DESCRIPTION OF THE SELECTED REMEDY

No further action is the selected remedy for the seventeen EI Sites (NFA Sites) discussed in this ROD. This alternative assumes that any institutional controls currently in existence will be discontinued by the Army at each NFA site. There will be no security guards or fences to exclude intruders. Warning signs are not required, and each property may be transferred for use consistent with the Fort Harrison re-use plan (Clark et al. 1997).

DECLARATION STATEMENT

The selected no further action alternative is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to hazardous substances which are the subject of this action, and is cost-effective.

I recommend the proposal for no further action.

_____ _____

Richard Blume-Weaver Date
Base Realignment and Closure Environmental Coordinator
Former Fort Benjamin Harrison, Indiana

Approved:

_____ _____

George Edwards Date
Colonel, U.S. Army
Garrison Commander
Fort Knox, Kentucky

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ACRONYMS AND ABBREVIATIONS

ARCOM	Army Reserve Command
BCT	BRAC Cleanup Team
BGS	Below Ground Surface
BRAC	Base Realignment and Closure
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chemical of Concern
DIS	Directorate of Installation Support
EI	Environmental Investigation
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
FBH	Former Fort Benjamin Harrison
HI	Hazard Index
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NFA	No Further Action
OWS	Oil/Water Separator
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
POL	Petroleum, Oils and Lubricants
PP	Proposed Plan
RAGS	Risk Assessment Guidance for Superfund
ROD	Record of Decision
SAIC	Science Applications International Corporation
STP	Sewage Treatment Plant
SVOC	Semi-Volatile Organic Compound
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
USASSC	U.S. Army Soldier Support Center
USGS	U.S. Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

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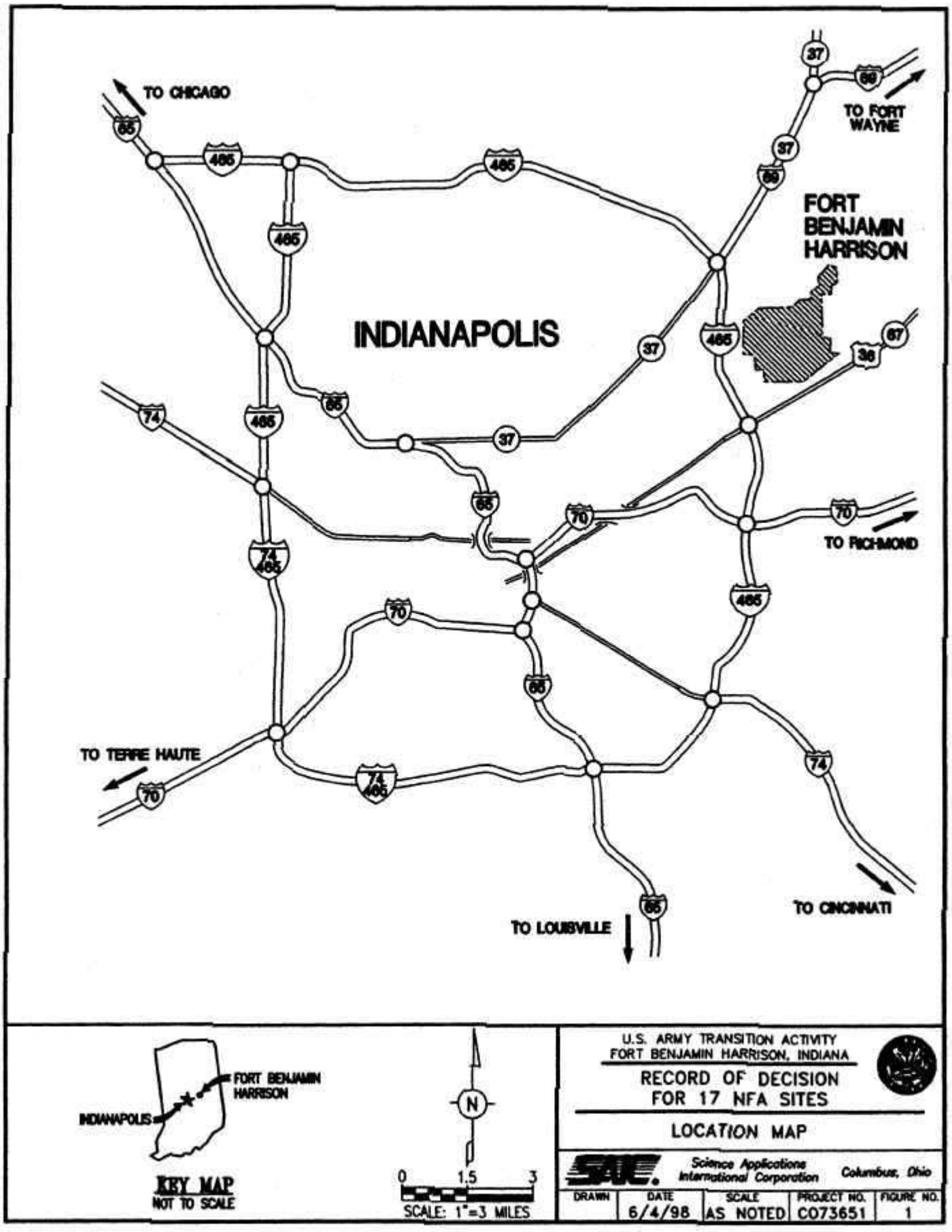
1. SITE NAMES AND LOCATIONS

The former Fort Benjamin Harrison (FBH) was a U.S. Army installation located in the City of Lawrence, Marion County, Indiana. The former installation, consisting of 2,501 acres, was approximately twelve miles northeast of downtown Indianapolis (Figure 1). FBH was bounded by residential areas and farmland, with the exception of light industrial areas to the southeast. The subject of this ROD is the decision to pursue no further action (NFA) at seventeen Environmental Investigation (EI) sites (NFA Sites) at FBH that have undergone environmental investigation and review.

The seventeen NFA Sites are listed below:

- EI Site 1 - Auto Craft Shop, Building 705, Glenn Road, Fort Harrison State Park..
- EI Site 3 - Former Post Exchange Gasoline Station, Building 619, east of 5801 Lawton Loop East.
- EI Site 4 - Directorate of Installation Support Engineering/Maintenance, Building 26, 9110 Otis Avenue.
- EI Site 5 - Electrical Shop, Building 4, 5551 North Post Road.
- EI Site 6 - Former Coal Storage Yard, Building 2, 9015 East 56th Street.
- EI Site SM18 - Pesticide Mixing and Storage Area, Building 27, east of 9110 Otis Avenue.
- EI Site SM19 - Pesticide Mixing and Storage Area, Building 514, The Fort Golf Course.
- EI Site SM25b,c - Historic Military Sites, WWI-era Dump, The Fort Golf Course.
- EI Site SM25f - Historic Military Site, World War II-Era Dump, north of 5759 Wheeler Road.
- EI Site SM25h - Historic Military Site, west of Building 518, Fort Harrison State Park.
- EI Site SM25i - Historic Military Site used around World War I (1908+), west of 5810 Lawton Loop West.
- EI Site SM25j - Historic Military Site, WWI-Era Dump, west of 5720 Lawton Loop West.
- EI Site SM27 - Former Sewage Treatment Plant, north of Building 509, 9400 block of East 59th Street, Fort Harrison State Park.
- EI Site 30 - Beaumont Triangle Area used for open storage of coal, 56th Street and Brooks Boulevard.
- EI Site 31 - Former Salvage Yard, northwest of Building 518, Fort Harrison State Park.
- EI Site 32 - Greene Avenue POL Areas (three areas formerly associated with the storage and handling of petroleum products), intersection of 56th Street and Post Road.

The locations of the seventeen NFA Sites are depicted in Figure 2. A description of each site is provided in Section 5, Site Description and Characteristics.



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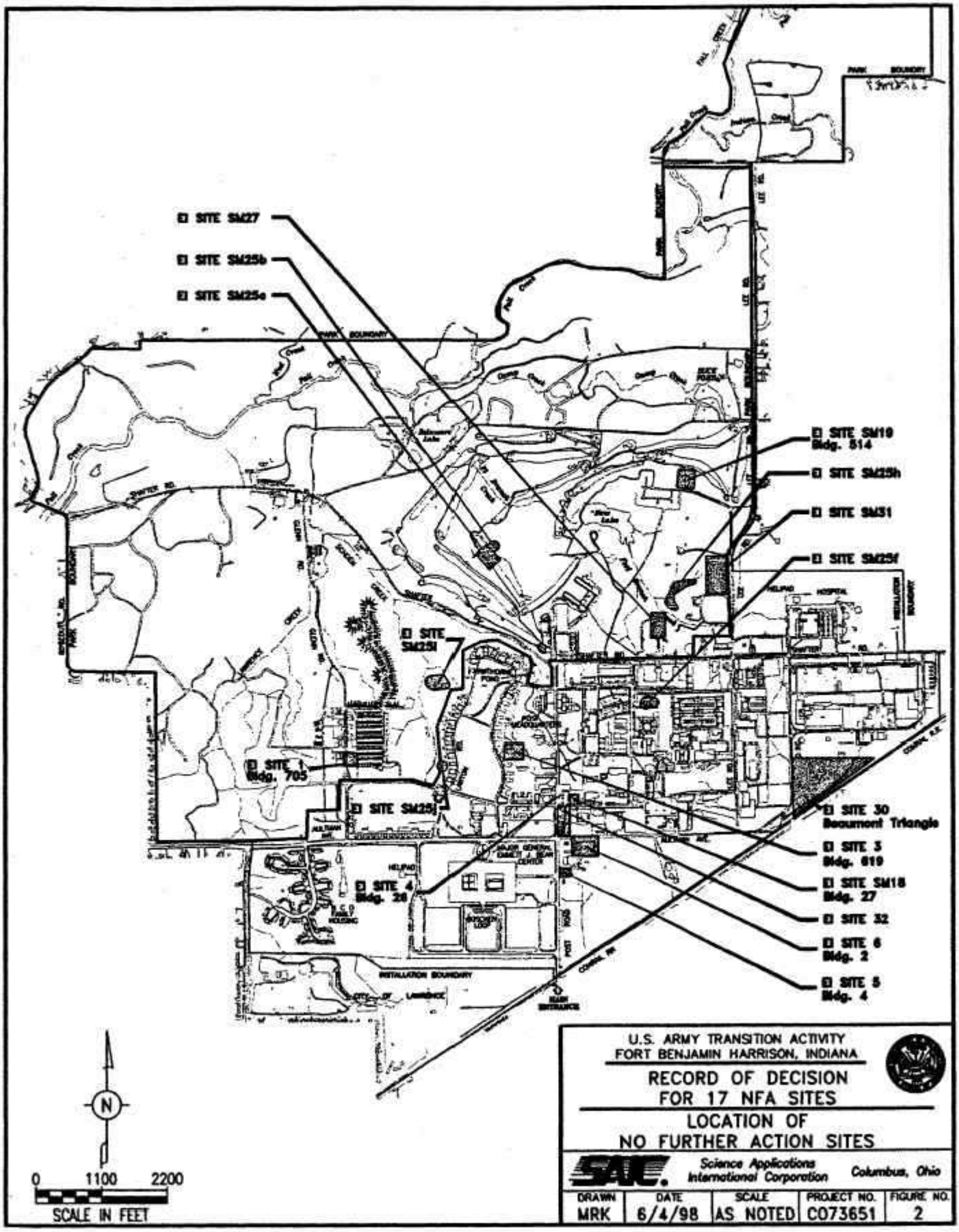
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SITE SM25e
SITE SM19 Bldg. 514
SITE SM25h
SITE SM31
SITE SM25f
SITE SM25i
SITE 1 Bldg. 705
SITE SM25j
SITE 4 Bldg. 28
SITE 30 Beaumont Triangle
SITE 3 Bldg. 619
SITE SM18 Bldg. 27
SITE 32
SITE 6 Bldg. 2
SITE 5 Bldg. 4
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RECORD OF DECISION
FOR 17 NFA SITES
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2. SITE HISTORY AND BRAC ENVIRONMENTAL PROGRAM

FBH was created by an act of the U.S. Congress on March 30, 1903. The installation originally was an infantry regiment post. Over the years it served as a training camp, induction and reception center, and was home to several Army schools, disciplinary barracks, a hospital, and a prisoner-of-war camp. In 1950, FBH became the Army Finance Center. In 1980, FBH was reorganized as the U.S. Army Soldier Support Center (USASSC) responsible for personnel service support, including finance, religion, legal aid, music, public affairs, morale, welfare, and recreation. USASSC housed five major tenant commands, including the Defense Finance and Accounting Service - Indianapolis Center, the Enlisted Records and Evaluation Center, Hawley Army Community Hospital, Readiness Group Harrison, and the 123rd ARCOM.

In 1991, FBH was placed on the U.S. Department of Defense Base Closure List. As a result of the Base Realignment and Closure (BRAC) program for FBH, environmental studies were conducted to address releases or suspected releases of hazardous substances.

An enhanced Preliminary Assessment (PA), conducted in 1991, identified areas requiring environmental evaluation and assessed their impact on the surrounding environment as well as the need for any immediate actions.

In 1994 the FBH BRAC Cleanup Team (BCT) was formed. Consisting of the FBH BRAC Environmental Coordinator, a representative of EPA Region V, and a representative of the Indiana Department of Environmental Management (IDEM), the BCT provides a means for the Army, EPA, and IDEM to cooperate in the planning and oversight of the BRAC environmental program at FBH. The BCT approved and/or concurred with the Phase II Environmental Investigation workplan, including the technical sampling plan.

The EI at FBH was conducted in two phases. Phase I, completed in 1994, investigated the soil and water at sites identified in the enhanced PA. The findings of the Phase I EI focused the activities of Phase II conducted in the fall and winter of 1996/1997.

The Phase I EI concluded that seven EI sites required no further action for planned reuse. This decision had the concurrence of the BCT and is documented in the Proposed Plan (PP) dated November 1996 (SAIC 1996). In another Proposed Plan dated December 21, 1998 (SAIC 1998b), seventeen additional EI sites are recommended for NFA based on the findings of the Final Phase II EI. These recommendations are based on the evidence collected indicating that these sites have not released hazardous waste or hazardous waste constituents that pose unacceptable risks to human health or the environment. This ROD approves the recommendation for no further action at the seventeen additional EI sites at FBH.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

In November 1994 the Restoration Advisory Board (RAB) was created. The RAB consists of the BRAC Environmental Coordinator for the former Fort Benjamin Harrison, a representative of EPA, a representative of IDEM, appointees from other Government agencies, and community stakeholders. RAB meetings provide opportunities for progress to be presented and issues to be discussed among all interested parties.

In addition, the Army holds public meetings at the former Fort Benjamin Harrison to receive public comments on recently published documents. These meetings follow public comment periods, which last no less than 30 days. Notices of public comment periods are published in the local media, and the documents are made available to the public at the local libraries. The Administrative Record is available to the public at Army Transition Activity Office, 5830 North Post Road, Lawrence, Indiana 46216-1048.

The Final Phase II EI, which included the investigations for the NFA sites, was issued in August, 1998. The PP for the seventeen sites was issued on December 21, 1998 and public comment was solicited through news media announcements and letters to local and state agencies. The comment period was 37 days and ended on January 22, 1999. A public meeting was held at FBH on January 20, 1999 to receive comments on the PP.

Responses to public comments are presented in the Responsiveness Summary, which is provided as an appendix in this document. The Responsiveness Summary combined with the EI/PP constitute the final EI/PP for the seventeen NFA sites.

4. SCOPE AND ROLE OF RESPONSE ACTION

FBH is a former Army installation. Environmental studies (PA and Phase I and II EIs) have been conducted to identify past releases or suspected releases of hazardous substances at FBH to assure suitability of the property for transfer and planned reuse. Property disposal and reuse activities were initiated following base closure in September 1995 and have continued to the present. This ROD approves the recommendation for no further action at seventeen sites investigated during the EI.

5. SITE DESCRIPTION AND CHARACTERISTICS

This Section describes each NFA site and summarizes findings of the EI concerning contamination at the sites. The Phase I EI consisted of a records review and site visits for the EI sites discussed in this plan. The records review characterized historical use and evaluated the potential for the presence of contaminants. Environmental sampling also was conducted as part of the Phase I EI for most of the sites discussed in this plan. The Phase II EI consisted of additional field sampling to further define the nature and extent of contamination at these sites. The Phase II EI also included a baseline risk assessment evaluating risk to human health and the environment, which is discussed in Section 6. The environmental sampling programs conducted at each proposed NFA site are briefly discussed below. Analytical data and risk assessment results for these sites are detailed in the Final Phase II EI Report (SAIC 1998a).

EI Site 1– Auto Craft Shop, Building 705

The self-help Auto Craft Shop, formerly in Building 705, was used by Army personnel and their dependents to work on personal vehicles. Vehicle maintenance operations conducted at the Shop included: oil changing; tire and battery storage, replacement, and service; brake repair; electrical systems repair; parts cleaning and degreasing; and engine tuneups.

Until 1982, waste oil was contained in 55-gallon drums stored inside Building 705 at a drum accumulation area. The building has a concrete floor with floor drains that lead to an

oil/water separator (OWS). Based on information provided by FBH personnel, the sanitary sewer was the ultimate discharge point for the floor drain and OWS. In 1982, a 550-gallon steel underground storage tank (UST) was installed near the northeast corner of the building to store the waste oil. The UST was removed in 1992 before the Phase I field activities began. Petroleum, oils, and lubricants (POLs) subsequently were stored in a plastic secondary containment basin located outside at the northeast corner of the building.

Phase I EI activities included a records review, field screening, subsurface soil sampling, monitoring well installation, and groundwater sampling. The Phase I soil and groundwater samples were analyzed for volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH), and total metals. Phase II EI activities consisted of additional environmental sampling which included the surface soil, subsurface soil, and groundwater. The samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs), total organic carbon (TOC), TPH, and total metals. Low concentrations of metals and polycyclic aromatic hydrocarbons (PAHs) were detected in surface and subsurface soil.

EI Site 3 – Former Post Gas Station, Building 619

According to historical records, Building 619 once served as the Post Exchange Gasoline Station. This building is located along the service road behind Building 670 on the east side of Lawton Loop. Five USTs were installed at this site in 1937, and were removed in 1992. Gasoline reportedly was contained in two 10,000-gallon tanks and fuel oil was contained in two 2,000-gallon tanks and one 1,000-gallon tank. No records exist indicating the occurrence of spills, leaks, or releases of petroleum products from this site. In addition, no records exist detailing the historic operations of this facility.

Phase I and Phase II EI activities at this site consisted of subsurface soil sampling and the installation and sampling of groundwater monitoring wells. The soil and groundwater samples were analyzed for VOCs, TPH, and metals. Phase II EI activities included resampling the monitoring wells installed during Phase I and analyzing samples for VOCs, TPH, and TOC. Low concentrations of organic compounds, including TPH, were detected in the subsurface soil.

EI Site 4 – Directorate of Installation Support Engineering/Maintenance, Building 26

The Directorate of Installation Support (DIS) Engineering/Maintenance, Building 26 is located at the intersection of Post Road and Otis Avenue. The following maintenance facilities were based in this building: carpentry shop, electrical shop, preventive maintenance shop, and heating and air conditioning shop.

Most maintenance activities were conducted at specific job sites where services were requested; however, some minor supporting maintenance functions were performed in Building 26. Sawing, sanding, painting, varnishing, and other woodworking activities were performed in the carpentry shop. In the past, areas of the shop were used to store paint thinner, asbestos, and asphalt coating. Electrical maintenance activities were primarily conducted at the job site, although past activities in the shop included transferring polychlorinated biphenyls (PCBs) to secure storage locations. According to DIS personnel, electrical transformers previously were

stored in the electrical shop in the northwest corner of the building. Work performed by the preventative maintenance shop included painting and minor repairs on plumbing fixtures.

Numerous chemicals were stored in the heating and air conditioning shop, including acids, bases, used petroleum naphtha, phosphates, biocides in solution, and other similar materials for use in maintenance operations. At one time, the DIS also operated a metal and paint shop in Building 26. Small amounts of acids, bases, paint strippers and thinners, and alcohols were stored in the shop.

Phase I EI activities included subsurface soil sampling, monitoring well installation, and groundwater sampling. Samples were analyzed for VOCs, SVOCs, TPH, and metals. Phase II EI activities included additional surface and subsurface soil sampling and resampling of the groundwater. The samples were analyzed for VOCs, SVOCs, pesticides, metals, TPH, and herbicides. Low concentrations of organic compounds, including pesticides, were detected in surface and subsurface soils.

EI Site 5 – Electrical Shop, Building 4

Maintenance operations associated with the Electrical Shop generally were conducted at the job site; however, some supporting repair work was performed in the shop, and it was used in the past to store and repair transformers containing PCB oils. A diesel-powered electrical generating station was located in an open lot south of Building 4. The generators are still present. Three 10,000-gallon USTs containing fuel to power the generators were located along the west side of the building. The tanks were installed in 1972 and removed in 1992.

Surface and subsurface soil sampling were completed in both the Phase I and Phase II EI. During Phase I, subsurface soil samples were analyzed for TPH and PCBs. Groundwater monitoring wells were installed and sampled as part of Phase II. Soil and groundwater were analyzed for VOCs, SVOCs, PCBs, metals, TPH, TOC, and cation exchange capacity (CEC) during Phase II. Organic compounds, including TPH, were detected in subsurface soil samples.

EI Site 6 – Former Coal Storage Yard, Building 2

The Former Coal Storage Yard is located just northeast of Building 2, the heating plant. From 1952 through 1988, coal-fired boilers were used in the heating plant operations. Use of coal was discontinued in 1989 on conversion of the heating plant to gas. For a number of years, several hundred tons of coal were stored in an open pile on an approximately 1-acre concrete pad. During wet weather, the coal pile at the yard reportedly produced a sludge that flowed over the concrete pad toward the west and into a concrete-lined drain that diverted it into a nearby settling/evaporation basin.

In both the Phase I and Phase II EI, soil samples were taken around the unit and surface water and sediment from the basin were analyzed for VOCs, SVOCs, metals, TOC, and TPH. Low concentrations of metals and PAHs were detected in the surface soil, subsurface soil, and sediment samples.

EI Site SM18 – Pesticide Mixing and Storage Area, Building 27

Building 27 was a former boiler room/maintenance shed located on Otis Avenue just east of Building 26 (EI Site 4). The building was a low shed, half of which was underground. The interior was divided into two main rooms and had a concrete floor. Several steam lines ran through the building. Pesticides and herbicides were stored in it during the 1970s. Following the period of pesticide storage, the building was flooded by broken steam lines. Water was pumped from the basement onto the lawn near the southeast corner of the building. In the summer of 1998, Building 27 was demolished and disposed offsite along with the surface soil at this site.

During the Phase I EI, standing water and sediment samples were collected from the basement of the building and analyzed for pesticides, herbicides, and metals. Phase II activities consisted of collocated surface and subsurface soil sampling at four borings located in low-lying parts of the lawn. Three monitoring wells also were installed. The samples were analyzed for VOCs, pesticides, herbicides, dioxins/furans, metals, and TOC. Low concentrations of organic compounds, including pesticides, were detected in surface and subsurface soil samples.

EI Site SM19 – Pesticide Mixing/Storage Area, Building 514

EI Site SM19 is a former pesticide storage area located at the southeastern edge of the Fort golf course near Lee Road. Building 514 was used until the mid- to late 1980s for the temporary storage of excess pesticides and herbicides. Pesticide application equipment also was stored in the building.

The Phase I EI consisted of collecting 12 surface soil samples and analyzing for pesticides and herbicides. Pesticides and one herbicide were detected in nine of the twelve samples at very low concentrations. These results were used to conduct a baseline risk assessment as part of the Phase II EI.

EI Sites SM25b,c – Historic Military Sites: WWI-era Dump

EI Sites SM25b and SM25c are located along the tenth hole of the former FBH golf course, approximately in the geographic center of the former installation. The two sites are suspected locations of pre-World War I dumps. Archaeological reports indicate that EI Site SM25b was in use from 1889 to 1913, and EI Site 25c was in use from 1890 to 1920.

The State of Indiana purchased the golf course from the Army in June 1995. EI Sites SM25b and SM25c were withheld from the transaction until the field sampling for the EI was complete. An expedited investigation and assessment of the sites was conducted in 1995 and 1996 to facilitate the property transfer and the reconstruction work performed on the golf course before public use.

Phase I EI activities at the site included a records review, site visit, geophysical survey, soil gas survey, and soil sampling. Samples were analyzed for SVOCs, metals, pesticides/PCBs, herbicides, and landfill parameters. Phase II EI activities included surface and subsurface soil sampling, another geophysical survey, test pit excavation at geophysical anomalies, and characterization of an ash-like material at SM25c. Low concentrations of metals and PAHs were detected in surface and subsurface soil.

EI Site SM25f – Historic Military Site: WWII-era Dump

EI Site SM25f is located just south of Gates Lord Hall, under what is now an asphalt-paved parking lot. The site was identified during a 1983 archaeological investigation as a World War II-era dump that was used in 1947. A subsequent archaeological survey performed in 1992 revealed that the former dump site probably had been destroyed and/or removed by the Army, since the area had been paved and two new barracks constructed in the immediate vicinity.

The Phase I EI at this site consisted of subsurface soil sampling. The samples were analyzed for VOCs, SVOCs, metals, and pesticides/PCBs/herbicides. Several metals were detected in concentrations that exceeded background; however, the concentrations were relatively low. Organic compounds were also detected, but the concentrations were less than 1 mg/kg. The Phase II EI at SM25f consisted of a baseline risk assessment using the Phase I sampling data.

EI Site SM25h – Historic Military Site, Building 518

EI Site SM25h lies north and west of Building 518, in Fort Harrison State Park. It was identified as a prehistoric Native American campsite and a military dump in use from 1930 to 1950. Archaeological investigations at the site have uncovered various artifacts and construction debris.

The Phase I EI consisted of a records review, site visit, and surface soil sampling. Samples were analyzed for SVOCs, metals, and chemicals commonly released by landfill. The Phase II EI activities included surface soil, subsurface soil, sediment, and surface water sampling. The samples were analyzed for SVOCs, TOC, TPH, pesticides/PCBs, herbicides, metals, CEC, and dioxins/furans. The sediment samples were collected from Fort Branch Creek and two unnamed tributaries adjacent to the site. Organic compounds, including PAHs and pesticides, were detected in surface soil samples. Low concentrations of organics, including VOCs, PAHs, pesticides, and dioxins were detected in the subsurface soil samples. Metals were detected in the downstream sediment samples.

EI Site SM25i – Historic Military Site

EI Site SM25i is located in a grassy field west of Building 654 behind Lawton Loop West. An archaeological report from 1984 stated that a scatter of debris and a concrete pad possibly related to a water treatment facility were located at this site. The potential for contamination at the site was linked to the possible remnants of the water treatment facility and the unknown source of the scattered debris.

The Phase I EI included collecting and analyzing six surface soil samples for SVOCs, metals, and chemicals commonly released by landfill. The Phase II EI consisted of the collection and analysis of surface and subsurface soil samples. These were analyzed for SVOCs. Organic compounds, including PAHs, were detected in the surface soil samples.

EI Site SM25j – Historic Military Site, WWI-era Dump

El Site SM25j is located in a grassy field behind Lawton Loop, just west of Buildings 645 and 646 on Lawton Loop West. An archaeological report from 1984 stated that a light scatter of historic debris was present behind the row of residences, and was exposed mostly in garden plots. The debris was dated to WWI (1908+) and included glass, plastic, and a brass cartridge. During a subsequent survey in 1992, no surface indications of the site were found. The potential for contamination at the site was linked to the unknown source and extent of the scattered debris.

The Phase I EI included a site reconnaissance, geophysical surveys, and surface soil sampling. Six samples were collected and analyzed for SVOCs, metals, chemicals commonly released by landfill. The Phase II EI activities included additional surface and subsurface soil samples to determine the extent of PAHs detected during Phase I. The samples were analyzed for SVOCs, TOC, and CEC. Organic compounds, including PAHs, were detected in the surface soil samples.

EI Site SM27 – Former Sewage Treatment Plant

EI Site SM27 is the location of a former sewage treatment plant (STP) identified on aerial photographs and FBH historical site maps from 1913 to 1938. The former STP was located in the wooded area just north of Building 509. Currently, a running track and athletic field cover a portion of the site. Fort Branch Creek lies just east of the site. Remnants of the former STP structures are not apparent, but a heavy scatter of concrete rubble and surface debris were found in the area that could be associated with the facility. Operational records for this facility have not been found.

The Phase I EI activities at the site included a site reconnaissance, surface geophysical survey to delineate the STP boundaries, and a subsurface geophysical survey to identify any residual site substructures. Phase II activities included surface soil, sediment, and surface water sampling. These samples were analyzed for VOCs, SVOCs, pesticides/PCBs, herbicides, metals, dioxins/furans, TPH, TOC, and CEC. PAHs were detected in the surface soil samples.

EI Site 30 – Beaumont Triangle Site

The Beaumont Triangle is located southeast of the intersection of Beaumont Road and Brooks Boulevard. The property is currently owned by the 123rd Army Reserve Command (ARCOM). The area north of the site is used for recreation and contains several ball fields. The site is an open field. Review of Army photographs indicated that this area was used in the past for the open storage of coal.

The site was not investigated during the Phase I EI. A field sampling program was conducted as part of the Phase II EI. Surface and subsurface soil, surface water, and sediment samples were collected. The samples were analyzed for SVOCs and metals. Low concentrations of metals and PAHs were detected in soil samples.

EI Site 31 – Former Salvage Yard

The former salvage yard is located along the west side of Lee Road and northeast of Building 518, the former sanitary waste incinerator. The general area has been displayed on historical maps as a wood yard, salvage yard, and scrap yard. No specific information was available regarding the use of the site or the type of materials that may have been used or stored there. During site walkovers and field investigation activities, piles of concrete blocks, brush, and miscellaneous items were found scattered around the site. Much of the site currently is covered by dense woods that appear to be 20 to 30 years old.

The site was not investigated during the Phase I EI. Due to the lack of historical information, the Phase II EI soil sampling program was designed to encompass a large area and detect a wide range of possible contaminants. Surface and subsurface soil samples were collected and six monitoring wells were installed. Soil and groundwater samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and TOC. Low concentrations of PAHs, pesticides, and metals were detected in surface and subsurface soil samples.

EI Site 32 – Greene Avenue POL Site

EI Site 32 is a combination of three areas formerly associated with the storage and handling of petroleum products: the Intersection Spill Site, the former Gas Station/Oil House (Building 6), and the area north of the former Gas Station/Oil House. All three sites are located east of the intersection of Post Road (formerly Greene Avenue) and 56th Street. The three areas were combined into one investigation site because of their proximity and the similarity of potential contaminants (i.e., POLs).

The Greene Avenue POL site was not included in the Phase I EI. Phase II included collecting 28 subsurface soil samples from fifteen soil borings, and the installation and sampling of seven groundwater monitoring wells. Organic compounds, including TPH and PAHs, were detected in the subsurface soil.

6. SUMMARY OF SITE RISKS

The sampling data collected from the proposed NFA sites were used to perform risk assessments in the Final Phase II EI Report. The risk assessments were used to determine whether the levels of contamination at the sites presented risk to human or ecological receptors that exceeded the target risk levels established by the Army Center for Health Promotion and Preventive Medicine. The risks at the sites were determined to be less than the target levels, and therefore, no further action is required at these sites.

A baseline human health risk assessment was performed for all of the sites modeled on methods and procedures outlined by the EPA in Risk Assessment Guidance for Superfund (RAGS). The characteristics of potential human receptors were tailored to the site use described in the Fort Harrison reuse plan (Clark, et al. 1997). For example, people exposed to EI Sites within the state park were evaluated under a set of assumptions for “recreational users,” while people exposed to sites that will be used industrially or commercially were evaluated under the assumptions for “industrial exposure.”

Risk to the health of humans who could come in contact with chemicals of concern (COC) at a given site was grouped into two types: carcinogenic and noncarcinogenic. Carcinogenic risk was considered unacceptable if it was greater than 10^{-4} (meaning the risk for cancer from the COCs at a site is 1 in 10,000). Noncarcinogenic risk was considered unacceptable if it was greater than 1 as measured by the Hazard Index (HI).

An ecological risk assessment (ERA) also was conducted in the Final Phase II EI Report. In consultation with EPA and IDEM, the Army identified representative ecological receptors, such as earthworms, the American robin, and the Indiana bat, and evaluated the potential effect of site contaminants on those receptors. The ecological risk assessment was accomplished in several phases. All seventeen NFA sites were evaluated in the first phase, called the Screening Risk Assessment. Three sites (EI Site SM25h, SM27, and 31) were evaluated further under more site-specific assumptions in a Baseline ecological risk assessment. The assumptions and methods of the screening and baseline ERA are detailed in the Final Phase II EI Report.

Risk to ecological receptors is measured by a quantity called the HI, which is similar to the HI used to assess noncarcinogenic human health risk. The Army's target risk level for ecological receptors is HI equal to 1, as recommended by EPA. This threshold value has been changed since the Final Phase II EI, where the threshold was an HI of 10 for surface soil exposure. This change is discussed in the Attachment to the Responsiveness Summary.

A site-by-site summary of human health and ecological risks is provided below. For human health risk, each receptor modeled in the risk assessment is listed along with the estimated cancer risk and HI. For ecological risk, a summary description of the results is provided. Additional details on the ecological risk can be found in Section 6 and Appendix P of the Final Phase II EI Report and in the Attachment to the Responsiveness Summary of this ROD.

> *Note*: The human health risk assessment evaluated risks under both current and future land use scenarios. When determining suitability of property for disposal and reuse, risk estimates for the future receptors are the primary consideration. Therefore, risks under future land uses are presented in the following site-specific summaries. These risk estimates correspond to the reasonable maximum exposure for each receptor evaluated. Where risks were calculated separately for surface and subsurface soil (e.g., future construction workers), the higher risk estimate is presented. The ecological risk values presented were computed in Round 2 of the baseline ERA. These results reflect the most realistic exposure assumptions.

EI Site 1 - The Auto Craft Shop, Building 705

At EI Site 1, future land use is industrial. Risks were estimated for future industrial workers and future construction workers. Industrial workers were assumed to be exposed to surface soil only. Construction workers were assumed to be exposed to surface and subsurface soil. The risk estimates were as follows:

- Industrial Worker: Carcinogenic Risk = 3×10^{-5} (3 in 100,000) HI = 0.2
- Construction Worker: Carcinogenic Risk = 6×10^{-7} (6 in 10,000,000) HI = 0.02

For both industrial and construction workers, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

EI Site 1 is dominated by buildings and pavement. No habitat exists to support ecological receptors; therefore, an ecological risk assessment was not conducted for this site.

Based on the results of the Phase II EI and the human health risk assessment, no further action is recommended for EI Site 1.

EI Site 3 - Former Post Exchange Gasoline Station, Building 619

At EI Site 3, future land use is residential. Risks were estimated for future adult and child residents based on exposure to groundwater only. Soil had not been sampled because the potential source of contamination was limited to the subsurface soil associated with USTs. The risk estimates were as follows:

- Adult Resident: Carcinogenic Risk = 1×10^{-6} (1 in 1,000,000) HI = 0.01
- Child Resident Carcinogenic Risk = 7×10^{-7} (7 in 10,000,000) HI = 0.03

For both adult and child residents, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}). No ecological risk assessment was performed. Based on the results of the Phase II EI and the human health risk assessment, no further action is recommended for EI Site 3.

EI Site 4 - Directorate of Installation Support Engineering/Maintenance, Building 26

At EI Site 4, future land use is industrial/commercial. Risks were estimated for future industrial workers and future construction workers. Industrial workers were assumed to be exposed to surface soil only. Construction workers were assumed to be exposed to surface and subsurface soil. The risk estimates were as follows:

- Industrial Worker: Carcinogenic Risk = 3×10^{-7} (3 in 10,000,000) HI = 0.01
- Construction Worker: Carcinogenic Risk = 2×10^{-8} (2 in 100,000,000) HI = 0.004

For both industrial and construction workers, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

EI Site 4 is dominated by buildings and pavement. No habitat exists to support ecological receptors; therefore, an ecological risk assessment was not conducted for this site.

Based on the results of the Phase II EI and the human health risk assessment, no further action is recommended for EI Site 4.

EI Site 5 - Electrical Shop, Building 4

At EI Site 5, future land use is industrial/commercial. Risks were estimated for future industrial workers and future construction workers. Industrial workers were assumed to be

exposed to surface soil only. Construction workers were assumed to be exposed to surface and subsurface soil. The risk estimates were as follows:

- Industrial Worker: Carcinogenic Risk = 5×10^{-6} (5 in 1,000,000) HI = 0.00006
- Construction Worker: Carcinogenic Risk = 3×10^{-7} (3 in 10,000,000) HI = 0.00002

For both industrial and construction workers, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

A screening ERA was performed for soil only. There was no unacceptable ecological risk to earthworms, cottontails, shrews, and robins. The HI was less than 1 for every receptor.

Based on the results of the Phase II EI and the human health and ecological risk assessments, no further action is recommended for EI Site 5.

EI Site 6 - Former Coal Storage Yard, Building 2

At EI Site 6, future land use is industrial/commercial. Risks were estimated for future industrial workers and future construction workers. Industrial workers were assumed to be exposed to surface soil only. Construction workers were assumed to be exposed to surface and subsurface soil. The risk estimates were as follows:

- Industrial Worker: Carcinogenic Risk = 6×10^{-5} (6 in 100,000) HI = 0.09
- Construction Worker: Carcinogenic Risk = 3×10^{-6} (3 in 1,000,000) HI = 0.04

For both industrial and construction workers, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

EI Site 6 was one of four sites reevaluated under the assumptions of the baseline ERA, as described in the Responsiveness Summary of this ROD. Under these assumptions, the HI value predicted potential risk to the shrew and American robin (HI=5.13 and 1.92, respectively). However, detailed analysis of the concentrations and distribution of the COCs leading to this risk reveal that actual risk to ecological receptors at EI Site 6 is unlikely. The full discussion on this point can be found at page A-61 in the attachment to the Responsiveness Summary.

Based on the results of the Phase II EI and the human health and ecological risk assessments, no further action is recommended for EI Site 6.

EI Site SM18 - Pesticide Mixing and Storage Area, Building 27

At EI Site SM18, future land use is industrial/commercial. Risks were estimated for future industrial workers and future construction workers. Industrial workers were assumed to be exposed to surface soil only. Construction workers were assumed to be exposed to surface and subsurface soil. The risk estimates were as follows:

- Industrial Worker: Carcinogenic Risk = 2×10^{-6} (2 in 1,000,000) HI = 0.002
- Construction Worker: Carcinogenic Risk = 1×10^{-7} (1 in 10,000,000) HI = 0.0005

For both industrial and construction workers, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

A screening ERA was performed for EI Site SM18 which indicated an unacceptable risk to ecological receptors from pesticides in the surface soil. There is no surface water or sediment at the site. HIs were 1.6 (earthworms), 37.1 (shrews), and 361 (robins). However, in the summer of 1998, the risk-causing contaminated soil was removed and disposed along with Building 27.

Based on the results of the Phase II EI, the human health risk assessment, and the subsequent removal of surface soils, no further action is recommended for EI Site SM18.

EI Site SM19 - Pesticide Mixing and Storage Area, Building 514.

At EI Site SM19, future land use is recreational. Under this scenario, risks were estimated for future adult and child incidental recreational visitors and future construction workers. All receptors were assumed to be exposed to surface soil only. The risk estimates were as follows:

- Adult Recreational Visitor: Carcinogenic Risk = 4×10^{-8} (4 in 100,000,000) HI = 0.001
- Child Recreational Visitor: Carcinogenic Risk = 2×10^{-8} (2 in 100,000,000) HI = 0.004
- Construction Worker: Carcinogenic Risk = 4×10^{-9} (4 in 1,000,000,000) HI = 0.0008

For both recreational visitors and construction workers, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

EI Site SM19 was one of the four sites reevaluated under the assumptions of the baseline ERA as described in the Responsiveness Summary of this ROD. Under these assumptions, the HIs for all receptors fall below the target threshold of 1. The results of this analysis can be found at page A-61 in the attachment to the Responsiveness Summary.

Based on the results of the Phase II EI and the human health and ecological risk assessments, no further action is recommended for EI Site SM19.

EI Site SM25b,c - Historic Military Sites: WWI-era Dump

At EI Sites SM25b and SM25c, human health risk does not exceed the target levels (HI of 1 and cancer risk of 1×10^{-4}). Ecological risk is below the target levels. These findings are presented in Final Phase II Environmental Investigation Report for EI Sites SM25b and 25c (SAIC 1995). Based on the results of the Phase II EI and the human health and ecological risk assessments, no further action is recommended for EI Sites SM25b and SM25c.

EI Site SM25f - Historic Military Site World War II-Era Dump

At EI Site SM25f, future land use is residential. Risks were estimated for future adult residents and construction workers. The site lies under a parking lot; therefore, surface soil was

not sampled. Risk estimates for future residents and construction workers are based on exposure to subsurface soil only. The risk estimates were as follows:

- Adult Resident: Carcinogenic Risk = 4×10^{-5} (4 in 100,000) HI = 0.001
- Child Resident: Carcinogenic Risk = 1×10^{-5} (1 in 100,000) HI = 0.003
- Construction Worker: Carcinogenic Risk = 1×10^{-6} (1 in 1,000,000) HI = 0.0003

For both residents and construction workers, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

EI Site SM25f is dominated by buildings and pavement. No habitat exists to support ecological receptors; therefore, an ERA was not conducted for this site.

Based on the human health risk assessment, no further action is recommended for EI Site SM25f.

EI Site SM25h - Historic Military Site, Building 518

At EI Site SM25h, future land use is recreational. Risks were estimated for future adult and child incidental recreational visitors. Recreational visitors were assumed to be exposed to surface soil, sediment, and surface water. The risk estimates were as follows:

- Adult Recreational Visitor: Carcinogenic Risk = 7×10^{-6} (7 in 1,000,000) HI = 0.004
- Child Recreational Visitor: Carcinogenic Risk = 3×10^{-6} (3 in 1,000,000) HI = 0.007

For recreational visitors, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

A baseline ERA was performed for EI Site SM25h which indicated the potential for unacceptable risk to ecological receptors from metals in the surface soil. HIs were 1.7 (earthworms), 3.6 (shrews), and 72.7 (robins). Mercury, lead, and zinc contributed HQs greater than 1 for one or more receptors [mercury (1.2 for earthworms), lead (3.3 for shrews and 67.3 for robins), and zinc (4.5 for robins). Lead elevated the ecological risk above the threshold limits. However, the maximum concentration of lead in surface soil (115 mg/kg) is lower than the BCT-approved cleanup goal of 440 mg/kg developed for the soils at the firing ranges, also located in the state park.

The maximum concentration of zinc in surface soil (111 mg/kg) is lower than the clean-up goal of 234 mg/kg developed for the soils at the firing ranges. Note that the development of the PRGs relies on more rigorous methods and higher quality data than used to compare risk. Therefore, a PRG is a more reliable and defensible number.

The maximum concentration of mercury at SM25h is 0.21 mg/kg (Table O.1-52) compared to a maximum background concentration of 0.11 (Table N-186). The low HQ of 1.2 and low HI of 1.7 indicate a low potential for harm. Remediation of soil is not indicated when it would alter or destroy the existing habitat to remove the very low amount of mercury.

Sediment and surface water in the creek located near EI Site SM25h also were evaluated in the baseline ERA. The risk exceeds the HQ and HI thresholds of 1. However, sediment and surface water occupy only a few square yards of surface area. Removal of the slightly contaminated sediment would require major habitat alteration and damage to nearby creek banks. It would also mean removing additional terrestrial vegetation during development of an access road. The low HQs/HIs of the sediment and surface water, very small affected area, and habitat alteration are sufficient evidence to conclude that remediation is not warranted.

Based on the results of the Phase II EI, the human health and ecological risk assessments, no further action is recommended for EI Site SM25h.

EI Site SM25i - Historic Military Site used around World War I (1908+)

At EI Site 25i, future land use is recreational. Risks were estimated for future adult and child incidental recreational visitors. Recreational visitors were assumed to be exposed to surface soil only. The risk estimates were as follows:

- Adult Recreational Visitor: Carcinogenic Risk = 2×10^{-6} (2 in 1,000,000) HI = 0.00003
- Child Recreational Visitor: Carcinogenic Risk = 1×10^{-6} (1 in 1,000,000) HI = 0.00007

For recreational visitors, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

EI Site SM25i was one of the four sites reevaluated under the assumptions of the baseline ERA as described in the Responsiveness Summary of this ROD. Under these assumptions, the HI for all receptors falls below the threshold of l. The results of this analysis can be found in the Attachment to the Responsiveness Summary.

Based on the results of the Phase II EI and the human health and ecological risk assessments, no further action is recommended for EI Sites SM25i.

EI Site SM25j - Historic Military Site, WWI-Era Dump

At EI Site SM25j, future land use is recreational. Risks were estimated for future adult and child incidental recreational visitors. Recreational visitors were assumed to be exposed to surface soil only. The risk estimates were as follows:

- Adult Recreational Visitor: Carcinogenic Risk = 2×10^{-5} (2 in 100,000) HI = 0.0002
- Child Recreational Visitor: Carcinogenic Risk = 8×10^{-6} (8 in 1,000,000) HI = 0.0006

For recreational visitors, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

Lead, vanadium, zinc, aluminum, and 4,4'-DDT contributed to ecological risk in excess of the threshold, according to the screening ERA for soil. However, lead and zinc concentrations were below the BDT-approved cleanup goals developed for the ranges at FBH. Here for example, the clean-up goals were 440 and 234 mg/kg for lead and zinc, respectively. Here, the maximum concentrations were 97 mg/kg for lead and 103 mg/kg for zinc. Aluminum and

vanadium concentrations fall within the range of detected background concentrations. For example, the observed range of site concentration for aluminum was 8,640 mg/kg to 12,500 mg/kg compared to the range of background concentrations of 6,210 mg/kg to 12,800 mg/kg. For vanadium, the site range was 20.9 mg/kg to 32.4 mg/kg and the background range was 16 mg/kg to 34 mg/kg. This means that there is likely no additional risk to ecological receptors from aluminum and vanadium from activities associated with SM25j.

The pesticide 4,4'-DDT also contributes to ecological risk to small birds. However, this and other pesticides are found in many soils at the former Fort Benjamin Harrison, elsewhere in the state of Indiana, and many other places. Concentrations are in the "normal" range where human activity has affected the natural background.

Based on the results of the Phase I and Phase II EI and the human health and ecological risk assessments, no further action is recommended for EI Site SM25j.

EI Site SM27 - Former Sewage Treatment Plant, North of Building 509

At EI Site SM27, future land use is recreational. Risks were estimated for future adult and child incidental recreational visitors. Recreational visitors were assumed to be exposed to surface soil, sediment, and surface water. The risk estimates were as follows:

- Adult Recreational Visitor: Carcinogenic Risk = 2×10^{-4} (2 in 10,000) HI = 0.004
- Child Recreational Visitor: Carcinogenic Risk = 6×10^{-5} (6 in 100,000) HI = 0.008

At EI Site SM27, human health risk assessment indicated noncarcinogenic risk below the target level (HI = 1). For the future recreational adult, the carcinogenic risk is $2x10^{-4}$, which exceeds the EPA target of 1×10^{-4}.

However, the Army maintains that no-further-action is an appropriate response at EI Site SM27. The cancer risk only slightly exceeds the threshold and is being driven by dermal absorption of PAHs in the soil. First, PAHs were detected at elevated concentrations at only two of the five sampling locations, indicating these constituents are not widespread. Second, the two samples showing the highest concentrations of PAHs were located closest to the asphalt running track. Asphalt is a well-known source of PAHs and the running track is situated such that runoff from the track flows downhill, over Site SM27, before flowing into the creek that drains the area. Finally, PAHs were not detected in similar concentrations at the other former sewage treatment plant investigated (EI Site SM26). Concentrations of PAHs at SM26 were consistently 10-50 times less than at SM27. The adjacent asphalt running track is the likely source of the PAHs at EI Site SM27, not activities associated with the operation of the former sludge treatment plant.

The following ecological COCs contribute to risk: cadmium, lead, and 4,4'-DDT. Lead is the dominant COC to small birds according to the baseline ERA Round 2. Review of analytical data indicates that the maximum lead concentration of 208 mg/kg in soil is less than the BCT-approved cleanup level of 440 mg/kg at the firing ranges. The cleanup goal's derivation methods are more rigorous and the data are higher quality than those used in ecological risk computations. The pesticide 4,4'-DDT also contributes to ecological risk to small birds.

However, this and other pesticides are found in many soils at the former Fort Benjamin Harrison, elsewhere in the state of Indiana, and many other places. Concentrations are in the "normal" range where human activity has affected the natural background.

Based on the analyses presented above, no further action is recommended for EI Site SM27.

EI Site 30 - Beaumont Triangle Area

At EI Site 30, future land use is commercial. Risks were estimated for future industrial workers and future construction workers. Industrial workers were assumed to be exposed to surface soil only. Construction workers were assumed to be exposed to surface and subsurface soil. The risk estimates were as follows:

- Industrial Worker: Carcinogenic Risk = 2×10^{-4} (2 in 10,000) HI = 0.003
- Construction Worker: Carcinogenic Risk = 9×10^{-6} (9 in 1,000,000) HI = 0.0007

At EI Site 30, the human health risk assessment indicated noncarcinogemc risk below EPA target risk (HI=1). For the industrial worker, the carcinogenic risk is $2x10^{-4}$, which is above the EPA target of 1×10^{-4}. This is attributed to dermal contact with PAHs in surface soil.

According to the screening ERA, there is ecological risk in excess of HQs of 1. Since the issuance of the August 1998 EI, the recommendation of no further action for EI Site 30 has been revisited. A baseline ERA consisting of Rounds 1 and 2 has been completed for this site. After the Round 2 analysis, the findings were that a few HQs and HIs still exceeded one. Further evaluation about this is found in Section 6 of the ROD and the attachment to this Responsiveness Summary.

EI Site 30 is presently part of the Benjamin Harrison Army Reserve Center, and maintained as an open space. Possible future use is commercial. The site was historically used for coal storage. The human health risk drivers are PAHs in surface soil. PAHs at FBH are attributable to the basewide use of coal.

EI Site 30 was one of the four sites reevaluated under the assumptions of the baseline ERA, as described in the Responsiveness Summary of this ROD. Under these assumptions, the HI value predicted potential risk to the shrew and the eastern cottontail (HI=3.20 and 1.44, respectively). However, the principal COC at this site (antimony) was detected only at one location and at a concentration just above the detection limit.

PAHs also caused the slight elevation of ecological risk above the target level. However, because of the widespread use and storage of coal at FBH, and because the site is zoned for commercial reuse, no further action is recommended for EI Site 30.

EI Site 31- Former Salvage Yard, near Building 518

At EI Site 31, future land use is recreational. Risks were estimated for future adult and child incidental recreational visitors. Recreational visitors were assumed to be exposed to surface soil only. The risk estimates were as follows:

- Adult Recreational Visitor: Carcinogenic Risk = 8×10^{-6} (8 in 1,000,000) HI = 0.009
- Child Recreational Visitor: Carcinogenic Risk = 4×10^{-6} (4 in 1,000,000) HI = 0.04

For recreational visitors, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

Arsenic, lead, and zinc contributed to ecological risk to small mammals at SM31. Of these, lead is the dominant COC. All HQs and HIs are in the 1 to 7 range based one the baseline Round 2 analysis. This was the only location where the lead concentration exceeded the PRG of 440 mg/kg. The analyzed data do not suggest widespread contamination at this unit, and given the small difference between the maximum concentration (458 mg/kg) and the cleanup goal (440 mg/kg), actual risk from lead exposure is unlikely. Further, EI Site 31 is a heavily forested site. Given the very small, incremental risk from contamination, the Army concludes that the harm done to the forest ecosystem by performing remediation would far outweigh any slight benefits.

Based on the results of the Phase II EI and the human health and ecological risk assessments, no further action is recommended for EI Site 31.

EI Site 32 - Greene Avenue POL Areas

At EI Site 32, future land use is industrial/commercial. Surface soil was not sampled because most of the area is paved and the potential source of contamination is limited to subsurface soil associated with the USTs. Exposure to subsurface soil is the only likely exposure pathway; therefore, only a construction worker receptor was evaluated. The risk estimates were as follows:

- Construction Worker: Carcinogenic Risk = 9×10^{-6} (9 in 1,000,000) HI = 0.0008

For construction workers, human health risk is below the target levels (HI of 1 and cancer risk of 1×10^{-4}).

EI Site 32 is dominated by pavement, gravel, a building, and a small area with grass cover. No habitat exists to support ecological receptors; therefore, an ERA was not conducted for this site.

Based on the human health risk assessment, no further action is recommended for EI Site 32.

7. DESCRIPTION OF THE "NO FURTHER ACTION" ALTERNATIVE

No further action is the selected remedy for the seventeen EI Sites (NFA Sites) discussed in this ROD. This alternative assumes that any institutional controls currently in existence will be discontinued at each NFA site. There will be no security guards or fences to exclude intruders. Warning signs are not required, and each property may be transferred for use consistent with the Fort Harrison re-use plan (Clark, et al. 1997).

8. EXPLANATION OF SIGNIFICANT CHANGES

The conclusions expressed in the Final Phase II EI and the Proposed Plan have not changed. The Army received comments on these reports, and the Responsiveness Summary documents the Army's final resolution of those comments. The only significant change incorporated since the publication of the Final Phase II EI and Proposed Plan was the revision of the target risk threshold for unacceptable risk to ecological receptors to contaminants in surface soil. That threshold had previously been an HI of 10; however, the Army has since reevaluated all sites with an HI greater than 1. The reason for this change is documented in the Attachment to the Responsiveness Summary. As discussed in this attachment, this change has not required the Army to modify any conclusions with respect to the NFA sites.

9. REFERENCES

Clark, Quinn, Moses & Clark 1997. Fort Benjamin Harrison Preliminary Plan, Planned Unit Development. January 30.

EPA (U.S. Environmental Protection Agency) 1993. Wildlife Exposure Handbook. 2 Vol.

EPA 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final.

HLA (Harding Lawson Associate) 1995. Revised Final Phase I Environmental Investigation Report, Fort Benjamin Harrison, Marion County, Indiana, September 1995.

SAIC (Science Applications International Corporation) 1995. Final Phase II Environmental Investigation Report, Fort Benjamin Harrison Sites SM25b and SM25c, Marion County, Indiana.

SAIC 1996. Proposed Plan for No Further Action Sites at Fort Benjamin Harrison, Marion County, Indiana. November 1996.

SAIC 1998a. Final Phase II Environmental Investigation Report, Fort Benjamin Harrison, Marion County, Indiana. August, 1998.

SAIC 1998b. Proposed Plan for No Further Action Sites, Former Fort Benjamin Harrison, Marion County, Indiana.

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APPENDIX

RESPONSIVENESS SUMMARY
FOR THE
FINAL PHASE II ENVIRONMENTAL INVESTIGATION
AND THE PROPOSED PLAN FOR THE SEVENTEEN NO FURTHER ACTION SITES

FORMER FORT BENJAMIN HARRISON
LAWRENCE, INDIANA

1. INTRODUCTION

This responsiveness summary has been prepared by the Army to document final resolution of comments received on the *Final Phase II Environmental Investigation* (SAIC 1998a) and *Proposed Plan for NFA Sites* (SAIC 1998b). All comments received on the Final Phase II EI are addressed in this responsiveness summary. The following sets of comments were received on the above-referenced documents:

- Comments from the IDEM on the Final Phase II EI, dated October 21, 1998.
- Comments from EPA on the Final Phase II EI, dated October 30, 1998.
- Comments from IDEM on the Proposed Plan for NFA sites, dated January 20, 1999.
- Comments from Mr. Gerald W. O'Callaghan on the Proposed Plan for NFA sites, dated January 21, 1999.

Due to schedule and program constraints, the Army will not be revising either the Final Phase II EI Report or the Proposed Plan. Consequently, comments related solely to the subject documents' organization or appearance have been noted but not accommodated. Comments related to approach, methodology, and conclusions have been responded to. In some cases, these responses required recomputation of risk assessment, and as a result, this responsiveness summary includes original work performed by the Army to address these comments. The original work included herein must be considered in order to fully evaluate the content and conclusions of the Final Phase II EI and the Proposed Plan for Seventeen NFA sites.

To facilitate understanding of the Army's responses, the comments are reproduced in their entirety in this responsiveness summary. The Army's responses are listed immediately following the comment and in the order they were delivered in the original transmittal.

2. COMMENTS FROM THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT ON THE FINAL PHASE II EI, DATED OCTOBER 21, 1998.

General Comments

Comment No. 1:

Both standard and incidental recreational scenarios are evaluated under both current and future land use at several environmental investigation (EI) sites. The exposure frequencies for the standard recreator are 2 days per week for 6 months for reasonable maximum exposure (RME) and 1 day per week for 6 months for central tendency exposure (CTE), and the exposure frequencies for the incidental recreator are half of those for the standard recreator. Higher exposure frequencies may be expected for RME because residents living near or adjacent to the park may use it regularly (for example, for walks or jogging). Also, all the EI sites evaluated as part of the recreational scenario lie within one parcel designated as a state park. Therefore, it is not clear why recreational visits are considered to be only incidental for some EI sites, particularly when the text also indicates that fences are considered ineffective barriers to exposure. Section 5.0 should be revised to justify the low exposure frequencies for the standard recreational scenario and for evaluation of an incidental recreator rather than a standard recreational visitor to the state park at some EI sites

Also, several EI sites that appear to be part of the state park area are omitted from evaluation under the current or future land use scenario, including SM25b, SM25c, SM25j, and Site 31. Section 5.0 should be revised to (1) include evaluation of these omitted EI sites or (2) justify the omission of these EI sites.

Response:

(a) Under future land use, the RME exposure frequency for the standard (i.e., not incidental) recreational receptor is 4 days per week for 6 months (i.e., 104 days). This RME exposure frequency is reasonable for a standard recreational frequency. An incidental recreational scenario was evaluated at some of the EI sites located within the state park because of their location in buffer areas rather than active recreational areas (as per state park management) (See Table 5-22 of Final Phase II EI Report; August 1998).

(b) An incidental recreational receptor was evaluated at EI Sites SM25j (future land use) and 31 (current and future land uses). Sites SM25b and SM25c were investigated by the Army in 1995 under a separate EI program. The detailed results of this investigation are presented in the Final EI for EI Sites SM25b and SM25c (SAIC 1995) and are summarized in the Final Phase II EI Report (SAIC 1998a). No total hazard index exceeded 1 for any receptor at EI Sites SM25b and SM25c. No chemical-specific risk exceeded 1×10^{-4}. Complete results of this investigation are presented in Final Phase II EI Report for FBH Sites SM25b and SM25c, Marion County, Indiana, 1995.

Comment No. 2:

Section 5.0 indicates that contaminants of concern (COC) are defined as chemicals that contribute to an exposure pathway that exceeds a 1×10^{-4} cancer risk. However, the EPA target

risk range is 1 x 10^{-6} to 1 x 10^{-4}. Therefore, COCs should include any chemicals that contribute to a pathway that exceeds or results in a risk within the target risk range. The text should be revised to define COCs as chemicals that contribute to exposure pathway-specific cancer risks equal to or greater than 1 x 10^{-6} or to noncarcinogenic hazards equal to or greater than 1.

Response:

As the comment states, the NCP defines the target cancer risk range as 1 x 10^{-6} to 1 x 10^{-4}. However, the selection of which value within the range to use as the target is a management decision.

Use of 1 x 10^{-4} as the target cancer risk is common. It is cited in EPA Region IV guidance and has been adopted by other EPA regions. If 1 x 10^{-4} is used as the target for an exposure pathway, then the chemical contributors identified as COCs have individual cancer risks within the target cancer risk range.

If 1 x 10^{-6} is used as the target for an exposure pathway, then the chemical contributors identified as COCs have individual cancer risks below 1 x 10^{-6}. Cleanup for chemicals with cancer risks less than 1 x 10^{-6} is generally not warranted.

Comment No. 3:

Inhalation exposure scenarios are evaluated for fugitive particulate emissions and volatilization of contaminants in groundwater. Exposure point concentrations (EPC) of contaminants in air were apparently calculated using actual concentrations of contaminants in soil and groundwater. However, the methodologies used to calculate these EPCs are not identified or discussed in the text. The methodologies used to calculate the air EPCs should be described in Section 5.0 so that the appropriateness of the air EPCs can be evaluated.

Response:

Appendix O includes a discussion of the methods and the equations for evaluating fugitive dust from soil and vapor emissions from groundwater.

Comment No. 4:

Section 6.3.3 discusses selection of the exposure units and receptor species and states that the red-tailed hawk (Buteo jamaicensis) *was selected as one of the ecological receptors for the ecological risk assessment. However, the American kestrel* (Falco sparverius) *has been observed at Fort Benjamin Harrison and is an appropriate alternative to the red-tailed hawk as an ecological receptor. The American kestrel has a lower body weight and higher food intake rate than the red-tailed hawk; therefore, the American kestrel is a more sensitive ecological receptor. Section 6.3.3 should be revised to consider the American kestrel as an alternative to the red-tailed hawk as a receptor for the ecological risk assessment.*

Response:

The red-tailed hawk was the receptor agreed to by both the EPA (Ms. Brenda Jones) and IDEM (Mr. Jim Smith) when the initial plans for the ERA were discussed and settled as documented in correspondence to EPA dated July 18, 1997. Receptors and other ecological topics were discussed at a site meeting August 1, 1997, followed up by correspondence dated mid-August 1997 that summarized both EPA and IDEM decisions. The red-tailed hawk is a legitimate receptor for the trophic position of top avian predator and also occurs at Fort Benjamin Harrison. This raptor's biology and feeding habits are documented in EPA's *Wildlife Exposure Handbook* (1993).

Comment No. 5:

Section 6.4.1.1 discusses exposure pathways for terrestrial classes and receptors, including the earthworm, eastern cottontail rabbit, white-tailed deer, Canada goose, short-tailed shrew, American robin, Indiana bat, red fox, and red-tailed hawk. However, the potential exposure pathways for receptors such as the white-tailed deer, Canada goose, and red fox appear to be incomplete. Specifically, the potential exposure to surface water is not quantitatively or qualitatively evaluated for these receptors. The white-tailed deer, Canada goose, and red fox may be exposed to contaminants in surface water through direct ingestion. Therefore, Section 6.4.1.1 and other relevant portions of the ecological risk assessment should be revised to address the potential exposure pathway of surface water ingestion for the white-tailed deer, Canada goose, and red fox.

Response:

The raccoon represents all animal receptors for surface water exposure. Due to the raccoon's high water intake, small body size, and aquatic feeding habits it is assumed that this receptor was at a higher risk of exposure than any other animals represented. Therefore, if the raccoon showed no risk for surface water contaminant exposure, then logically no other receptor should possess risk. Since many of the El sites that are likely to be visited by receptors, such as deer and goose, do not possess nearby surface water resources, no surface water measurements were available or needed. Reliance was placed on the raccoon at those EI sites where surface water measurements were available.

Comment No. 6:

The discussion of ecological risk results in Section 6.6.1 contains numerous discrepancies with Appendix P. For example, Section 6.6.1.6 states an SM18 soil hazard index (HI) for the American robin of 361; however, Table P-29 in Appendix P lists the SM18 soil HI for the American robin as 343. In addition, Section 6.6.1.8 states an SM20 soil HI for the American robin of 484; however, Table P-38 in Appendix P lists the SM20 soil HI for the American robin as 501. The discussion of individual site ecological risks in Section 6.6.1 and the corresponding tables in Appendix P should be thoroughly reviewed and revised to eliminate such discrepancies.

Response:

The discrepancies in this section have been noted. These inconsistencies have been investigated, and are found to have no effect on the conclusions of the ERA. Note that EI Site SM18 has been remediated and EI Site SM20 will be further analyzed in the focused feasibility study.

Comment No. 7:

Section 7.0 states that the improved decision rule for soil, which has been refined based on U.S. Army Center for Health Promotion and Preventive Medicine guidance, consists of an HI greater than 10. Therefore, based on this decision rule, HIs below 10 are acceptable. However, an HI greater than 1 indicates the potential for ecological risk. Because EPA guidance does not state that HIs between 1 and 10 are acceptable, the methodology and assumptions used to change the decision rule for soil from HIs exceeding 1 to HIs exceeding 10 should be thoroughly documented, and the documentation should be submitted to IDEM for approval prior to finalizing revisions to the conclusions and recommendations provided in Section 7.0.

In addition, Round 1 of the ecological risk assessment uses the 95th percentile upper confidence limit (UCL_{95}) of the data as the EPC; however, Round 2 uses an EPC based on the arithmetic mean of the data. This approach is contrary to EPA guidance which states that "the 95 percent UCL of the arithmetic mean concentration is used as the average concentration because it is not possible to know the true mean" (EPA 1992c). Consistent with this guidance, the UCL_{95} should be used as the concentration term for both Round 1 and Round 2; however, other exposure parameters may vary between rounds if adequately justified. Therefore, the ecological risk assessment should be revised to recalculate Round 2 results based on the use of the UCL_{95} as the concentration term. Further, the conclusions and recommendations in Section 7.0 should be revised to be based primarily on the Round 1 results. The results from Round 2 of the ecological risk assessment (as recalculated) may be used for comparative purposes or to provide context for the risk manager. However, the Round 2 results should not replace Round 1 results for the purposes of drawing primary conclusions and recommendations for the ecological risk assessment.

Response:

The Army has reevaluated its position on the decision rule for risk to ecological receptors. The recommendations of the Final Phase II EI were based on the risk threshold of HI greater than 10. However, since the publication of the Final Phase II EI, the Army has performed additional analysis on those sites at which the HI falls between 1 and 10. There were four such sites: EI Site 6, SM18, SM25i, and 30. The results of this analysis are included as an attachment to this responsiveness summary.

The Army maintains, however, that a resultant HI between 1 and 10 does not directly trigger remediation. Interpreting such a result requires site-specific evaluation and risk-management decisions. This interpretation of HIs is consistent with the Tri-Service Procedural Guidelines For Ecological Risk Assessment (Wentsel et al., 1996). In this guidance, Menzie, et al. 1996, advanced a ranking of HQs as follows:

HQ = 1 to 10 some small potential for adverse effects
HQ = 10 to 100 significant potential for adverse effects
HQ > 100 expected adverse effects.

Additionally, it should be noted that in the baseline ERA all hazard quotients were summed to present cumulative HIs, regardless of the mechanism of toxicity or mode of action. This assumption is inherently more conservative than HIs specific to a mode of action.

Regarding the exposure and effects assumptions in the baseline ERA, verbal guidance from Ms. Brenda Jones at EPA was given that an arithmetic mean would be appropriate in the Baseline Round 2. Baseline Round 1 did use the 95% percentile as did the screening ERA. Unless a variety of exposure parameters (arithmetic mean, $UCL_{95\%}$) are used, the usefulness of the screen and baseline is diminished.

Comment No. 8:

Appendix P contains the supporting hazard quotient (HQ) and HI calculation tables for the ecological risk assessment. Overall, the HQ and HI calculation tables appear to be complete and accurate; however, a few calculations are incomplete. For example, Table P-100 shows an undefined "na" in the HQ cell for 2,3,7,8-tetrachlorodibenzofuran, and the HI calculation for cyanide in Table P-120 appears to be incomplete. The HQ and HI calculation tables in Appendix P should be thoroughly reviewed and revised to ensure that all calculations are complete.

Response:

In investigating Table number P-100, no undefined HQs and His were noted as mentioned in the comment. The HQ and HI calculation for cyanide equals 0 because the BAF value is shown to be 0. Other spot checks in appendix P did not reveal any incomplete calculations.

Comment No. 9:

Appendix P also contains the summary statistics and EPC determination tables for the EI sites included in the ecological risk assessment. These tables indicate that the EI site soil data were screened against residential, health-based screening levels, including EPA Region 9 preliminary remediation goals (PRG) (EPA 1998b) and IDEM Voluntary Remediation Program (VRP) Tier II cleanup goals. As specified in the February 24, 1998, letter from IDEM to the Office of the Base Realignment and Closure (BRAC) Environmental Coordinator (IDEM 1998), these residential, health-based screening levels are inappropriate for use in the ecological risk assessment because they are human health-based and do not consider ecological risks. Therefore, the ecological risk assessment should be revised to use neither PRGs nor VRP Tier II cleanup goals for screening of data used in the assessment.

Response:

Even though the residential and health based screening levels are presented in Appendix P tables, the values for the ERA analysis were retracted before the screen, resulting in neither PRG nor VRP Tier II cleanup goals being used in the ERA.

Specific Comments

Comment No. 1:

Section 5.1.1, Page 5-4, Paragraph 2. *The text states that Phase I and II groundwater data for the same monitoring well were averaged for several EI sites. The two data sets may not be comparable because of seasonal variation in the local groundwater table. The comparability of the two data sets should be evaluated, and justification for averaging the data should be provided.*

Response:

Phase I and II data were comparable in terms of data quality. The coverage of seasonal variations in the groundwater characteristics is desirable if the data are to be used in evaluating long-term exposure to the groundwater. The purpose of the noted averaging was to avoid any spatial bias that would occur if all of the data were simply treated as a single data group. This would not be an issue if an equal number of samples were drawn from each monitoring well. If, however, more samples were drawn from one well relative to another, then averaging at that location before grouping with the other wells would minimize spatial bias. The data for a given location were averaged, and then statistically evaluated with the data from other locations.

Comment No. 2:

Section 5.1.2.3, Page 5-7, Paragraph 1. *The text states that IDEM VRP Tier II cleanup goals were used for a screening test. The February 24, 1998, IDEM letter states that IDEM cleanup goals should not be used to screen out chemicals in site-specific risk assessments (IDEM 1998). Therefore, the screening test discussion should be removed from Section 5.0.*

Response

The method agreed to by both IDEM and EPA for health-based screening in the selection of COPCs was to use the lesser of the IDEM and EPA Region IX PRGs as the screening criterion for a given constituent. Note that if the Tier II cleanup goal was lower than the Region IX PRG, it was used in the screen. Use of the IDEM Tier II cleanup goal is more conservative (i.e., screens out less analytes) than using the Region IX PRGs. Therefore, making such a change would not alter the recommendations or conclusions of the report.

Comment No. 3:

Section 5.1.2.3, Page 5-8, Paragraph 2. *This paragraph describes the evaluation of the additive health effects of multiple chemicals screened out of the HHRA using EPA Region 9 "risk-based concentrations (RBC)" (EPA 1998b). The text indicates that if the RBC exceedances at an EI site were slight and the planned future land use did not include residential use, no chemicals were added to the chemicals of potential concern (COPC) list for that site. This approach may underestimate risk. All chemicals that contribute to cancer risks equal to or greater than* 1×10^{-6} *or to noncarcinogenic hazards equal to or greater than 1 should be included in the risk assessment. Also, it is unclear whether any chemicals were included in the HHRA as a result of*

this evaluation. Any chemicals included as COPCs based specifically on comparisons to EPA Region 9 PRGs ["RBC"] should be clearly identified in the text or associated tables.

Response:

The method used to evaluate the additive effects of multiple chemicals does not underestimate risk. As noted in the text, all screening values used are based on the more conservative residential scenario. Use of residential PRGs where the planned future land use is not residential is a conservative approach and is very unlikely to underestimate risk.

Comment No. 4:

Section 5.2.1, Page 5-10, Bullet 3. *This bullet indicates that 130 acres of the installation will be retained by the Army. However, Page ES-2 of the executive summary indicates that a 144-acre parcel of the installation will be retained by the Army. This discrepancy should be reconciled.*

Response:

The comment is noted. The correct area of the parcel being retained by the Army is 144 acres.

Comment No. 5:

Section 5.2.1.2, Page 5-13, Bullet 18. *This bullet indicates that EI Site 30 will be evaluated as part of a commercial/industrial scenario. However, no future land use for this EI site is provided in Figure 5-2. Figure 5-2 should be revised to indicate a proposed future land use for EI Site 30 that corresponds to the exposure scenario evaluated in the HHRA.*

Response:

The comment is noted. The planned future land use for EI Site 30 is commercial/industrial (Clark, et al. 1997).

Comment No. 6:

Section 5.2.1.2, Page 5-14, Paragraph 4. *The text identifies several EI sites for which a construction scenario will be evaluated under a future land use scenario. The text also states that incidental construction will be evaluated for several EI sites. However, no explanation of the appropriateness of an incidental construction scenario is provided. Furthermore, it seems feasible that construction may take place at all EI sites in the future. Therefore, exclusion of any EI site from evaluation under the construction scenario should be justified in the text.*

Response:

An incidental construction scenario was evaluated at some of the EI sites located within the state park because these sites are located in the peripheral buffer rather than in active recreational areas (as per state park management) and no construction is planned in these areas. Incidental construction activities include trail installation and posthole digging. The exposure scenarios were based on the planned future land use for the former Fort Benjamin Harrison.

Comment No. 7:

Section 5.2.1.2, Page 5-15, Paragraph 2. *This portion of the text describes each receptor evaluated as part of the HHRA. However, the discussion is qualitative, and the exposure scenario is not defined in the discussion. At a minimum, the text should be revised to cite the exposure parameter tables and the equations in Appendix O.*

Response:

The format followed in Section 5.2, the exposure assessment, is similar to that in RAGS, Part A, where the receptors are introduced before the exposure pathways, parameters, or equations. Section 5.2.1 introduces the land uses and receptors that are evaluated for each land-use scenario. The exposure pathways evaluated in the HHRA (which bring together the receptor, medium to which the receptor is exposed, and the route by which the receptor is exposed) are discussed in Section 5.2.2 and shown in graphic and tabular format in Figure 5-2 and Table 5-22, respectively. The exposure parameters introduced in Section 5.2.4 are supported by Tables 5-23 and 5-24.

Comment No. 8.

Section 5.2.2.3, Page 5-18, Paragraph 2. *This paragraph indicates that sediment exposures in the drainage trench and settling/evaporation basin at EI Site 6 were not evaluated. Justification for exclusion of these potential exposures should be provided in the text.*

Response:

Human health exposure to sediment in the settling basin was considered highly unlikely, so no pathway was indicated in the risk assessment. As stated in Section 4.5.4 EI Site 6 Summary and in Table 7-1, Conclusions and Recommendations of the Final Phase II EI Report, removal of water and sediment from the settling basin has been recommended for EI Site 6 at the time of redevelopment.

Comment No. 9:

Section 5.3, Page 5-21, Paragraph 1. *The text indicates that EPA's 1995 Health Effects Assessment Summary Tables (HEAST) document was consulted to obtain toxicity information. The HEAST were updated by EPA in 1997 (EPA 1997). The most recent version of the HEAST should be consulted and cited in the text.*

Response:

The comment is noted. During the preparation of the Phase II EI report, the most recent version of the HEAST tables was used at the time the risk calculations were conducted.

Comment No. 10:

Section 5.3. *Some general toxicity information is presented for several COCs in this section. However, chemical-specific toxicity profiles for each COC are not provided in the text. Such profiles should be included.*

Response:

The comment is noted. Parties interested in obtaining chemical-specific toxicity profiles for the COCs can locate them at through EPA's Integrated Risk Information System (IRIS) at www.epa.gov/ngispgm3/iris/subst-fl.htm.

Comment No. 11:

Section 5.4.4.1, Pages 5-30 and 5-32. *The text indicates that for EI Sites 3 and 32, no surface soil samples were collected because of possible contamination in subsurface soil. Because subsurface soil contamination should not preclude collection of surface soil samples, further justification should be provided for the exclusion of these sites from the surface soil sampling efforts and subsequently from the HHRA.*

Response:

EI Sites 3 and 32 are underground storage tank sites. Therefore, contamination would be expected at depth rather than at the surface if the tanks leaked. The field investigation at these two sites was conducted in accordance with the Final Phase II EI Technical Sampling Plan (TSP) agreed to by both IDEM and EPA.

Comment No. 12:

Section 5.5.4, Page 5-42. *This section discusses uncertainty in the exposure assessment. The following issues are not included in this discussion and should be addressed in the text:*

- *Uncertainty associated with chemicals not included in the HHRA based on background or RBC screening, lack of toxicity data, and so on;*
- *Uncertainty associated with exposure parameter values;*
- *Uncertainty associated with modeled EPCs.*

Response:

The text discusses uncertainties associated with the COPC selection process (Section 5.5.3) including discussion on the background comparison and RBC screen. Uncertainties associated with the exposure parameters are discussed in Section 5.5.5.

Comment No. 13:

Section 5.5.5, Page 5-42. *This section discusses uncertainty in the toxicity assessment. A discussion focusing on the potential synergisms and antagonisms between chemicals and the lack of data regarding these potential health effect issues should be added to the text.*

Response:

The comment is noted. Except for the segregation of noncancer effects according to target organ, the effects of multiple chemicals is considered additive, which is a conservative approach. Because this conservative approach was taken, no additional discussion is required.

Comment No. 14:

Table 5-22, Page 5-71. *Exposure of residential receptors to groundwater is not evaluated for EI Site SM25f. Section 5.2.1.2 indicates that the groundwater exposure pathway will be evaluated for future residents. This section also states that the residential scenario will be evaluated for EI Sites 3 and SM25f. However, the residential groundwater exposure scenario is evaluated only for EI Site 3. The text should be revised to evaluate this exposure scenario for EI Site SM25f, or justification for the exclusion of this evaluation should be provided.*

Response:

The Phase II EI was conducted in accordance with the Final Technical Sampling Plan (TSP) for Phase II EI. This plan was reviewed and agreed to by IDEM and EPA. As per the Phase II EI TSP, no groundwater monitoring wells were installed at EI Site SM25f. Residential exposure assumptions were used to evaluate risk from soil exposure.

Comment No. 15:

Figure 5-3, Page 5-135. *This figure presents the conceptual site model (CSM) for the site. The CSM indicates that soil contamination may result from spills, discharges, and deposition. The figure should also indicate that surface water or sediment contamination may result from spills, discharges, and deposition. Also, the CSM indicates that contaminant leaching results in groundwater contamination. Soil should also be identified as an environmental medium potentially affected by contaminant leaching.*

Response:

The comment is noted.

Comment No. 16:

Appendix O, Tables O.1-1 and O.1-2. *Footnotes are presented at the end of each of these tables. However, the footnotes are not cited in the text of the tables. The footnotes should be cited in the text of the tables.*

Response:

The comment is noted.

Comment No. 17:

Appendix O, Section O.1. *For the dermal contact with soil exposure pathway, the text indicates that the dermal absorption factor (ABS) for chlordane (0.04) should be used as a surrogate for alpha-chlordane and gamma-chlordane. However, the default ABS value for organics (0.1) was used in calculating the alpha-chlordane and gamma-chlordane-specific absorbed doses from dermal exposure to soil for EI Sites SM19 and SM20 for maintenance workers and recreational visitors. The alpha-chlordane and gamma-chlordane absorbed doses for the dermal contact with soil exposure pathway should be recalculated using an ABS of 0.04, and absorbed dose calculations for other chemicals should be reviewed to eliminate similar errors.*

Response:

The reviewer is correct. However, by using 0.1 as the dermal absorption factor, as was done in this risk assessment, a more conservative risk was calculated than if a dermal absorption factor of 0.04 was used. Furthermore, neither alpha-chlordane nor gamma-chlordane were identified as COCs in the risk assessment. Therefore, using the lower absorption factor will not alter the COCs identified in the risk assessment nor the conclusions or recommendations of the report.

SECTION 6.0

Comment No. 18:

Section 6.3.4, Page 6-15, Paragraph 3. *This paragraph states that assessment endpoints are societal values expressed as ratios and that if they exceed 1.0 or unity, they require further examination. This paragraph also states that these ratios compare exposure concentrations and effect concentrations. This discussion actually applies to the HQ, which is a tool for risk characterization, not an assessment endpoint. As is also stated in this paragraph, an assessment endpoint is defined by EPA (1998a) as an explicit expression of the environmental value to be protected that is operationally defined by an ecological entity and its attributes. For example, an assessment endpoint may be the survival of soil invertebrates. This paragraph should be revised to remove the discussion describing assessment endpoints as HQs.*

Response:

The comment is noted. The text is written to present the computation and results of assessment endpoints and HQs.

Comment No. 19:

Section 6.3.5, Page 6-17, Paragraph 2. *This paragraph defines ecological chemicals of potential concern (ecoCOPC) as substances detected at concentrations above background at each EI site that have the potential to pose a hazard to animals. However, the methodology and*

the results of screening chemicals detected at each EI site against background concentrations are not discussed. Section. 6.3.5 should be revised to discuss the screening methodology used for data included in the ecological risk assessment. Also, the results of the screening should be included in Appendix P.

Response:

The comment is noted. As implied in the comment, site chemical concentrations were screened against background chemical concentrations. The approach was the same as that used in the human health risk assessment (Section 5.1.2.2 Background Comparison). Also, the results are the same for both ecological and human health risk assessments.

Comment No. 20:

Section 6.4.2, Page 6-24, Paragraph 2. *This paragraph provides the equations used for groups of terrestrial receptors exposed to contaminants in soil. The equation for RME shrew tissue concentration is given as follows:*

RME shrew tissue = shrew exposure x shrew body weight/shrew IR_F

where:

RME shrew tissue = Concentration in shrew tissue (mg/kg)

shrew exposure = Shrew exposure to contaminant (mg/kgBW/day)

shrew body weight = Body weight (kg)

IR_F = *Total daily ingestion (kg/kgBW/day)*

This equation is not valid for determining the contaminant concentration in shrew tissue. Specifically, this equation does not work given the units of the parameters and does not account for how much contaminant the shrew bioaccumulates. Tetra Tech discussed this problem with Dr. Barney Cornaby, of SAIC, who prepared the Phase II Environmental Investigation Report for the Army. Dr. Cornaby acknowledged the problem and suggested that the equation be revised to replace the shrew body weight with a bioaccumulation factor (BAF) for vertebrates (Tetra Tech 1998). However, this BAF is already included as a parameter in the red-tailed hawk and red fox exposure equations. Therefore, the red-tailed hawk, and red fox exposure equations should be revised to remove this BAF. Section 6.4.2 should be revised to provide the correct red-tailed hawk and red fox exposure equations and the correct RME shrew tissue concentration equation. In addition, all HQ calculations involving shrew tissue concentration in Appendix P should be revised to include the correct RME shrew tissue concentration.

Response:

The HQ and HI values presented are correct and values do not change even though the calculation formulas are changed to better represent the sequence of the bioaccumulation of contaminants from food and their concentrations in shrew body tissue.

Comment No. 21:

Section 6.4.2, Page 6-27, Paragraph 2. *This paragraph states that the default soil-to-plant uptake (SP) and BAF for ecoCOPCs without published values are 1.0 for metals and 1.0 for organics based on "the range of values reported for these two types of contaminants." However, no discussion of this range of values is provided in the ecological risk assessment. Therefore, the validity of the values cannot be assessed. An alternative to use of a standard default SP or BAF value for organics would be dividing the organic ecoCOPCs into categories, such as pesticides, volatile organic compounds, and semivolatile organic compounds, and then using surrogate values based on published SP and BAF values for ecoCOPCs of similar structure. Section 6.4.2 should be revised to discuss the range of values reported for inorganic and organic ecoCOPCs and to provide additional justification for use of 1.0 as a default SP and BAF value, especially for organics. In addition, Section 6.4.2 should be revised to consider using surrogate SP and BAF values based on structural similarity for those ecoCOPCs without published SP and BAF values.*

Response:
The defaults of 1.0 are conservative numbers. Only a few chemicals have soil-to-plant and bioaccumulation factors greater than 1; and they (e.g., DDT, Hg) are rather well documented. Most documented chemicals show SPs and BAFs of rather low numbers (e.g., 0.01 and lower). Publicly available information substantiates this position. The data sources were communicated to IDEM and EPA in the written and verbal correspondence of 1997 cited in response to IDEM General comments numbers 4 and 7. No other data about SPs and BAFs were provided by IDEM in lieu of Army sources when this input was requested in 1997. Therefore, the computations were performed in good faith using the best available values of SPs and BAFs.

Comment No. 22:

Section 6.6.1, Page 6-32, Paragraph 2. *This paragraph states that "another dimension of the magnitudes of the hazard quotient (HQ) and the hazard index (HI) is the quantity and quality of the site." It is unclear what "quantity and quality of the site" means. If this phrase refers to habitat at the site, the statement appears to be incorrect. HQs and HIs are based on ecoCOPC concentrations, uptake factors, and toxicity values. Therefore, the quantity and quality of habitat are not a "dimension of the magnitudes" of HQs and HIs. Quantity and quality of habitat may be considered in determining whether an ecological risk assessment is required for a site or in interpreting the meaning of calculated HQs and HIs. However, quantity and quality of habitat does not impact the absolute magnitude of the HQs and HIs. Section 6.6.1 should be revised to clarify the discussion of the magnitude of HQs and HIs.*

Response:

Quality and quantity of habitat implies two differing aspects of evaluation in relation to the risk findings of the ERA. Habitat quality contributes to an animal's use of an area due to the site compatibility with the animal's habitat preferences. These preferences are not represented in the evaluation in relation to the absolute magnitude of the HQ or HI. Quantity refers to the size of the EI site in comparison to a receptor's home range. Quantity of the habitat is reflected in HI

and HQ numbers through the application of an Area Use Factor (AUF) which represents this comparison in numerical form. This proportional number means that increasing EI site size also increases the probability of the receptor spending more time within the site boundary. This results in increased exposure to the contaminants of the area. The reviewer appears to be correct; the text is not clear. However, clarifying these points would not alter the conclusions of the report.

Comment No. 23:

Section 6.7.2, Page 6-55, Paragraph 1, Bullet 1. *This bullet states that EI Site 3 did not need an ecological risk assessment because of the absence of ecological habitat there. However, Section 6.6.1.2 states that no ecological risk assessment was performed for this site because only groundwater samples were collected at the site. The bullet and Section 6.6.1.2 should be revised to clearly state the status of EI Site 3 with regard to the need for an ecological risk assessment.*

Response:

Based on the results and recommendations of the Phase I EI, and in accordance with the Final Phase II EI Technical Sampling Plan, only groundwater samples were collected at EI Site 3 in Phase II. No groundwater contamination was identified; therefore, no ecological risk assessment was performed for EI Site 3.

Comment No. 24:

Section 6.7.2, Page 6-55, Paragraph 1, Bullet 4. *This bullet states that "eight sites have low risk with HQs and HIs only slightly above 1 and mostly for pesticides." However, at least three of these eight sites have soil HIs over 100; specifically, the SM18 soil HI for the American robin is 361 (driven by lead), the SM20 soil HI for the American robin is 501 (driven by 4-4'-DDT), and the SM25j soil HIs for the shrew and the American robin are 657 (driven by aluminum) and 204 (driven by lead), respectively. This bullet should be revised to correctly represent the ecological risks at the EI sites.*

Response:

The comment is noted. Further computations and/or decisions have been completed on these eight sites. For example, EI Site SM18 has been remediated, and EI Sites SM20 and SM21 will be further analyzed in a focused feasibility study. EI Site SM25j is judged not to require remediation, as discussed in Section 6 of the ROD. Additionally, baseline ERA rounds 1 and 2 were performed on EI Sites 6, SM19, SM25i and 30. EI Sites SM19 and SM25i showed no HQs and no HI greater than 1 in baseline ERA Round 2. EI Sites 6 and 30 exhibited HQs and HIs in the 1 to 5 range, but were judged not to warrant remediation. (See the Attachment to this Responsiveness Summary for a full evaluation of EI Sites 6, SM19, SM25, and 30.)

Comment No. 25:

Table 6-20, Page 6-127. *This table presents the derivation of toxicity reference values for aquatic biota exposed to surface water. "Tier II chronic" is listed as one of the benchmark categories; however, no explanation of what "Tier II chronic" means is provided in the table.*

Table 6-20 should be revised to clearly define the Tier II chronic benchmark category and to cite the source of the associated values.

Response:

The comment is noted. Primary references used in Table 6-20 are compiled in Suter and Tsao (1996).

Comment No. 26:

Table 6-21, Page 6-141. *This table provides a summary of ecoCOPCs with HQs greater than 1.0. However, it is unclear what data were used to derive these HQs. Based on the discussion in Section 6.6.1, Table 6-21 appears to present the background ecoCOPCs with HQs greater than 1.0. Table 6-21 should be revised to clearly state what data were used to derive the HQs for the ecoCOPCs presented.*

Response:

Table 6-21 is a synopsis of HQ calculations presented in Appendix P.

Comment No. 27:

Figure 6-1, Page 6-159. *This figure presents the CSM for ecological receptors. However, the footnotes for the ecological receptors refer only to mid-level and top predators. Therefore, it appears that low-level receptors were not evaluated for such pathways as soil ingestion. The CSM in Figure 6-1 should be revised to accurately reflect all receptors and potential exposure pathways evaluated.*

Response:

The closed circles in the diagram are meant to include all prey species, including mid-level predators and ingested substances, such as soil, up the food chain to that point.

Comment No. 28:

Figure 6-2, Page 6-160. *This figure presents the terrestrial and aquatic food web. However, the terrestrial food web does not include possible ingestion of surface water by receptors such as the white-tailed deer, Canada goose, and red fox. Figure 6-2 should be revised to accurately present the complete terrestrial and aquatic food web.*

Response:

The raccoon was the receptor chosen to represent all organisms in relation to surface water exposure. Due to the animal's high water intake, small body size, and aquatic feeding habits it is assumed that this receptor is at a higher risk of exposure than any other animals represented. Therefore, if the raccoon showed no significant risk for surface water contaminant exposure, then logically no other receptor should posses risk. The food web presented is to represent pathways of exposure most pertinent to the applicable receptors. The implication from the food

web that no other receptors have exposure to potential surface water contamination was not intended.

SECTION 7.0

Comment No. 29:

Section 7.0. *The HHRA conclusions provided in Section 7.0 are based only on exposures exceeding a 1 x 10^{-4} cancer risk. These conclusions are therefore incomplete and inappropriate. The HHRA conclusions should provide information regarding cancer risks equal to or greater than 1 x 10^{-6} and noncarcinogenic hazards equal to or greater than 1 for all exposure scenarios so that risk managers can make site-specific decisions. Any conclusions presented in the report should consider all cancer risks within EPA's target risk range as well as all noncarcinogenic hazards equal to or exceeding 1. Also, Section 7.0 should be revised as necessary in response to the specific comments on Sections 5.0 and 6.0 and Appendices O and P.*

Response:

The comment is noted. Please see response to General Comment No. 2.

Comment No. 30.

Section 7.5, Page 7-7, Paragraph 1. *This paragraph states that ecological risks to shrews from soils are acceptable based on the improved decision rule discussed in Section 7.0 because the HQs and HIs fall between 1 and 10. However, as discussed in General Comment No. 7, the documentation associated with the revised decision rule has not been submitted to IDEM for review. Therefore, until such time as IDEM approves the Army's decision rule, all HQs above 1 should be interpreted as indicating potential ecological concern. As stated in Section 6.6.1.5, EI Site 6 had a soil HI of 11.4 for the shrew. Section 7.5 should be revised to discuss this as a potentially unacceptable ecological risk because 11.4 > 1 (it should also be noted that 11.4 does not fall between 1 and 10). In addition, this paragraph states that sediments in the settling basin pose an unacceptable risk to ecological receptors at EI Site 6. However, no recommendation is provided as to how to address this unacceptable risk. Section 7.5 should be revised to provide recommendations for addressing the unacceptable ecological risk posed by the sediments in the settling basin.*

Response:

The comment is noted. As explained in the response to General Comment 6, the Army has reevaluated its position on the decision rule of an HI of 10 or greater to represent significant risk to ecological receptors. However, the Army maintains that a resultant HI between 1 and 10 does not directly trigger remediation. For EI Site 6, a baseline ERA (Rounds 1 and 2) was performed for soil and indicated that HQs and HIs were in the 1 to 5 range. As explained in the ROD, remediation was not deemed necessary at EI Site 6. Sediment in the settling basin poses risk to biota within the basin itself, not to the environment. Water and sediment from the settling basin at EI Site 6 will be removed and disposed of by the property developer.

Comment No. 31:

Section 7.14, Page 7-21, Paragraph 3. *This paragraph states that no further action is recommended for EI Site SM25h because the maximum concentration of lead in surface soil is lower than the cleanup goal (440 milligrams per kilogram [mg/kg]) developed for the soils at the rifle range. This cleanup goal is referenced to a 1997 SAIC document cited in the text. Because the recommendation for no further action is based on the cleanup goal developed for the soils at the firing range, the assumptions used to derive this cleanup goal should be included in the ecological risk assessment.*

Response:

Clean up goals for lead and other COCs at the firing ranges were developed using exposure and effects equations for a variety of ecological receptors (e.g. vegetation, small mammals, small birds, and raptors) and are presented in the report on *Preliminary Remediation Goals for EI Sites SM22, SM23, and SM24* (SAIC, January 1997). The ecological cleanup goal was 440 mg/kg for lead and the human health cleanup goal was 500 mg/kg.

Comment No. 32:

Section 7.16, Page 7-23, Paragraph 2, Bullet 2. *This bullet states that the observed ranges of aluminum and vanadium concentrations at EI Site SM25j were within their respective background concentration ranges; no further action is recommended regarding these COCs. However, Section 6.3.5 states that ecoCOPCs and COCs are chemicals whose concentrations exceed background concentrations. Furthermore, Section 6.3.5 suggests that the concentration data were screened against background concentrations. It is unclear how the aluminum and vanadium concentrations at EI Site SM25j can be considered to be background concentrations if the data were already screened against background concentrations. The apparent discrepancy between the uses of background concentrations in Section 7.16 and Section 6.3.5 should be resolved.*

Response:

At EI Site SM25j, the maximum observed concentration in surface soil for aluminum (12,500 mg/kg) and vanadium (32 mg/kg) is similar to the maximum observed concentrations in the background soil samples; 12,800 mg/kg for aluminum and 34 mg/kg for vanadium. However, the concentration distribution for these two compounds across the site was above the background. Also, the ANOVA statistical method screens the data based on central tendencies. Therefore, these compounds were included in the site COPC list and evaluated in the risk assessment. Because the site maximum concentrations of aluminum and vanadium are similar to the background concentrations, no further action was recommended for EI Site SM25j.

Comment No. 33:

Section 7.19, Page 7-28, Paragraph 1. *This paragraph states that the lead concentration in soils at EI Site SM27 does not exceed the firing range cleanup goal of 440 mg/kg. This paragraph further states that ecological risk is predicted at the site, but that the ecological*

resources present do not need protection. It is unclear why the ecological resources do not need protection if ecological risk is predicted. This paragraph should be revised to clarify this matter.

Response:

The highest observed concentration of lead (208 mg/kg) is less than the cleanup level developed for the rifle ranges (440 mg/kg) and approved by BCT. The technical approach in determining the PRG, or cleanup goal, is more rigorous and the quality of the data is higher for the development of cleanup level than for risk predictions in the ERA. Thus, the PRG is more reliable and defensible than a risk prediction using conservative assumptions. The implication of this is that the ecological resources at the site are not at risk with concentrations less than 440 mg/kg of lead. Thus, they require no protection.

Comment No. 34:

Section 7.20, Page 7-30, Paragraph 2. *This paragraph states that the polynuclear aromatic hydrocarbons (PAH) in surface soil at EI Site 30 contribute to the human health and ecological risk. However, Section 6.6.1.19 states that the PAHs contributing to ecological risk at EI Site 30 were found in sediment, not soil. This discrepancy between Section 7.20 and Section 6.6.1.19 should be resolved.*

In addition, this paragraph states that the PAH concentrations detected at EI Site 30 are below the IDEM VRP Tier II cleanup goals for nonresidential land use. However, IDEM's VRP Tier II cleanup goals do not consider ecological risk. Therefore, use of the Tier II cleanup goals does not provide a basis for a no further action recommendation with regard to ecological risk. This paragraph should be revised to point out that IDEM's VRP Tier II cleanup goals do not consider ecological risk.

Response:

The comment is noted. The analyzed PAH risks resulted from sediment evaluation, not surface soil. Please see text in Section 7 on page 7-29 where the presence of PAHs is clearly associated with the sediment. It is noted that the IDEM VRP Tier II cleanup goals are related to human health and not ecological risk.

Comment No. 35:

Section 7.21, Page 7-32, Paragraph 1. *This paragraph states that no further action is recommended for EI Site 31. However, lead concentrations in soil at this site exceed the firing range soil cleanup goal of 440 mg/kg, and the HQs and HIs for lead at this site are unacceptable (above 10). Therefore, the recommendation of no further action for EI Site 31 appears to be incorrect. Section 7.21 should be revised to recommend an appropriate action for addressing the lead contamination in soil at EI Site 31.*

Response:

The comment is noted. The maximum concentration of lead at EI Site 31 was 456 mg/kg at one sampling point. This was the only location where the lead concentration exceeded the PRG of

440 mg/kg. The analyzed data do not suggest widespread contamination at this unit, and given the small difference between the maximum concentration and the cleanup goal, actual risk from lead exposure is unlikely. Further, EI Site 31 is a heavily forested site. Given the very small, incremental risk from contamination, the Army concludes that the harm done to the forest ecosystem by performing remediation would far outweigh any slight benefits.

3. COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY ON THE FINAL PHASE II EI, DATED OCTOBER 30, 1998.

ADEQUACY OF RESPONSE TO COMMENTS
ADEQUACY OF RESPONSE TO COMMENTS FROM U.S. ENVIRONMENTAL PROTECTION AGENCY, DATED FEBRUARY 20, 1998

Data Quality Assurance and Quality Control Comments

General Comment 1:

This comment requests a clarification of the "B" qualifier which has been used in the inorganic data summary tables, yet is not defined in the U.S. EPA CLP National Functional Guidelines for Organic and Inorganic Data Review (Functional Guidelines). The Army's response defined the "B"qualifier as an estimate since the value is between the IDL and the CRDL. Although this is not an approved inorganic data qualifier, this is not considered to be a critical issue.

Response:

The "B" qualifier was applied to the data by the laboratory, not by the independent data validator. As requested, the laboratory performed the analyses using CLP methods. In accordance with USEPA protocol, the laboratory must adhere to specific guidelines when filling out the Form I data reports. This protocol is outlined in USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis Multi-Media Multi-Concentration, Document Number ILM03.0 which states in Exhibit B, Section III, Part C, Page B-17:

"C (Concentration) qualifier - - Enter "B" if the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" shall be entered."

Specific Comment 4:

This comment requests clarification on whether positive results were reported and flagged with a "J" in relation to a failed continuing calibration recovery. The Army's response is that positive results were reported, and only the "UJ" qualifier was applied. However, the Functional Guidelines require positive and negative results to be flagged in the case of a failed continuing calibration standard. Therefore the Phase II EI Report should be revised so that all positive results associated with this failed continuing calibration standard are flagged with a "J".

Response:

No positive results were reported; therefore, no changes will be made to the report.

Specific Comment 10:

The response to this comment states that total petroleum hydrocarbon (TPH) data were qualified using the Functional Guidelines for Inorganic Data Review. However, TPH is an organic test

method run on a gas chromatograph. It is most similar to the pesticide analysis in the CLP Statement of Work. The Phase II EI Report should be revised so that the TPH data are reviewed and flagged according to the pesticide section of the Functional Guidelines for Organic Data Review.

Response:

The TPH data were validated based on the National Functional Guidelines for Organic Data Review. The response to comments on the Draft EI Report mistakenly included TPH with TOC.

Specific Comment 11:

This comment requests clarification on the criteria for qualification and acceptance/rejection of graphite furnace (GFAA) results. The Army's response is that GFAA sample results are qualified and accepted or rejected based partially on the matrix spike sample (MSS) recovery. For example, if the sample result is not detected and the MSS recovery is <30%, the data is flagged "R". However, the Functional Guidelines do not allow GFAA data to be flagged or rejected due to poor MSS recoveries. Therefore, revise the Phase II EI Report so that GFAA data are not flagged or rejected due to poor MSS recoveries. All GFAA data which were rejected due to poor MSS recoveries should be included in the risk assessment.

Response:

The Army's response was addressing matrix spike samples (digestion spikes) not analytical spikes (post-digestion spikes). The National Functional Guidelines for Inorganic Review, Section VII, Spike Sample Analysis, E.7. states, "If spike recovery results fall < 30% and the sample results are < IDL, qualify the data for these samples as usable (R)." This applies to all digestion spike recoveries (ICP, GFAA and Hg); therefore, the data were flagged correctly.

Ecological Risk Assessment Comments

Specific Comment 1, Page 6-2:

*The comment has not been adequately addressed. It appears that the Army may have misunderstood the intent of the comment. The response requests that U.S. EPA provide the latest policy guidance regarding evaluation of populations in ERAs and indicates that the document will be revised with this information. However, the revisions to the document do not appear to reflect the change that was requested by U.S. EPA. Modifications to the original statement are underlined and do not reflect the change regarding populations requested by U.S. EPA: "...the ERA focuses primarily (word added) on populations or groups of interbreeding individuals and individuals. In the ERA process, individuals are always (changed from **only if**) addressed as if they are protected under the Endangered Species Act." The document should be revised to address the original comment.*

Response:

As stated earlier, the Army re-requests from EPA written guidance and specific citations to existing EPA literature regarding the policy on evaluating organism and/or populations and/or

communities and/or ecosystems. The assessment endpoints for both the screening and baseline ecological risk assessment were established to protect receptors at the population level of ecological organization and not to protect receptors at the individual organism level of ecological organization. This was done because no federally-listed threatened or endangered species occupy habitats associated with the assessed EI sites, with the exception of the firing ranges. The cleanup levels of the firing ranges, which are located in a potential bat roosting area, were developed and approved by BCT in consultation with the U.S. Fish and Wildlife Service.

The loss of one individual of a listed species or species of special concern might adversely affect the survival of a population. For nonprotected species, the loss of some individuals, in general, does not adversely affect survival of a population. The risk assessment approach is consistent with ecological risk assessment guidance and is a generally accepted concept within the discipline of ecological risk assessment.

Specific Comment 2, Page 6-2:

The comment has been partially addressed. The response indicates that verbatim U.S. EPA definitions of assessment and measurement endpoints will be added to the text. However, the document does not reflect U.S. EPA definitions in this section (definitions have been added to Page 6-15 as requested by U.S. EPA Specific Comment 6). This page was revised and now includes two sentences which present two similar statements related to the definition of the risk quotient. It appears that this may be an editorial error and one of the sentences may have been intended to be removed, since the statements contain the same information with only one or two words modified. Revise the document to clarify this issue.

Response:

The comment is noted.

Specific Comment 3, Page 6-3:

The comment was adequately addressed. The comment requested that specific text be added to the definition of exposure assessments. The response and document have been revised, but not with the exact italicized text. However, the added text appears to reflect the intent of the comment.

Response:

No response required as per EPA note on this comment.

Specific Comment 5, Page 6-5:

The comment has been partially addressed. The response indicates that a distinction will be made "that background comparisons apply only to inorganic compounds and that background comparisons do not apply to organic chemicals." However, the revision to the document only states "There is no background for organic chemicals." This may be confusing to readers since it does not provide the rationale for this statement. The text should be revised as indicated in the

response. Otherwise, the text should be revised to indicate that all organic compounds detected at FBH are considered to be above background and are evaluated in the ERA.

Response:

The comment is noted. As per the Final Phase EI II Technical Sampling Plan, background soil samples were analyzed for inorganic compounds only.

Specific Comment 8, Pages 6-22 and 6-23:

The comment was adequately addressed. Clarification to the exposure equations were made by adding the units which include body weight. It is indicated that the average daily dose included body weight, therefore, dose to dose comparisons were performed.

Response:

No response required as per EPA note on this comment.

Specific Comment 9, Page 6-28 (Revised document page 6-31):

The comment has not been adequately addressed. The intent of the comment appears to have been misunderstood. The response indicates that the Army agrees and will add language about the elimination of chemicals that do not have toxicity referenced values (TRVs) ***in the uncertainty section****. However, the U.S. EPA comment indicates that COPCs should not be dropped from the risk assessment and should be retained as COPCs and qualitatively addressed. Chemicals with no TRVs have still been eliminated from discussions of COPCs within the risk assessment. This is misleading since hazard quotients for compounds without TRVs are calculated as zero which results in sites being presented as having no exceedances.*

Additionally, the second paragraph on page 6-31 indicates that COPCs without toxicity thresholds were carried through the risk characterization as uncertain risks to ecological receptors and then were considered further in the risk assessment process. The consideration of chemicals without TRVs as COPCs is not apparent in the performance of this risk assessment. For example, Tables P-17 through P-124 present a hazard quotient of zero for chemicals without TRVs and do not include those chemicals as COPCs in any of the site-specific descriptions. No qualitative discussion has been included regarding the potential for additive risks associated with chemicals that do not have specific TRVs. This factor is considered significant for this risk assessment since many of the detected compounds do not have associated TRVs. Revise the summaries of overall risk for each area to specifically discuss the presence of these compounds and their relative potential impact to ecological exposures.

Response:

The comment is noted. Analytes lacking TRV data should be retained throughout the ERA process. Each site specific risk characterization should indicate which chemicals did not have TRV data and for which chemicals hazard quotients could not be calculated. However, omission of this discussion does not affect the conclusions of the EI.

Specific Comment 10, Page 6-52 (Revised document Page 6-68):

The comment has not been adequately addressed. The Army appears to disagree with the comment. However, the response indicates that the intent of the comment has been misunderstood. The U.S. EPA comment states that it disagrees with the interpretation of the hazard quotient that is presented and states that U.S. EPA believes a hazard quotient that exceeds 1.0 indicates possible risk. However, the response argues that the uncertainty section is the correct place for discussing the limitations of the hazard quotient. The U.S. EPA comment is not related to the appropriateness of this information within the uncertainty section, but rather the statements that were made regarding hazard quotients representing "more real risk is to place more credibility on all COCs greater than 10." The original text has not been revised; therefore, revise the text as indicated in the original comment.

Response:

The Army has reevaluated its position on the decision rule for risk to ecological receptors. The recommendations of the Final Phase II EI were based on the risk threshold of HI greater than 10. However, since the publication of the Final Phase II EI, the Army has performed additional analysis on those sites for which the HI falls between 1 and 10. There were four such sites: EI Site 6, SM18, SM25i, and 30. The results of this analysis are included as an attachment to this responsiveness summary.

The Army maintains, however, that a resultant HI between 1 and 10 does not directly trigger remediation. Interpreting such a result requires site-specific evaluation and risk-management decisions. This interpretation of HIs is consistent with the Tri-service Procedural Guidelines For Ecological Risk Assessment (Wentsel et al., 1996). In this guidance, Menzie, et al. 1996, advanced a ranking of HQs as follows:

HQ = 1 to 10 some small potential for adverse effects
HQ = 10 to 100 significant potential for adverse effects
HQ>100 expected adverse effects.

Additionally, it should be noted that in the baseline ERA all hazard quotients were summed to present cumulative HIs, regardless of the mechanism of toxicity or mode of action. This assumption is inherently more conservative than HIs specific to a mode of action.

Specific Comment 11, Page 6-53 (Revised document Page 6-70):

The comment has not been adequately addressed. The Army disagrees with the comment and has not removed the text as requested. Instead, the original text has been revised to "soften the interpretation about no immediate endangerment from chemicals." However, the revised text appears to include additional speculative information. The revised document now states that "there are many forests and fields at EI sites whose appearance is similar to forests and fields at reference or 'clean' places. While this is not sufficient to claim no immediate endangerment, such abundant habitat means food and cover to support organisms. Many organisms were observed, further suggesting no immediate endangerment." This does not adequately address the comment and the text should be revised to address the original comment.

Response:

The Army maintains that the presence at FBH of habitats which include many plants and many animals that are similar to reference habitats suggests, at a minimum, that no gross or acute impacts are occurring at FBH. Furthermore, this information is applicable in a weight-of-evidence evaluation.

Specific Comment 12, Page 6-53 (Revised document Page 6-72):

The comment has not been adequately addressed. The response indicates that the Army agrees, but the document does not appear to have been revised to address the comment. For example, the summary still includes discussion of only those exceedances with hazard quotients greater than 10. Revise the report to address the original comment.

Response

See response to Specific Comment No. 10.

Geotechnical Comments

Comment No. 1:

Geotechnical Comment Number 1 pertains to well development, groundwater purging and sampling and associated high turbidity values. Monitoring well development should include removing an equal volume of water used during well installation, and then monitoring field parameters (i.e., pH, temperature, specific conductivity, and turbidity) until stabilization has been achieved. The well installation records in Appendix B do not contain the volume of water used during installation of each monitoring well. Therefore, the actual volume of water required to develop the monitoring wells cannot be determined, and only the stabilization of field parameters can be used as development criteria.

In assessing the stabilization of field parameters, several factors can contribute to turbidity values being higher than the desired range of 5-10 Nephelometric Turbidity Units (NTU's), including: pumping the well at a rate too high during development and introducing artificial turbulence into the well; and, using an inappropriate sand pack grain size which could allow fine material to enter through the well screen. The grain size of the sand pack should have been adjusted to match the grain size of the monitored hydrogeologic formation. A review of the well installation records indicate a No. 5 Torpedo filter media was used for filter pack installation in most of the wells. A No. 4 Ohio Sand, No. 4 quartz sand and a No. 7 quartz sand were used for sand pack installation in a few wells. The reason for the change in filter media size is not explained and the hydrogeologic formation where the well screen was installed does not appear to be a factor.

The sampling forms indicate that a large number of wells were purged and sampled by bailer method. Turbid groundwater samples can result from this type of sampling. The surging action produced by the bailer when dropped in and pulled out of the well provides enough energy to loosen fine material in the sand pack, resulting in the fine material washing through the well screen and into the groundwater sample.

It does not appear that alternative methods for purging prior to sampling and sample collection were attempted in an effort to decrease turbidity values in groundwater samples. The well purging and sampling was performed by bailer or pump then bailer. Therefore, it is not known if the desired turbidity values for groundwater samples can be obtained. Low flow purging and sampling using pumps set at flow rates less than 1 liter per minute is recommended for any future sampling to attempt to reduce the turbidity in the groundwater samples. This sampling technique has been employed at sites where high turbidity values in groundwater samples has been thought to impact metals analytical results.

Because the proper well development has not been demonstrated, the Army should discuss the implications that high NTUs may have on sample results. This discussion should include an assessment of the overall impact of the sample results on the risk assessment for the site being monitored and any follow-up sampling that may be required.

Response:

Except for the four wellpoints at EI Site SM26, all monitoring wells were installed using the hollow-stem auger drilling method. Only five wells required the addition of water to aid in well installation. No water was used in the drilling or installation of the remaining 37 wells.

Monitoring well-development was conducted in accordance with Standard Procedure UFP 5-4. In general, the development process consisted of removing the stagnant well water with a bailer or low-flow pump, followed by pumping at a reduced rate of 1 gallon per minute or less. Mechanical surging was included as part of the initial development of wells that were screened in substantial sand units (i.e., several feet thick). Each well was developed by removing from 5 to 9 well volumes and monitoring for the stabilization parameters pH, temperature, and specific conductance. An additional 1.5 to 3.5 times the volume of water added to the five wells during drilling and installation was removed as part of their development. Well development was continued until the pH, temperature, and specific conductance stabilized. A turbidity value of 5-10 NTUs was not specified as a well development criterion in the phase II EI Technical Sampling Plan, nor was it an issue with EPA in the RFI or Phase I EI sampling programs.

In many cases, the wells would go dry during development no matter how slowly the water was removed, even at rates less than 1 liter per minute. Numerous wells required more than two hours for the static water level to recharge to within 90 percent. Some required almost a full day to recharge. Because of this, it was not uncommon for individual wells to take 3 or more days to develop. Purging a well dry creates turbulent flow into the well and results in samples with high turbidity. However, this could not be avoided in some wells even at purge rates below 1 liter per minute. This is due to the poor recharge from thin discontinuous sand or silt units within the glacial till. Comparably, wells completed in areas with relatively thick sand layers and abundant recharge, as at the former skeet range, produced water with low turbidity.

All of the Phase II wells were completed where groundwater was first encountered during drilling. Quite often, the first groundwater was encountered in a thin sand or silty clay layer that was bounded above and below by relatively tight clay. Many of the wells were constructed to monitor a 1-foot thick saturated sand or silt unit. In these instances, 90 percent of the 10-foot long well screens are situated in the fine-grained clay units. Designing a filter pack to withhold

90 percent of the formation material does nothing to prevent the fine-grained clays from entering the wells. In order to obtain turbidity-free water, the filter pack would have to be sized according to the grain-size of the finest unit screened in the well, and not according to the formation material as proposed by the reviewer. Although choosing a filter pack to withhold 90 percent of the clay-sized particles would result in low turbidity, it would disrupt the natural flow characteristics of the coarse-grained formation, reduce flow into the well to a trickle, and promote sample aeration. Clearly, this is not an acceptable solution since the sample is not representative of natural conditions. A representative sample that is free of turbidity may never be obtained from wells that purge dry after removing each well volume or where a significant portion of the screened formation is fine-grained clay.

The Army maintains that the wells were developed and purged as well as could be done given the geologic conditions. The reviewer mentions sites where high turbidity values in groundwater samples have been thought to affect metals analytical results. The Army sampled and analyzed both dissolved and total metals at FBH. The results for total metals—which would represent the worst-case situation—were used in the risk assessments. No further sampling or evaluation is necessary.

Specific Geotechnical Comments

Specific Comment No. 1:

This comment addressed the issue of the groundwater. It was questioned whether groundwater might not be under confined conditions. The Army replied that groundwater was usually found in thin discontinuous sand lenses that form zones of perched groundwater that are often found under semi-confined conditions. Perched groundwater, by definition, cannot be under confined or semi-confined conditions. Also, as noted later in the General Comments, the Final Phase II RFI Report states that the groundwater is unconfined. The Army should reevaluate the groundwater conditions at the Fort Benjamin Harrison facility and present a thorough and detailed explanation that substantiates the conclusions.

Response:

Much of the confusion with the near-surface hydrogeology at FBH is based on scale. The heterogeneity of the glacial till deposits has created inherently complex hydrogeologic conditions. Virtually all of the EI site wells were completed at depths of less than 30 feet. The geologic materials encountered in this zone are predominantly glacially derived silty clays with intervening thin discontinuous lenses of silt, sand, or sand and gravel. The more permeable lenses may or may not be saturated, but the clays are generally hard and dry. Paired wells have been installed in the glacial till by the U.S. Geological Survey (USGS) at four locations across FBH. Based on water level elevations in these well pairs, there is a downward hydraulic gradient between the thin sand layers within the till. The permeability of the clay unit is comparably very low, but limited amounts of groundwater can also percolate downward through the clays. As stated in the Final Phase II RFI report, this till unit when viewed as a whole may represent a shallow unconfined groundwater flow system. This statement is in reference to the whole shallow glacial till unit across the entire FBH site, where the combined water levels in all of the wells appear to represent a regional water table.

On a much smaller scale, groundwater in individual sand layers at specific EI sites may be unconfined or locally semi-confined. The semi-confined conditions arise due to the permeability contrast between thin sand layers and the surrounding thick clay. This situation was encountered in many borings and wells installed during the Phase II EI. The USGS installed a cluster of three wells near the east landfill to investigate the groundwater conditions in that area. The shallow well was screened from 13.5 to 18.5 feet to monitor a 2.5-foot thick sand. The intermediate well was completed from 47 to 57 feet in a 9-foot thick sand. The static water levels after development were approximately 3 feet and 28 feet, respectively, which indicates confined or semi-confined conditions. The third well was completed in soft clay at a depth of 110 feet, but this well was scheduled for abandonment due to lack of water. No other potentially permeable units were encountered at this location.

In some areas, groundwater exhibiting unconfined conditions was encountered in silty clay zones within the till. In other areas, like the former skeet range, groundwater in the relatively thick near-surface sand unit was unconfined. One of the USGS wells installed north of the golf course encountered a 10-foot thick sand unit at a depth of 65 feet. Only the lower half of this sand unit was saturated and under unconfined conditions. This unit is believed to be the Fall Creek aquifer, but it does not appear to extend across the entire installation.

Based on evidence gathered in three separate investigations at FBH, groundwater does occur under perched, water-table, and semi-confined conditions in the near-surface glacial till unit. These conditions are be site-specific and scale-dependent.

ADDITIONAL ISSUES IDENTIFIED IN THE PHASE II EI REPORT ADDITIONAL COMMENTS ON THE PHASE II ENVIRONMENTAL INVESTIGATION REPORT FOR FORT BENJAMIN HARRISON, DATED AUGUST 1998 – EI INVESTIGATORY/REPORTING ISSUES

1. General Comment:

The Phase II EI Report includes a discussion on background soil samples and provides tables indicating the associated soil groups. However, the report does not provide the analytical data from the background samples collected. Each site summary discusses the sampling results and compares them to background levels as higher, lower, or about the same, but the reader is unable to directly compare the results. Revise the Final Phase II EI Report to include the analytical data for all background soil samples or a specific reference to where these data can be found within the report.

Response:

The background data for the three soil associations at former Fort Benjamin Harrison are provided as Appendix N , Volume III of the Final Phase II EI Report.

2. General Comment:

On pages 2-5 and 2-6 of Section 2.1.4.1, the groundwater at the site is described as being semi-confined. On page 2-7 (last paragraph) the report states that "groundwater may be perched and semi-confined locally." It is unclear how groundwater can be perched and semi-confined at the same time. In addition, the Final Phase II RFI Report dated August 7, 1998, on page 2-8, states that the groundwater is under unconfined conditions. Since the two reports cover the same site, there should be continuity in the discussion on groundwater between the reports. The Phase II EI Report provides additional detail by explaining how the semi-confined conditions were determined including presenting explicit examples of EI sites where groundwater exists under semi-confined conditions, the construction of the monitoring wells at those sites [e.g., screened zone(s)], and the water levels. Revise the Phase II EI Report to present consistent groundwater discussions in the EI and RFI Reports.

Response:

Please see response to Specific Geotechnical Comment No. 1 above. In addition, hydrogeological information was provided through a USGS groundwater investigation after completion of the Phase II EI field program. This information was not available for inclusion in the RFI report. The Phase II EI report will not be revised to be consistent with the RFI report.

3. General Comment:

Because the water level maps were developed for general illustration purposes only, the groundwater contour plates (Plates 3-1 through 3-3) should include a note similar to the last two sentences on page 3-24.

Response:

The comment is noted.

4. Section 2.2.2 – Archaeological and Historically Significant Areas, page 2-13:

The text indicates that a 1990 archaeological investigation identified six new sites (four prehistoric and two historic) at FBH. The text discusses the historic sites, but does not provide the locations for these sites or mention the location or status of the four prehistoric sites. All significant sites should be identified on a figure and a discussion regarding the regulatory requirements for preservation of these sites should be included.

Response:

The referenced paragraph was reproduced from the Enhanced PA, and has been included under a similarly titled section in the Phase I RFA and the Phase I EI reports. The archeological sites refers to two turn-of-the-century farmsteads and four sites that pre-date the establishment of FBH. As these six sites have archeological and historic significance only, they were not subject to environmental investigation. Protection of these sites has been ensured to the satisfaction of the Indiana State Historic Preservation Officers and the National Advisory Council on Historic Preservation. A discussion regarding the regulatory requirements for preservation of these sites is beyond the scope of this investigation.

5. Section 3.1.1, Soil Gas Surveys, pages 3-2 and 3-3:

This section states that soil gas surveys were used for screening tools at two sites (EI 30 and EI 32). Appendix H, Passive Soil Gas Survey Report states that soil gas surveys were performed at three sites (EI 8, EI 30, and EI 32). Section 3.1.1 should be revised to include a discussion of the soil gas survey performed at EI 8.

Response:

There is no EI Site 8; it was mistakenly identified in the soil gas report. A limited soil gas survey was performed at SWMU #8 during the Phase II EI field program to supplement data for the Phase II RCRA Facility Investigation. The contract laboratory reported the soil gas data for all three sites in a single document, which was reproduced in its entirety in Appendix H. SWMU #8 is not part of the EI program and the soil gas results for this site will not be discussed in Section 3.1.1.

6. Section 3.2, Background Sampling, pages 3-10 through 3-14:

This section discusses background sampling; however, the report does not present the analytical data for the background samples collected. Since the report continuously compares the various EI sites to background levels, revise the Phase II EI Report to include the laboratory analyses and a table summarizing the analyses.

Response:

See response to General Comment 1 above.

7. Tables 3-3 and 3-4, pages 3-32 and 3-33:

These tables present the background soil samples and their respective soil association. It would be beneficial if the three soil associations were referenced to each specific EI site or each EI site referenced to its soil association.

Response:

With few exceptions, a reference to the soil association used for background comparisons is provided in the discussion of analytical results for each EI site. Typically, these are mentioned in the section on surface soil sampling results. Note that background comparisons were not used for EI sites SM20 and SM21, since the soil samples were not analyzed for inorganics. In addition, soil samples were not collected at EI Sites 3, SM19, and SM25f during the Phase II investigation.

8. Section 4.14.1, Phase I EI Activities, page 4-13:

The second paragraph on this page indicates that laboratory analysis for landfill parameters are presented on Table 4.14-1. However, Table 4-14.1 does not identify any parameters specifically as "landfill parameters," although it is presumed that these parameters are pH, cation exchange capacity (CEC) and total organic carbon (TOC), as shown. In addition, parameters that are commonly analyzed for at landfills are biological oxygen demand (BOD), total dissolved solids (TDS) and chemical oxygen demand (COD). Revise the table to specifically identify the landfill parameters.

Response:

This section briefly summarizes the Phase I EI sampling results. Landfill parameters are a group of analytes considered in the Phase I investigation, but they were not carried over into the Phase II program. These results were omitted from Summary Table 4.14-1 to keep it as brief as possible, yet still show pertinent results. Please refer to Section 4.19 and Table 4.65 of the Phase I EI report for a description of landfill parameters and detailed results.

9. Section 4.15.2, Phase II EI Activities, page 4-115:

The fourth paragraph on this page discusses the sediment samples located at EI Site SM25h. It is difficult to correlate the text with the associated Figure 4.15-2. Revise the Phase II EI Report to reference the samples (by sample numbers) that are being discussed.

Response:

Figure 4.15-2 appears congested because it shows all sampling points for site SM25h, plus four surface water/sediment sampling points on Fort Branch Creek that are associated with EI Site

SM27. Instead, please refer to Figure 4.15-5 that shows only the surface water/sediment sampling points associated with EI Site SM25h.

10. Section 4.15.4, Summary, page 4-121:

This section presents the observations of the sampling results at EI Site SM25h. The observations do not include those for surface water at this site. Revise the Phase II EI Report to include observations concluded from the results of surface water sampling at EI Site SM25h.

Response:

Dissolved and total concentrations of calcium, cobalt, chromium, iron, potassium, magnesium, and vanadium were detected above upstream levels in both of the downstream surface water samples. The dioxin OCDD and the pesticide 4,4'-DDD were detected in the surface water sample collected on the unnamed tributary, but not in the downstream sample collected on Fort Branch Creek.

11. Section 4.16.2, Phase II EI Activities, page 4-122:

This section states that soil sample SS-H2-05 was within the sphere of the Phase I samples. Based on this statement, Figure 4.16.2 indicates that this Phase II sample should be identified as SB-H2-04. The Army should review the sample numbers and locations and revise either the figure or the text to correctly identify the Phase II sample that is within the sphere of the Phase I samples.

Response:

The sentence is confusing. Samples SS-H2-01, SS-H2-02, and SS-H2-03 were located beyond the sphere of the Phase I samples and outside of the geophysical anomaly. Sample SS-H2-04 was located within both the geophysical anomaly and the sphere of the Phase I samples. Sample location SS-H2-05 was within the geophysical anomaly, but just beyond the sphere of the Phase I samples.

12. Section 4.17, EI Site SM 25j – Historic Military Site, page 4-125:

EI Site SM25j is described on page 4-125 as being west of Buildings 645 and 646. Figure 4.17-2 shows the site west of Buildings 647 and 648. The text or figure should be revised to accurately locate the site.

Response:

Figure 4.14-2 is correct, EI Site SM25j is west of Buildings 647 and 648.

13. Section 4.18.5, Summary, page 4-142:

The summary for EI Site SM26, on page 4-142 indicates that no concentrations of total metals in the downgradient monitoring wells were higher than background. Figure 4.18-5 and Table 4.18-4 substantiates this claim. However, the data presented on Figure 4.18-5 indicates that the

metal concentrations in the background monitoring well (GW-S1-04) are almost always significantly higher than concentrations in downgradient wells. For example, lead and nickel in the background monitoring well are 158 and 139 µg/L, respectively while the highest downgradient well (GW-S1-03) shows 46.6 and 18.2 µg/L, respectively. The Final Phase II EI Report should be revised to discuss the implications of background concentrations in downgradient wells. It is suggested that the Army reconsider the utility of well GW-S1-04 as a background well.

Response:

The locations of all four wellpoints were field-checked and modified by IDEM before installation. GW-S1-04 is located hydraulically upgradient of the sludge drying beds. The area immediately to the east is heavily wooded with steep topography and recognized as likely habitat for the Indiana bat. This limited the possible locations for groundwater monitoring and precluded the use of truck-mounted drilling equipment for well installation.

Many of the elevated metals in the groundwater samples are likely due to the physical makeup of the wellpoints. While these wellpoints have a stainless steel mesh inlet screen, their core is constructed with a 2-inch I.D. galvanized steel pipe. In addition, the bottom drive point is a heavy gauge galvanized steel chisel point. Due to the presence of cobbles and coarse gravel in the shallow subsurface, considerable effort was required to hammer/drive these wellpoints into the saturated interval. GW-S1-03 and GW-S1-04 were the most difficult to install. The galvanized steel could have contributed filterable metals to the samples, especially if the galvanic coating was abraded during installation.

All of the wellpoints recharge very slowly and produce slightly to moderately turbid water. The relatively high turbidity also adds to the elevated metal content of the unfiltered groundwater samples. As shown in the filtered groundwater results, there is no significant difference between the four water samples.

The groundwater and surface water results indicate that the sludge-drying beds have not been affected significantly by those media. That was the intent of the sampling program in this area. As mentioned above, the elevated metals in groundwater at GW-S1-04 could be caused, in part, by factors that are not site-related. The Army maintains that this wellpoint is a valid background sampling point.

14. Section 4.20.2, Phase II EI Activities, page 4-150:

The Final Phase II EI Report states that the surface samples were analyzed for SVOCs, total metals, soil pH, and TOC. Since a soil gas survey was conducted at this site, and VOCs were identified, it is unclear why VOCs were not included in the analyses for the soils. The rationale for not including VOCs should be included in the revised report.

In addition, Section 4.20.3.1, Soil Gas Survey Results, states that the hot spots found using the soil gas survey were evaluated further during the surface and subsurface soil sampling program. Figures 4.20-2 and 4.20-3 which show the soil gas hot spots and Figures 4.20-4 and 4.20-5 which show the surface and subsurface sampling locations respectively, indicate that many of the hot spots were not sampled, but instead areas just outside the hot spots were sampled. The text

of the Final Phase II EI Report should be revised to correctly indicate the sampling locations, and the rationale for not sampling directly in the hot spots should be discussed. Also, the summary should be reviewed and revised if necessary based on the fact that no soils were tested for VOCs in the hot spots as indicated by the soil gas survey.

Finally, the fact that many of the hot spots were not sampled should be discussed in the human health and ecological risk assessments, as well as in the Conclusions and Recommendations sections.

Response:

Both EPA and IDEM agreed to omit VOCs from the Phase II EI Technical Sampling Plan for EI Site 30, but requested that samples be screened in the field using an Organic Vapor Analyzer (OVA). Based on the soil gas survey results, twelve soil borings were installed at this site. Prior to drilling a boring, the surface was scanned with the OVA to help locate the boring to the area with the highest reading. However, all surface scans around the prospective borings resulted in measurements below the most sensitive setting of the OVA. Samples were collected from depths of 1-3 and 3-5 feet in each soil boring.

Organic vapors were not detected with the OVA in these interval samples, except in the sample from 3-5 feet in soil boring SB-BT-08, which had an OVA response of 4.8 parts per million. Since the surface scans and the field screening did not detect contamination, the samples were not analyzed for VOCs.

The soil gas sample locations shown in Figures 4.20-2 and 4.20-3 are scaled incorrectly. The correct soil gas sample locations are shown in figures in Appendix H, pages H-30 and H-32. Soil borings were located based on these figures, visual observation of surface conditions, and drill rig accessibility. The soil gas sample points were staked in the field and were still available for locating the borings. The corresponding sampling points are shown below:

Soil Boring	Soil Gas Point	Soil Boring	Soil Gas Point
SB-BT-01	101	SB-BT-07	97
SB-BT-02	102	SB-BT-08	87
SB-BT-03	93	SB-BT-09	16
SB-BT-04	85	SB-BT-10	7
SB-BT-05	39	SB-BT-11	44
SB-BT-06	50	SB-BT-12	79

As shown in the Appendix H figures, the borings were located at most of the major soil gas hot-spots. Soil gas point 74 was not accessible by drill rig. Soil borings SB-BT-01 and SB-BT-12 were installed in "clean" soil gas areas to test the validity of the soil gas results. Since most all of the soil gas hot-spots were sampled, and the results were used in the risk assessments, the conclusions and recommendations remain unchanged.

15. Table 4.16-2, Data Summary Table: Subsurface Soil – EI Site SM25j – Historic Military Site:

This table is identical to Table 4.17-2, Data Summary Table: Subsurface Soil – EI Site 25j. It appears that the table is supposed to be the data summary table for subsurface soil at EI Site SM25i. The subsurface soil data for EI Site SM25i are, therefore missing. Revise the Phase II EI Report to include the correct table.

Response:

The reviewer is correct. The detected organic compounds are shown on Figure 4.16-4 EI Site SM25i, Subsurface Soil Results.

16. Section 7.20, EI Site 30, Beaumont Triangle Area, pages 7-29 and 7-30:

It is unclear why no further action is recommended for EI Site 30. This section clearly states that both ecological and industrial worker exposures pose unacceptable risk at the site. Additional justification, and/or explanation is required to support the recommendation of no further action.

Response:

According to the screening ERA, there is ecological risk in excess of HQs of 1 as stated in the comment. Since the issuance of the August 1998 EI, the recommendation about no further action for EI Site 30 has been revisited. A baseline ERA consisting of Rounds 1 and 2 has been completed for this site. After the Round 2 analysis, the findings were that a few HQs and HIs still exceeded one. See further discussion this in Section 6 of the ROD and the attachment to this Responsiveness Summary.

17. Appendix E – General Comment:

Appendix E presents the slug test data for various monitoring wells at the site. Some of the data were analyzed as unconfined and some as confined groundwater systems. As noted earlier in General Comment No. 2, there are some unresolved questions concerning the exact groundwater conditions at the site. Additional information should be provided for those wells that were analyzed presuming confined conditions. Information regarding the screened interval and the water level should be included to confirm that groundwater is truly under confined conditions.

Response:

See response to General Comment No. 2 above.

18. Appendix M – General Comment:

In section M.2.1.1 Semivolatile Analysis, it states that a sample was extracted after its hold time had expired. Negative results were qualified and positive results were "not identified." This phrase also appears in section M.2.1.1 TOC Analysis and M.2.1.4 Volatile Organic Analysis. However, the meaning of "not identified" is not readily apparent in any of these sections. Revise

the Phase II EI Report to clarify the definition of "not identified" (e.g., should be defined as "not qualified" or "not detected").

Response:

"Not identified" in the referenced sections is defined as "not found."

19. General Comment – Grammatical Issues:

The footers for Section 4 of the report show a date of June 1997 on the odd numbered pages and June 1998 on the even numbered pages. In addition, some sections show dates of June 1998 while others show August 1998. These typographical errors should be corrected.

Response:

The comment is noted.

ADDITIONAL COMMENTS ON THE PHASE II ENVIRONMENTAL INVESTIGATION REPORT FOR FORT BENJAMIN HARRISON, DATED AUGUST 1998 – HUMAN HEALTH RISK ASSESSEMENT ISSUES

General Comments

1. General Comment:

Human exposure to groundwater has only been evaluated at one site (EI Site 3) as a potentially complete exposure pathway based on future residential land use. Contact with groundwater was not considered a viable exposure pathway in any of the other areas under investigation. Section 5.2.2.2 Groundwater Pathways, states that "Currently potable water is supplied to the area of the former installation by the city of Lawrence public water system. According to the development plan for FBH (Clark, et. al., 1997) future residential, and nonresidential development also will be serviced by the city's water system." Thus, groundwater was only evaluated for future residential land use.

However, risk assessments typically evaluate exposure to groundwater considering the possibility that a well may be placed anywhere within the boundary of the property. Based on the proposed future land use of the property as mixed-use, it is conceivable that this may occur in the future, especially given the fact that part of the former installation is a state park with potential residential usage. For example, restroom facilities, including water services, could be constructed within the State Park at or near a former EI Site. There is a potential that these restroom facilities could be serviced by well water.

In addition, because some areas have shallow groundwater, the possibility exists that a construction worker may encounter groundwater during excavation activities. Thus, revise the Phase II EI Report to include the evaluation of groundwater as a potential exposure medium for all areas within the former installation. If groundwater data do not exist for a given site but soil (contaminant) data do exist, the soil data can be screened against available criteria to assess the potential for contaminants to leach from soil to groundwater. The Soil Screening Guidance, Technical Background Document (EPA/540/R-95/128, May 1996) provides criteria for determining the potential for contaminants to leach from soil to groundwater.

Response:

The HHRA has evaluated future land use exposures in accordance with the approved reuse plan for FBH. Because the city water system currently supplies the area, and because the reuse plan specifies that future development will by serviced by the city water system, residential and recreational exposures to groundwater (e.g., at restroom facilities serviced by well water) are unlikely and have not been evaluated. Construction worker exposures to groundwater are feasible at sites where soil intrusion is likely or expected (in accordance with the reuse plan) and where the depth to groundwater is less than or equal to 10 feet. (Note that the risk assessment evaluates subsurface exposures only to a depth of 10 feet). However, since no EI sites meet these criteria, construction worker exposures to groundwater are unlikely, and are not evaluated.

2. General Comment:

This comment addresses the use of current guidance. It should be noted that U.S. EPA released an updated Exposure Factors Handbook in August, 1997 (EPA/600/P-95/002Fa). The exposure parameters, as presented in Table 5-24 and applied throughout the risk calculations, should be checked to ensure consistency with the most recent guidance.

Response:

The exposure parameters used in the risk assessment are generally consistent with the most recent guidance. Although the 1997 Exposure Factors Handbook recommends some different parameters than other previous guidance documents, the conclusions and recommendations in the EI would not be affected.

3. Section 4.2, EI Site 3, Former Post Exchange Gasoline Station, Building 19, pages 4-9 through 4-14, and Section 5.2.1.2, Future Land Use, page 5-14:

Investigations at EI Site 3 (a former PX gasoline station), focused on media potentially impacted based on prior historical use of the site. Thus, sampling included subsurface soil and groundwater. As this site has been identified for potential future residential land use, it is suggested that a few surface soil samples be obtained to evaluate the potential for the presence of polynuclear aromatic hydrocarbons (PAHs), lead, and dioxin/furans. Although it is likely that fuel constituents such as benzene, toluene, ethylbenzene and xylene in the surficial soil would readily volatilize, there is the possibility that contamination could occur via automotive activities including pumping leaded fuel, exhaust producing products of incomplete combustion (including dioxin/furans), and the usage of motor oil. PAHs and dioxin/furans do not readily leach to groundwater and would remain attached to surficial soil. Lead would be expected to act similarly. It is on the basis of the potential for adverse health effects from these contaminants (i.e., lead has been shown to cause severe developmental and central nervous system effects in children), and the proposed future land use as residential, that it is suggested that the surface soil be evaluated to be protective of human health.

Note that a similar issue was identified by the Indiana Department of Environmental Management (IDEM) in Comment 41 of its February 13, 1998 comments regarding the Draft Phase II EI Report.

Response:

EI Site 3 is an underground storage tank site. Contamination is expected at depth from leaks in the tanks and not at the surface. The field investigation at these two sites was conducted in accordance with the sampling plan agreed upon by both IDEM and EPA.

4. Section 4.1.4, EI Site 25f, Historic Military Site, pages 4-112 and 4-113, and Section 5.2.1.2, Future Land Use, page 5-14:

Site 25f is a historic military site that is proposed for future residential land use. Out of six subsurface soil samples, only one had acceptable organic data in which PAHs and pesticides were detected at levels above screening criteria. Pesticide/PCB data for the remaining five

subsurface soil samples were rejected. Based on the historical use of the site (former WWII-era dump), there is unknown material present which has not been adequately characterized, nor has the extent of the fill area been delineated. Although this site is currently paved, the possibility of redevelopment for future residential use would include excavation activities which may result in the discovery of unknown anomalies as well as cause the displacement of subsurface soil to surficial levels. Thus, it appears that additional samples are necessary to fully characterize the fill contents in the subsurface layers, to determine the presence of organic and inorganic constituents, and to evaluate detected concentrations to determine whether there is a risk to human health or the environment before this property is transferred by deed to the new owner.

Response:

The PAH data rejected were from the Phase I EI. Most of the data rejected are at the detection limit of the respective compounds. Based on the recommendations of the Phase I EI, and with the concurrence of EPA and IDEM, the Phase II EI activity for EI Site SM25f consisted of using the Phase I EI data for conducting human health risk assessment only. No additional samples were requested at that time.

5. Section 5.2.1.1, Current Land Use, page 5-11, Maintenance Scenario:

Under current land use, the text states that maintenance workers were not evaluated at EI Sites SM26 and 27 (former sewage treatment plant) because these sites are inactive. It is possible that infrequent maintenance work or caretaker activities could occur at these sites even if these areas are currently not in use. The issue at EI Sites SM26 and 27 is that cancer risks for the incidental recreational visitor were in the 10-4 risk range. A maintenance worker might have increased exposure relative to a recreational visitor, potentially resulting in a risk to human health. Therefore, revise the assessment of EI Sites SM26 ands SM27 to include a maintenance worker scenario.

Response:

EI Sites SM26 and SM27 are located in the perimeter buffer zone of the state park. Therefore an incidental recreational scenario was evaluated. A focused feasibility study is being prepared for EI Site SM26 to address the need for remediation there. The Army maintains that no-further-action is the appropriate response at EI Site SM27. The cancer risk only slightly exceeds the threshold (2×10^{-4}), and this cancer risk is being driven by dermal absorption of PAHs in the soil. First, PAHs were detected at elevated concentrations at only two of the five sampling locations, indicating these constituents are not widespread. Second, the two samples showing the highest concentrations of PAHs were located closest to the asphalt running track. Asphalt is a well-known source of PAHs and the running track is situated such that runoff from the track flows downhill, over Site SM27, before flowing into the creek that drains the area. Finally, PAHs were not detected in similar concentrations at the other former sewage treatment plant investigated (EI Site SM26). Concentrations of PAHs at SM26 were consistently 10-50 times less than at SM27. The adjacent asphalt running track is the likely source of the PAHs at EI Site SM27, not activities associated with the operation of the former sewage treatment plant.

6. Section 5.2.1.2, Future land Use, page 5-14, Residential Scenario:

Both EI Site SM25h and EI Site 31 were originally proposed as a location for future residential use. The Army has indicated that the planned reuse for this area is a buffer zone within the State Park and no longer intended for residential use. According to the Assistant Director of the Indiana Department of Natural Resources Parks, and Recreational Division (John Burkman, personal communication, September 23, 1998), State Parks in Indiana have definitive boundaries and there is no designated buffer zone. In addition, Indiana State Parks provide housing for park managers and assistants within the boundaries of the State Park. Thus, it is not unreasonable to assume that in the future these areas may be designated for residential use and should therefore be evaluated under a residential scenario.

Note that this issue was originally identified by IDEM in Comments 26 and 60 of its February 13, 1998 comments regarding the Draft Phase II EI Report.

Response:

EI Site SM25h and EI Site 31 are located in the buffer zone of the state park. In a letter to the Army dated March 5, 1998, Mr. Gerald Pagac, Director of the Division of State Parks and Reservoirs, Indiana Department of Natural Resources, stated of the area around Building 518, the former incinerator: "The area will remain as a part of a peripheral buffer zone which might be traversed by a pedestrian trail in the future. At this point in time, we have no plans to develop a trail through this area." Note that the area of the former incinerator includes EI Site SM25h and Site 31.

Further, in a letter to the Army dated May 6, 1998, Mr. Pagac stated, "At one time, Site 518 was considered as a site for a manager or an assistant manager residence. Alternative sites have been chosen..." Mr. Pagac has confirmed that his reference to "Site 518" is the incinerator (Building 518) site.

7. Section 5.2.1.2, Future Land Use, page 5-14, Construction Scenario:

Based upon the reuse plan, thirteen sites are evaluated for construction work under future land use conditions. The construction worker scenario includes an evaluation of all potential exposure pathways relating to surface and subsurface soils. Groundwater, however, was not included as a potential medium for exposure. Because a majority of the thirteen sites have a high groundwater table, the potential for exposure exists during intrusive activities. For example, construction is planned at EI Site 32, where groundwater is as shallow as 2.78 feet below ground surface (bgs). Thus, the risk assessment for this potentially exposed population should evaluate all potential exposure pathways from all media, including the potential to be exposed to contaminated groundwater via incidental ingestion, dermal contact or inhalation of volatile organics.

Response:

Construction worker exposures to groundwater are feasible at sites where soil intrusion is likely or expected (in accordance with the reuse plan) and where the depth to groundwater is less than or equal to 10 feet. (Note that the risk assessment evaluates subsurface exposures only to a depth

of 10 feet). However, there are no EI sites that meet these criteria. Therefore, construction worker exposures to groundwater are unrealistic.

No organic contamination was detected at EI Site 32 – Greene Avenue POL Site. The average depth of groundwater at this site is 10 feet bgs with the exception of monitoring wells GW-IS-03 and GW-IS-06. No contamination was detected above the Maximum Contaminant Levels (MCL) established by EPA in these two monitoring wells.

8. Section 5, Tables 5-74 and 5-75, pages 5-124 through 5-131:

These tables present the non-cancer hazard and cancer risk by site for each exposure medium. As this is a summary table, it would be appropriate to include the combined (total) hazard and/or risk for each site based on exposure to all media at each location. It is the cumulative value, which reflects the actual potential for human health effects and provides an indication as to the relative degree of hazard and/or risk at each site. Revise the tables to include the combined (total) hazard and/or risk for each site based on exposure to all media at each location.

Response:

The reviewer's comment is noted. However, the revision requested would not affect the conclusion of the report.

9. Table 5-72. RME Risk Characterization Summary (Future Land Use) SI Site 32 – Greene Avenue POL Sites, Fort Benjamin Harrison, Marion County, Indiana, page 5-122:

In the Draft Phase II EI Report, dated September 1997, on Table 5-76, RME Risk Characterization Summary (Future Land Use) EI Site 32 – Greene Avenue POL Sites, the evaluation of an industrial worker under future land use conditions demonstrated a carcinogenic risk of 2E-04 based on dermal contact with subsurface soil. In the Final Phase II EI, an industrial worker scenario for EI Site 32 is listed as being evaluated in Section 5.2.1.2 Future Land Use, Commercial/Industrial Scenario. However, Table 5-72 shows this potentially exposed population as not being evaluated (as designated by "NA" on the table) and, according to Table 5-21 COPCs for EI Site 32: Greene Avenue POL Sites, COPCs were identified in subsurface soil. Explain the rationale for the exclusion of this potentially exposed population from the Phase II EI Report.

Response:

In the Final Phase II EI, industrial workers were assumed to be exposed only to surface soils. The industrial worker was evaluated at EI sites designated for light industrial or commercial future land use. Exposures may be encountered while coming or going to work, or as a result of contact with soils tracked into buildings. The industrial worker has no contact with soils deeper than 0.5 feet below ground surface (BGS).

10. Appendix O. Tables O.1-5 through O.1-8:

All the footnotes on these tables were cutoff. Revise the tables accordingly.

Response:

The comment is noted. As stated in the introduction to the Responsiveness Summary, the Army will not publish a revised Final Phase II EI Report.

ADDITIONAL COMMENTS ON THE PHASE II ENVIRONMENTAL INVESTIGATION REPORT FOR FORT BENJAMIN HARRISON, DATED AUGUST 1998 – ECOLOGICAL RISK ASSESSMENT ISSUES

1. General Comment, Section 6:

The results of the screening risk assessment indicate that there are 15 sites that have hazard quotients (HQs) greater than 1. However, baseline risk assessments were only conducted for those sites with a HQ greater than 10 (four sites). The use of a HQ of 10 to determine potential ecological risk is not supported. In a screening-level risk assessment, U.S. EPA typically uses a HQ greater than 1 as the threshold for the determination of the potential for ecological risk and the need for conducting a baseline risk assessment. Eight sites (Sites 6, SM18, SM20, SM21, SM25i, SM25j, and 30) were found to have hazard quotients greater than 1, but no further risk assessments and no further actions have been recommended by the Army. The site-specific summaries do not provide adequate rationale for dismissing the potential risk and the justification for using a HQ of 10 is not acceptable. In addition, these sites also had detections of other chemicals that were not considered in the calculation of the HQ since they did not have Toxicity Reference Values (TRVs). Thus, the potential for risk may have been underestimated by this assessment.

Response:

Based on the lower HQ and HI thresholds of 1, four EI sites have been reanalyzed using baseline ERA techniques for soil. They are EI Sites 6, SM19, SM25i, and 30. It was found in baseline ERA Round 2 that two EI Sites (SM19 and SM25i) did not exhibit HQs and HIs greater than 1, while EI Sites 6 and 30 did have HQs and HIs slightly greater than 1.

EI Site SM18 has been remediated and EI sites SM20 and SM21 will be further evaluated in a focused feasibility study. EI Sites SM25j, 6, and 30 are proposed for no further action, as explained in Section 6 of the ROD and the Attachment to this Responsiveness Summary.

2. General Comment, Section 6:

The base conversion to a State Park and public use has not been adequately addressed or discussed in this risk assessment. For example, risk assessment was not conducted at five sites (Sites 1, 3, 4, SM25f, and Site 32) since there was no significant ecological habitat associated with them. The potential for future use by, and exposures to ecological receptors is not considered. These sites may be located within the area of FBH that is scheduled for transfer to the State for public use. The potential future use and future exposures at the site should be mentioned in the site-specific summaries associated with each of these sites. Risk Management decisions regarding the ultimate clean up strategies for these areas may be significantly influenced by this information.

Response:

Ecological risk assessment was not conducted at five sites (Sites 1, 3, 4, SM25f, and 32) because there is no ecological habitat associated with them (i.e., very small in size compared to

home ranges and/or pavement/gravel with no vegetation). This situation of very small exposure units and no vegetation is unlikely to change in the future.

3. General Comment, Section 6:

Surface water and sediment associated with several drainages near specific EI sites have been sampled and analyzed. However, surface water and sediment samples to characterize the significant water bodies within the watershed that are influenced by the activities at FBH have not been collected. The surface water drainage ditches adjacent to the sites have exceedances of the TRVs and these ditches discharge into surface water that is considered significant ecological habitats. For some of the sites, aquatic exposures are not addressed because the drainage ditches do not represent viable aquatic habitats, however, may directly discharge to adjacent, viable, aquatic ecosystems. The viable interconnected aquatic habitat is not considered or discussed in this assessment. Surface water and sediment sampling from the major creeks and lakes should be considered since the base will be transferred for public use. It is recommended that the Army document the status of these aquatic ecosystems upon transfer of these sites. In addition, sediment should be sampled at the base boundary to determine if there are any concerns regarding off-site discharges.

Response:

Recommendation for sampling of additional sediment and surface water is noted, but the focus of the EI report is on selected sites and not the entire facility, which is considered outside the scope of the effort.

Note that sediment and surface water were sampled at each EI site when present. No facility-wide effects from the EI sites are expected, given the low potential for risk found in analysis of the sites. At the time of the closure of FBH in 1995, all surface water bodies on the installation met state standards for recreational use. The state has maintained control of these water bodies since closure, and has not reported them out of compliance with state standards.

4. General Comment, Section 6:

The risk assessment does not specifically reference the data that is used to calculate the reasonable maximum exposure (RME) concentration for each of the EI sites. In addition, typical risk assessment summary information such as maximum detection/frequency of detection tables and reference to figures which illustrate the various media samples as they relate to the habitats of each of the EI sites has not been included. Thus, the risk assessment tables that present the RME can not be verified and can not be reviewed without significant level of effort. In addition, the representativeness and adequacy of sampling within the ecological habitats cannot be assessed. It is recommended that the source of data used in the calculation of the RME be specified and referenced in the risk assessment.

Response:

The tables showing RME derivations and sample summary statistics are presented in the human health risk assessment section.

5. Specific Comment 1, Section 6.3.1, Conceptual EI Site Model, Page 6-6. *Exposure Routes:*

The word "terrestrial" should be inserted before the word ecological receptors in the first sentence of the last paragraph.

Response:

The comment is noted.

6. Specific Comment 2, Section 6.3.1, Conceptual EI Site Model, Page 6-7. *Receptors:*

Section 6.3.2, pages 6-10 state that wetland habitats are important ecosystems at FBH. However, the Conceptual Site Model (CSM) [Figure 6-1] does not include amphibians. In addition, Section 6.3.2.2, Fauna, list several amphibian species. Revise the document to explain why exposures/impacts to amphibians are not qualitatively addressed in the ERA.

Response:

Amphibian species were not included in the conceptual site model and in the food web because toxicity data are limited for these species, and risks to amphibian species are assumed to be included in the risk of completely aquatic receptors (e.g., aquatic biota) and receptors that prey on amphibians (e.g., heron).

7. Specific Comment 3, Section 6.3.3, Selection of Ecological Units and Receptor Species, Page 6-14:

The last sentence of this section which states that "the spatial boundaries of the ecological exposure unit are the same as the unit defined for the human health risk assessment" conflicts with the information presented in the previous sentence which indicates that the exposure unit was defined on the basis of existing habitat and land use and the spatial area of EI site habitats relative to the home range and home range and foraging areas of the receptors. Revise the ERA to clarify this statement.

Response:

The spatial boundaries and areas of the exposure units for ecological receptors are the same as those defined in the human health risk assessment section. This is not in conflict with the statements about home range and foraging areas. The description of the site habitats refers to the usable habitat by defined receptors within these spatial boundaries. The site size (i.e., the area within the site boundaries) is used in calculating risks, but this site area may not consist of completely compatible habitat for receptor species use.

8. Specific Comment 4, Table 6-19, Page 6-123:

This table does not include the NOAA/OME sediment TRVs. Revise the ERA to include the TRVs and evaluate Site SM26 using this information. Please note that this request was also made by

IDEM in Comment No. 37 on the Draft Phase II Environmental Investigation Report, dated February 13, 1998.

Response:

OME and NOAA TRVs are depicted in this table for analytes when available. However, when an OME or NOAA value do not exist, a Long et al. ER-L is used if available to avoid lack of information.

9. Specific Comment 5, Table 6-20, Page 6-127:

The units (mg/L) presented on the table are incorrect. Revise the table to include the appropriate units (μg/L). Please note that this request was also made by IDEM in Comment No. 38 on the Draft Phase II Environmental Investigation Report, dated February 13, 1998.

Response:

The comment is noted. The correct unit, μg/L is actually used in the computations of ecological risk assessment in surface water. Therefore, no error was introduced into the calculations.

10. Specific Comment 6, Figure 6-1, Page 6-159:

The figure does not include potential exposures to amphibians and does not indicate the potential for dermal exposures for terrestrial receptors. Revise the figure to include this information. Please note that this comment was requested by IDEM in Comment No. 39 on the Draft Phase II Environmental Investigation Report, dated February 13, 1998.

Response:

Amphibian species were not part of the conceptual site model, food web figures, and analyses because toxicity data are limited for these species and risks to amphibians are assumed to be included in the risk of completely aquatic receptors (e.g., aquatic biota) and receptors that prey on amphibians (e.g., heron). Dermal exposure for terrestrial receptors is already recognized, and it is assumed to be minimal in comparison to internal exposure from incidental soil and prey ingestion.

ADDITIONAL COMMENTS ON THE PHASE II ENVIRONMENTAL INVESTIGATION REPORT FOR FORT BENJAMIN HARRISON, DATED AUGUST 1998 - STATISTICAL ISSUES

1. Appendix N, General Comment:

It is not clear how the Army used the results of the statistical analyses presented in Appendix N. The Army performed both an Analysis of Variance (ANOVA) on the grouped data as well as an upper tolerance level (UTL) analysis of each individual datum (compared to the pooled background data). The Army performed both types of analyses on all of the data and occasionally found conflicting results. For example, Table N-230 indicates that mercury detected in surficial soils in EI Site SM 26 is not related to site activities (by the ANOVA analysis) and yet Table N-231 indicates that 6 of 9 soils samples collected in the shallow soils in EI Site SM 26 are above the UTL. As the maximum mercury concentration detected in a soil sample collected from the surficial soils in EI Site SM 26 was 40 ppm and the maximum background concentration of mercury was 400 times lower, it appears that mercury in surficial soils in EI Site SM 26 is site related. However, it is not clear from the EI Report if the Army carried mercury over as a constituent of potential concern (COPC) into the risk assessment. Revise the EI Report to state how the results of the statistical analyses were used and how conflicting results in the various types of statistical analyses were resolved. The document should include tables showing which COPCs were selected based on the statistical analyses.

Response:

As worked out in detail with the IDEM and EPA, and presented in the Workplan for the RFI and EI sites, COPCs were selected based on the analysis of variance (not the UTL comparison). UTL comparison was conducted solely to support the nature-and-extent evaluation. Chemicals identified as COPCs with concentrations exceeding their UTL were discussed in the nature and extent evaluation.

Tables O.1-5 through O.1-81 are the Summary Statistics and Exposure Point Concentration tables. These tables show all the detected chemicals in an exposure unit and which are identified as COPCs. If an analyze was eliminated as a COPC in the screening process, the reason for elimination is given in the column entitled “Screening Status.”

In the example given in the comment, mercury was not identified as a COPC in surface soil. See Table 5-17 and Appendix N Table O.1-62.

4. COMMENTS FROM THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT ON THE PROPOSED PLAN FOR NFA SITES, DATED JANUARY 20, 1999.

Comment 1:

As stated in 40 CFR 300.515(e)(1), both EPA and the State of Indiana shall be involved in the preliminary discussions of the alternative addressed in the feasibility study (FS) report for a site prior to the preparation of the proposed plan and the record of decision (ROD). At the conclusion of the remedial investigation (RI) and FS, the lead agency, in conjunction with the support agency, shall develop the proposed plan. In addition 40 CFR 300.515(e)(1) and 40 CFR 300.430(f)(2)(iii) state the proposed plan shall include a statement that the lead and support agencies have reached agreement or, when this is not the case, a statement explaining the concerns of the support agency with the lead agency's proposed plan. The Army has not conferred with IDEM before preparing the proposed plan and has therefore not complied with 40 CFR 300.515(e)(1).

Response:

The Army is required to pursue cleanup at its closing bases in a "CERCLA-like" manner. The former Fort Benjamin Harrison is not a CERCLA site and has no obligation to follow strictly the procedural and administrative requirements of the CERCLA program.

Note that an FS is not required for sites that have been shown to pose no unacceptable risk through a Baseline Risk Assessment (BRA). A focused FS is currently being prepared for those sites that have been shown by the BRA to require additional investigation and, if necessary, remediation. IDEM will have an opportunity to comment on this FS and participate in the remediation decision.

Comment 2:

The proposed plan lists a target excess lifetime cancer risk (ECLR) of 1 x 10^{-4} for carcinogenic compounds detected at FBH. The proposed plan does not state why the Army has established a target ELCR level of 1 x 10^{-4}. The proposed plan should explain that the NCP lists an acceptable risk range of 1 x 10^{-4} to 1 x 10^{-6} for considering response actions at a site and to explain why the Army has selected the minimal acceptable ELCR for determining whether response action is warranted.

Response:

The NCP defines the target cancer risk range as 1 x 10^{-6} to 1 x 10^{-4}. However, the selection of which value within the range to use as the target is a management decision.

Use of 1 x 10^{-4} as the target risk is common. It is cited in EPA Region IV guidance and has been adopted by other EPA regions. If 1 x 10^{-4} is used as the target for an exposure pathway, then the chemical contributors identified as COCs have individual cancer risks within the target cancer risk range.

If 1×10^{-6} is used as the target for an exposure pathway, then the chemical contributors identified as COCs have individual cancer risks below 1×10^{-6}. Cleanup for chemicals with cancer risks less than 1×10^{-6} is generally not warranted.

Comment 3:

EI sites SM27, 30, and SM25b,c have ELCR levels that exceed 1×10^{-4} for the exposure scenarios evaluated in the baseline risk assessment; therefore, a response action is appropriate and required for these sites. The Army should prepare an FS for each of the three EI sites that have ELCR levels that exceed 1×10^{-4}. The remediation goals for these sites should be consistent with the NCP, which states the remediation goals "shall establish acceptable exposure levels that are protective of human health and the environment and shall be developed by considering ... applicable or relevant and appropriate requirements under federal environmental or state environmental or facility siting laws, if available, and .. for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound limetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} risk level shall be used as a point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure.

Response:

The Army maintains that no-further-action is an appropriate response at EI Site SM27. The cancer risk only slightly exceeds the threshold (2×10^{-4}), and this cancer risk is being driven by dermal absorption of PAHs in the soil. First, PAHs were detected at elevated concentrations at only two of the five sampling locations, indicating these constituents are not widespread. Second, the two samples showing the highest concentrations of PAHs were located closest to the asphalt running track. Asphalt is a well-known source of PAHs and the running track is situated such that runoff from the track flows downhill, over Site SM27, before flowing into the creek that drains the area. Finally, PAHs were not detected in similar concentrations at the other former sewage treatment plant investigated (EI Site SM26). Concentrations of PAHs at SM26 were consistently 10-50 times less than at SM27. The adjacent asphalt running track is the likely source of the PAHs at EI Site SM27, not activities associated with the operation of the former sewage treatment plant.

EI Site 30 is located on Army property, although the site is zoned for commercial use should the property leave Army ownership. EI Site 30 was historically used for coal storage. The human health risk drivers are PAHs in surface soil. PAHs at FBH are attributed to the basewide use of coal. Additionally, the PAH concentrations fall below the IDEM Tier II cleanup goals for non-residential land use.

Sites SM25b and SM25c were investigated by the Army in 1995 under a separate EI program. The detailed results of this investigation are presented in the Final EI for EI Sites SM25b and SM25c (SAIC 1995) and are summarized in the Final Phase II EI Report (SAIC, August 1998). No total hazard index exceeded 1 for any receptor at EI Sites SM25b and SM25c. No chemical-specific risk exceeded 1×10^{-4}. (See IDEM Specific Comment 4, which states that

when the proper number of significant figures is used, the cancer risk reported should be 1×10^{-4}). Complete results of this investigation are presented in Final Phase II EI Report for FBH Sites SM25b and SM25c, Marion County, Indiana, 1995.

Comment 4:

On page 4 of the proposed plan under the section titled "Discussion of Baseline Risk Assessment Results," the following statement is made: "The Army's target risk levels for ecological receptors is an Hi (hazard index) equal to 10 for surface soil exposure and an HI equal to 1 for all other media." Section 7.0 of the Phase II EI report (SAIC 1998) states that this "improved decision rule for soil" was refined based on Army Center for Health Promotion and Preventative Medicine guidance. This statement is supported by only a single record of telephone conversation between Army personnel (Army 1998). In addition, contrary to the "Framework for Ecological Risk Assessment" (EPA 1992b), the "Wildlife Exposure Factors Handbook" (EPA 1993), and the "Guidelines for Ecological Risk Assessment (EPA 1998a), does not state that His between 1 and 10 are acceptable. Therefore, as previously stated in General Comment 7 on Phase II EI report submitted October 21, 1998 (IDEM 1998), the Army should thoroughly document the methodology and assumptions used to change the decision rule or target level for ecological receptors from an HI equal to 1 to an HI equal to 10 for soil. This documentation should be submitted to IDEM for approval prior to finalizing the proposed plan. Also, the proposed plan should be revised to include a reference to IDEM's approval of the target level for ecological receptors. However, remedial actions should be evaluated if the HI is greater than 1 and IDEM has not provided approval to change the target level for ecological receptors from an HI equal to 1 to an HI equal to 10.

In addition, the site-specific HI (numerical value) for ecological and human receptors should be mentioned for each site, not just referenced to the target level.

Clarification is needed if the HI target level for ecological receptors is based on the LOEL (average), LOEL (max), NOEL (average), or NOEL (max).

Response:

The Army has reevaluated its position on the decision rule for risk to ecological receptors. The recommendations of the Final Phase II EI were based on the risk threshold of HI greater than 10. However, since the publication of the Final Phase II EI, the Army has performed additional analysis on those sites for which the HI falls between 1 and 10. There were four such sites: EI Site 6, SM18, SM25i, and 30. The results of this analysis are included as an attachment to this responsiveness summary.

The Army maintains, however, that a resultant HI between 1 and 10 does not directly trigger remediation. Interpreting such a result requires site-specific evaluation and risk-management decisions. This interpretation of HIs is consistent with the Tri-service Procedural Guidelines For Ecological Risk Assessment (Wentsel et al., 1996). In this guidance, Menzie, et al. 1996, advanced a ranking of HQs as follows:

HQ = 1 to 10 some small potential for adverse effects
HQ = 10 to 100 significant potential for adverse effects
HQ> 100 expected adverse effects.

Additionally, it should be noted that in the baseline ERA all hazard quotients were summed to present cumulative HIs, regardless of the mechanism of toxicity or mode of action. This assumption is inherently more conservative than His specific to a mode of action.

Regarding the exposure and effects assumptions in baseline ERA, verbal guidance from Ms. Brenda Jones at EPA was given that an arithmetic mean would be appropriate in the Baseline Round 2. Baseline Round 1 did use the 95% percentile as did the screening ERA. Unless a variety of exposure parameters (arithmetic mean, $UCL_{95\%}$) and a variety of effects (NOAEL, LOAEL) are used, the purpose for the screen and baseline are thwarted.

As stated in the introduction to the Responsiveness Summary, the Army will not be issuing a revised Proposed Plan. However, this ROD includes a presentation of the risk assessment results, and that presentation includes the details requested by the commentor.

Baseline ERA assumptions in Round 1 are NOAEL (RME concentration). Baseline ERA assumptions in Round 2 are NOAEL (Average concentration).

Comment 5:

The proposed plan does not discuss the need for implementing deed restrictions or other institutional controls to limit site use to the anticipated land uses and exposure scenarios evaluated in the baseline risk assessment. Because the Army has not demonstrated that no action is protective of human health for certain land uses (such as residential use), institutional controls are required to ensure that the EI sites are not used for purposes other than those evaluated in the baseline risk assessment and the land uses that should be prohibited through the use of deed restrictions are summarized in the table below: (table omitted from response).

The Army should revise the proposed plan to discuss institutional controls that will be implemented for FBH.

Response:

The Army evaluated human health risks based on the approved FBH reuse plan. It is the responsibility of future users to evaluate risk should there be a change from the reuse plan. No deed restrictions or other institutional controls are necessary at any of the EI sites recommended for no further action.

Comment 6:

As commented previously by IDEM staff (IDEM 1998b), the Phase II EI report (SAIC 1998) contains various errors, omissions, inconsistencies, and the need for further classification regarding both the human health and ecological risk assessment components of the Phase II EI report. The majority of IDEM staff's technical review comments are reproduced below. Individual comments that impact primarily the organization and appearance of the Phase II EI

report are not reproduced. The remaining comments may impact the numeric estimates of EI site-specific risks and hazards and therefore the need for remedial action at specific EI sites. The U.S. Army should therefore revise the Phase II EI report to address IDEM staff's technical review comments. Based on the revised risk and hazard results, the proposed plan should be revised as necessary and resubmitted. At a minimum, the proposed plan should reference the revised Phase II EI report.

Response:

Included in this Responsiveness Summary are the Army's final resolution of comments received from IDEM on the Final Phase II EI. As stated in the Introduction to this Responsiveness Summary, budget and program constraints preclude a revised publication of the Final Phase II EI Report. The responses herein should be viewed, where appropriate, as amending the Final Phase II EI Report. The conclusions expressed in these responses may amend, but do not change, the conclusions of the Phase II EI.

Comment 7:

The proposed plan does not discuss a range of alternatives for the EI sites. Following preparation of a FS, the proposed plan should be revised to discuss a range of remedial alternatives for the sites and provide a brief analysis of the alternatives for the sites and provide a brief analysis of the alternatives with respect to the nine evaluation criteria listed in 40 CFR 300 430. As currently written, the proposed plan does not allow the public or state to assess alternative remedial options for the EI Sites.

Response:

The development of remedial alternatives is not necessary for sites that have been shown through a Baseline Risk Assessment to pose no unacceptable risk.

Comment 8:

Section 40 CFR 300.430(f)(4)(ii) states that if a remedial action is selected that results in hazardous substances remaining at the site exceeding levels that allow unlimited use and unrestricted exposure, the lead agency shall review the remedial action no less often than every five years after initiation of the remedial action.

Response:

The comment is noted. Five-year reviews are implemented under CERCLA for remedial action and to calculate whether the response action remains protective of public health and the environment. However, no remedial action is planned for the NFA sites, and therefore five-year reviews are unnecessary.

Comment 9:

The summary of risks does not state the ELCR levels in an easily understood manner for the general public. As suggested by the proposed plan guidance, the ELCR levels should be

accompanied by a discussion that explains, for example, that an ELCR level of 10^{-4} means that one additional person out of ten thousand is at risk for developing cancer if the site is not remediated. The proposed plan should be revised to state the ELCR levels in an easily understood manner for the general public.

Response:

As stated previously, the Proposed Plan is not being revised; however, language requested in the comment has been incorporated into the ROD.

SPECIFIC COMMENTS

Comment 1. Introduction, Page 1.

The introduction refers to the "Final Phase I EI Report (HLA 1996)." However, according to the references at the end of the proposed plan, this document was completed in 1995. Therefore, the above-referenced document should be cited as "(HLA 1995)."

Response:

The comment has been noted.

Comment 2. Summary of Environmental Investigation Results, EI Site 6, Page 5; and Preferred Alternative: No Further Action, Page 8.

Page 5 of the proposed plan states with regard to EI Site 6, "In the Phase II EI, the Army recommends the removal and proper disposal of the water and sediment in the settling basin once reuse is begun." Alternatively, page 8 of the proposed plan states with regard to EI Site 6, "As a result, the EI recommends that the reuser remove the sediment and water from the settling basin."

Contrary to these statements, Table 7-1 in the Phase II EI report recommends the following for EI Site 6 based on unacceptable risk to ecological receptors from sediment in the settling basin: "Remove water and sediment from the settling basin. Once this action is complete, no further action is planned." As is evident in this statement, the Phase II EI report does recommend that the water and sediment be removed from the settling basin at EI Site 6. However, the Phase II EI report does not recommend that this action be completed by the reuser.

Because contaminated sediments in the settling basin are site-related, the Army should complete the necessary remedial action of removing water and sediment from the settling basin prior to property transfer. It should not be the responsibility of the reuser to conduct the remedial action. The proposed plan should be revised to state that the Army will remove water and sediment from the settling basin prior to property transfer.

Response:

The comment is noted. As stated in Section 4.5.4 EI Site 6 Summary and in Table 7-1, Conclusions and Recommendations of the Final Phase II EI Report, removal of water and

sediment from the settling basin has been recommended for EI Site 6. This will be accomplished by the redeveloper of the property.

Comment 3. Summary of Environmental Investigation Results, EI Site SM18, Page 6.

The proposed plan states, "The ecological risk assessment indicated an unacceptable risk to ecological receptors from pesticides in the surface soil. However, in the summer of 1998 the risk-causing contaminated soil was removed and disposed along with Building 27." However, Table 6-21 of the Phase II EI report (SAIC 1998) identifies HI's equal to 239 based on lead exposure for a robin, 21 based on lead exposure for a shrew, and 28.1 based on zinc exposure for a robin. The proposed plan should be revised to clarify that the on-site concentrations of lead and zinc used to calculate these HI's are within the range of background concentrations.

Response:

The comment is noted. However, soil at EI Site SM 18 was remediated by the Army in the summer of 1998; therefore, the risk associated with lead and zinc has been mitigated.

Comment 4. Summary of Environmental Investigation Results, EI Sites SM25b,c, Page 6.

The discussion regarding EI Sites 25b,c refers to a "Phase II EI" that was completed in "1995/96." However, this earlier "Phase II EI" report (SAIC 1995, Final Phase II Environmental Investigation Report, Fort Benjamin Harrison Sites SM25b and SM25c, Marion County, Indiana") is not referenced in the proposed plan. Also, the Human Health Risk Assessment (Section 6.0) and the Conclusions and Recommendations (Section 7.0) sections of the current Phase II EI report (SAIC 1998) do not reference the earlier "Phase II EI" as the primary source of the risk assessment results for EI Site SM25b,c. The Phase II EI report (SAIC) and the proposed plan should be revised to reference the earlier "Phase II EI report (SAIC 1995) as the source of the risk assessment results for EI Sites SM25b,c.

In addition, the proposed plan states, "Human health risk is below the target levels, HI of 1 and cancer risk of 1×10^{-4}." However, as stated in Section 4.13.4.1 of the current Phase II EI report (SAIC 1998), the carcinogenic risk for the groundskeeper receptor is 1.2×10^{-4}. Consistent with standard risk assessment procedures, this risk should be reported with only one significant figure or 1×10^{-4}. Therefore, the proposed plan should be revised to clarify that the carcinogenic risk for EI Sites SM25b,c, equals the target level of 1×10^{-4} for the groundskeeper receptor.

Response:

Sites SM25b and SM25c were investigated by the Army in 1995 under a separate EI program. The detailed results of this investigation are summarized in the Final Phase II EI Report (SAIC, August 1998). No total hazard index exceeded 1 for any receptor at EI Sites SM25b and SM25c. No chemical-specific risk exceeded 1×10^{-4}. Complete results of this investigation are presented in Final Phase II EI Report for FBH Sites SM25b and SM25c, Marion County, Indiana, 1995 (SAIC, 1995).

Comment 5. Summary of Environmental Investigation Results, EI Site SM27, Page 7.

The proposed plan states that the carcinogenic risk of 2 x 10^{-4} calculated for EI Site SM27 is driven by polycyclic aromatic hydrocarbon (PAH) contamination (primarily benzo(a)pyrene) in soil. The proposed plan further states, "The area of contamination appears to be confined to the area around two surface soil locations." However, the proposed plan concludes that "no further action is recommended for EI Site SM27." Several problems exist with this conclusion and the proposed plan's characterization of the soil contamination contributing to the site-specific carcinogenic risk. First, the site-specific carcinogenic risk level of 2 x 10^{-4} exceeds the stated target of 1 x 10^{-4} (see also General Comment 1 regarding this target level). No further action is inappropriate when a site-specific carcinogenic risk greater than 1 x 10^{-4} is identified. Second, the proposed plan provides no documentation for the statement regarding the extent of soil contamination contributing to the carcinogenic risk. The proposed plan should be revised to include excavation and removal of PAH-contaminated soil at EI Site SM27 to reduce the site-specific carcinogenic risk to, at a minimum, 1 x 10^{-4}.

Response:

The Army maintains that no-further-action is an appropriate response at EI Site SM27. The cancer risk only slightly exceeds the threshold (2 x 10^{-4}), and this cancer risk is being driven by dermal absorption of PAHs in the soil. Firstly, PAHs were detected at elevated concentrations at only two of the five sampling locations, indicating these constituents are not widespread. Secondly, the two samples showing the highest concentrations of PAHs were located nearest to the asphalt running track. Asphalt is a well-known source of PAHs and the running track is situated such that runoff from the track flows downhill, over Site SM27, before draining the area. Finally, PAHs were not detected in similar concentrations at the other former sewage treatment plant investigated (EI Site SM26). Concentrations of PAHs at SM26 were consistently 10-50 times less than at SM27. The adjacent asphalt running track is the likely source of the PAHs at EI Site SM27, not activities associated with the operation of the former sewage treatment plant.

5. COMMENTS FROM MR. GERALD W. O'CALLAGHAN ON THE PROPOSED PLAN FOR NFA SITES, DATED JANUARY 21, 1999.

Comment 1:

I have studied Toxicology and Risk Assessment, and I know that the range of acceptable exposure levels for carcinogens is from 10 E-4 to 10E-6. The Plan used 10E-4 as the cut off point for carcinogenic risk factor, when it is common practice to use the more conservative practice of 10E-6. This lower figure is more reasonable given the uses of the site, which include a state park, you recreational fields, and residential properties. The possibilities for dermal contact, especially for children, is real and the public deserves the safer, lower concentrations.

Response:

The NCP defines the target cancer risk range as 1×10^{-6} to 1×10^{-4}. However, the selection of which value within the range to use as the target is a management decision.

Use of 1×10^{-4} as the target cancer risk is common. It is cited in EPA Region IV guidance and has been adopted by other EPA regions. If 1×10^{-4} is used as the target for an exposure pathway, then the chemical contributors identified as COCs have individual cancer risks within the target cancer risk range.

If 1×10^{-6} is used as the target for an exposure pathway, then the chemical contributors identified as COCs have individual cancer risks below 1×10^{-6}. Cleanup for chemicals with cancer risks less than 1×10^{-6} is generally not warranted.

Comment 2:

EI Site SM27, the former sewage treatment plant, has PAHs in the soil above even the upper limit carcinogenic risk factor of 10E-4. Also, benzo(a) pyrene levels are above the IDEM Tier II cleanup goals for nonresidential land use. Some form of remediation is required in this area.

Response:

The Army maintains that no-further-action is an appropriate response at EI Site SM27. The cancer risk only slightly exceeds the threshold (2×10^{-4}), and this cancer risk is being driven by dermal absorption of PAHs in the soil. First, PAHs were detected at elevated concentrations at only two of the five sampling locations, indicating these constituents are not widespread. Second, the two samples showing the highest concentrations of PAHs were located closest to the asphalt running track. Asphalt is a well-known source of PAHs and the running track is situated such that runoff from the track flows downhill, over Site SM27, before flowing into the creek that drains the area. Finally, PAHs were not detected in similar concentrations at the other former sewage treatment plant investigated (EI Site SM26). Concentrations of PAHs at SM26 were consistently 10-50 times less than at SM27. The adjacent asphalt running track is the likely source of the PAHs at EI Site SM27, not activities associated with the operation of the former sewage treatment plant.

Comment 3:

EI Site 30, the Beaumont Triangle, also has soil levels above the upper limit risk factor of 10E-4. This area is used for children's soccer, football, and baseball leagues, so the danger of dermal contact is very real. This area should be remediated.

Response:

EI Site 30 is an open field located in the Benjamin Harrison Army Reserves Center. It is zoned for commercial use should the property ever leave Army ownership. Ball fields for the use of Army reservists are located north of the site, but the area of the site is not open for public use. The site was historically used for coal storage. The human health risk is due to PAHs in surface soil, which at the former Fort Benjamin Harrison are attributable to the basewide use of coal. Additionally, the PAH concentrations fall below the IDEM Tier II cleanup goals for non-residential land use."

Comment 4:

EI Site 31, the former salvage yard, has lead levels in the soil above the approved levels. This area should be remediated.

Response:

There was only one location where the lead concentration exceeded 440 mg/kg, the BCT-approved cleanup goal at the firing ranges. The data do not suggest widespread contamination at this unit, and given the small difference between the maximum concentration (456 mg/kg) and the cleanup goal, actual risk from lead exposure is unlikely. Further, EI Site 31 is heavily forested. Given the very small, incremental risk from contamination, the Army concludes that the harm done to the forest ecosystem by performing remediation would far outweigh any slight benefits.

ATTACHMENT TO THE RESPONSIVENESS SUMMARY

Introduction

The Army has reevaluated its position on the decision rule for risk to ecological receptors. The Final Phase II EI used an HI of 10 or greater as the threshold of unacceptable risk posed by contaminants in surface soil. Since the publication of the Final Phase II EI, the Army has performed additional studies on sites for which the resulting HIs from constituents in the surface soil were greater than 1. The purpose of this attachment is to present the results of these studies.

Several sites investigated in the EI pose risk to ecological receptors at levels resulting in an HI greater than 1. The risk at three of these sites (SM22, SM23, and SM24) has been mitigated by a removal action. Another site (SM18) was also remediated. Three other sites (SM20, SM21, and SM26) are being investigated in a focused feasibility study, and if necessary, remediation of these sites will be conducted. The ecological risk assessment for another eight sites (6, SM19, SM25i, SM25j, SM25h, SM27, 30, and 31) suggests degrees of risk; however, further analysis of data relative to background concentration, approved remediation goals for the firing ranges, or distribution of the COC in question, reveal that the HI for many of these sites does not accurately reflect the actual risk. This reasoning and the basis for concluding no-further-action at sites is outlined in the Final Phase II EI. The Army received several comments related to these sites, and consequently, the discussion of these sites is expanded in Section 6 of this ROD.

The revision of the decision rule has meant that four sites required further study. These sites previously concluded with no further action because the HI was at or near 10. The four sites are:

- EI Site 6—Former Coal Storage Yard, Building 2
- EI Site SM19—Pesticide Mining and Storage Area, Building 514
- EI Site SM25i—Historic Military Site used around World War I (1908+)
- EI Site 30—Beaumont Triangle Area used for open storage of coal.

The following sections describe the additional analysis that has been performed to assess the ecological risk at these four sites. The most important component of this analysis is the application of baseline ERA assumptions. All four sites were subject to the screening ERA, but none of them were carried into the baseline ERA in the Final Phase II EI because they fell below an HI of 10. Computing HIs under the assumptions of the baseline ERA was necessary for these four sites in order to make informed risk-management judgments.

Background

Recent EPA (1997) guidance outlines an eight-step process for documenting whether actual or potential ecological impacts exist at a site, identifying which contaminants at a hazardous waste site pose a risk and generating data to be used in evaluating cleanup options. The screening-level ERA comprised Steps 1 and 2 of that process. Screening-level ERAs are simplified risk assessments that can be conducted with limited data by assuming values for exposure and toxicity parameters for which data are lacking. Assumptions for exposure and toxicity values are biased toward overestimating risk in a screening-level assessment.

Conservative assumptions are important to ensure that sites are not dismissed from further evaluation in a baseline ERA when an unacceptable risk actually exists at the site. As specified by EPA (1997), there are only three possible decisions for a site at the end of the screening-level ERA:

- There is adequate information to conclude that ecological risks are negligible and therefore remediation is not needed on the basis of ecological risk

- The information indicates, adverse ecological effects, and a more thorough assessment is warranted, leading to remediation

- The information is not adequate to make a decision at this point, and the ecological risk assessment will continue to the baseline ecological risk assessment (Steps 3-7).

As explained in the Introduction, due to the Army's reconsideration of the decision rule, the third decision point was reached for four sites, and a baseline ecological risk assessment was required. Briefly, the baseline ERA consists of two types of computations: Round 1 and Round 2, where three variables are made more realistic and less conservative.

The baseline ERA (Steps 3-7 of the eight-step process) addresses which contaminants pose a risk, whether actual or potential, and which sites should be evaluated from a cleanup perspective. The baseline ERA accomplishes these tasks by refining some of the overly conservative assumptions used in the screening-level ERA. For example, the analysis phase of the baseline ERA (Step 6) requires replacing generic data from Round 1 wherever possible with species- or site-specific data in Round 2. (For example, the arithmetic-mean concentration is used in Round 2 as opposed to the 95% UCL in Round 1 because it is a more realistic estimate of the central tendency exposure to the members of the receptor population from contaminants distributed lognormally.)

Furthermore, species-specific home-range information is used in the analysis phase of the baseline ERA to estimate more accurately the percentage of the receptor's exposure that comes from the contaminated area. For example, the assumption that the home ranges of all terrestrial receptor species are entirely within the contaminant area (AUF = 1), and thus, the animals obtain 100 percent of their ingestion (i.e., food, water, soil) from the exposure area, is conservative. The conservative assumption that AUF = 1 is applicable to screening-level assessments (EPA 1997). The baseline ERA attempts to incorporate more realistic exposure information to recalculate an AUF. Comparing the species home range to actual site size results in a proportion for the exposure to the area. For more specific information concerning the methodologies of the screening-level and baseline ERAs see Section 6.7 of the FBH ERA (1998, Methods and Findings of Baseline ERA).

Risk Management (Step 8) decisions are based upon information from both the screening-level ERA and the baseline ERA (Round 1 and Round 2). However, when both Round 1 and Round 2 results are available for a particular site or group of sites, the Round 2 results should be relied upon more heavily, as they contain more realistic results from a more comprehensive analysis.

The former decision rule of HI-greater-than-10 applied only to surface soil; therefore, these calculations focus on surface soil only. The ecological receptors are the same as previously used: earthworms, shrews, robins, and cottaintails. The larger home-range receptors (deer, fox, bat, and hawk) were not analyzed because their screening HIs were below 1.0.

Results

A summary of the results of this analysis is presented below. Detailed results of the Baseline Round 1 and Round 2 are found in Tables 1 through 32. These tables show the changes in hazard quotients (HQs) and hazard indices (sum of all HQs or HIs).

EI Sites 19 and SM25i show HIs in Round 2 to be less than 1 for all receptors. EI sites 6 and 30 show HIs in Round 2 being greater than 1 but relatively low (ranging from 1 to 5).

Summary of Hazard Indexes Baseline Ecological Risk Assessment (Round 2) for EI Sites 6, SM19, SM25i, and 30

EI Site	Earthworm	Shew	American Robin	Eastern Cottontail
6	5.88E-01	5.13	1.92	7.85E-01
SM19	0.00	2.23E-01	5.81E-01	5.45E-04
SM25i	0.00	9.19E-06	0.00	4.42E-07
30	1.63E-02	3.20	9.86E-01	1.44

Discussion

EI Sites SM19 and SM25i—The baseline ERA showed that these two sites have HQs and HIs less than 1. This indicates that there is no unacceptable ecological risk and that no remediation is required. This conclusion is supported by the findings of the human health risk assessment, which are that no HIs or cancer risks exceed target levels (HI of 1 and a cancer risk of 1×10^{-4}).

EI Site 6— Arsenic and cadmium are the principal ecological COCs to small mammals, and cadmium to small birds. The risk posed by these COCs slightly exceeds the threshold according to Round 2 of the baseline ERA. However, only one surface soil sample (SB-CS-09) had an arsenic value (12.6 mg/kg) above the background 95% UTL of 12 mg/kg. The site mean average for arsenic is 6.7 mg/kg, while the background mean is 5.7 mg/kg. There is no background maximum value or UTL listed for cadmium in Appendix N. At the site, only 6 out of 20 surface samples had detectable concentrations of cadmium. These ranged from 0.66 to 2.1 mg/kg; all others were below detection (0.55 mg/kg). The site mean value was calculated in Appendix N as being 0.56 mg/kg, the same as the detection limit. Thus, there are a few elevated metals, though they are not widespread. Remediation is not warranted where the COC concentrations were detected in just a few samples above detection limits or background.

Based on this analysis, the Army has concluded that further investigation of EI Site 6 is not warranted, and that no further action is required.

EI Site 30—Antimony is the principal source of risk to small mammals (e.g., shrews and cottontails). However, antimony was detected in only one site sample. The concentration was 7.3 mg/kg and was flagged with a "B" by the lab. The other 11 samples were all below detection limits (5.1 to 6.4 mg/kg). There is no background UTL listed in Appendix N for comparison. The ecological COC was only detected in one sample at concentrations just barely above detection limits.

Another issue that must be addressed when making all risk management decisions is the balancing of two types of ecological risk: the risk from the contaminants in the soil and the risk from removing the contamination or the remediation of the habitat.

Regarding the risk from the contaminants: It has been established that baseline-level ecological risk exhibits high HQs to various receptors at EI Site 30. As stated earlier, the ecological risk seems sufficient to warrant further investigation into possible cleanup.

Regarding the risk from remediation: The habitat would be greatly altered to remove the metal contamination by typical means (bobcats, dozers, backhoes, etc.). For example, removal of vegetation would be complete and top soil would be removed. The present habitat of bushes and hedgerows would be altered to a cleared area that offered little to no food and cover to ecological receptors. Ecological succession to recovery would be measured in decades.

Antimony was detected in only one location, and the resultant HI was only slightly higher than the threshold limit (HI=3.2 for the shrew). Based on this fact and the likelihood that attempting remediation would cause more ecological damage than it would prevent, the Army has concluded that further investigation of EI Site 30 is not warranted, and that no further action is an appropriate response.

Table 1. Hazard Quotient Table for Earthworms at EI Site 6 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	**EI Site concentration RME** (mg/kg)	**Earthworm TRV** (mg/kg)	**EI Site HQ** RME / TRV	**%HI** HQ / HI *x* 100
Inorganics				
Arsenic	9.59E+00	6.00E+01	1.60E-01	18.95%
Cadmium	7.95E-01	2.00E+01	3.97E-02	4.71%
Calcium	9.09E+04	No TRV	No TRV	No HQ
Copper	3.19E+01	5.00E+01	6.38E-01	75.62%
Magnesium	3.51E+04	No TRV	No TRV	No HQ
Selenium	3.20E-01	7.00E+01	4.57E-03	0.54%
Silver	3.74E-01	No TRV	No TRV	No HQ
Organics				
Acenaphthene	1.77E-02	No TRV	No TRV	No HQ
Acenaphthylene	2.47E-02	No TRV	No TRV	No HQ
Anthracene	1.07E-01	No TRV	No TRV	No HQ
Benzo(a)anthracene	5.70E-01	No TRV	No TRV	No HQ
Benzo(a)pyrene	6.85E-01	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	7.06E-01	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	3.20E-01	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	9.40E-01	No TRV	No TRV	No HQ
Butylbenzylphthalate	1.20E-02	No TRV	No TRV	No HQ
Carbazole	2.88E-02	No TRV	No TRV	No HQ
Chrysene	1.10E+00	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracen	1.80E-01	No TRV	No TRV	No HQ
Dibenzofuran	2.80E-02	No TRV	No TRV	No HQ
Di-n-butylphthalate	1.53E-02	No TRV	No TRV	No HQ
Fluoranthene	5.52E-01	No TRV	No TRV	No HQ
Fluorene	4.72E-02	3.00E+01	1.57E-03	0.19%
Indeno(1,2,3-cd)pyrene	5.33E-01	No TRV	No TRV	No HQ
2-Methylnaphthalene	8.68E-02	No TRV	No TRV	No HQ
Naphthalene	4.23E-02	No TRV	No TRV	No HQ
Phenanthrene	3.28E-01	No TRV	No TRV	No HQ
Pyrene	1.25E+00	No TRV	No TRV	No HQ
			HI =	8.44E-01

TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 2. Hazard Quotient Table for Short-tailed Shrew at EI Site 6 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	BAF_1	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Arsenic	9.59E + 00	8.00E-03	5.59E-03	6.60E-03	3.08E-02	6.98E-01	7.35E-01	1.45E-01	5.06E+00	65.63%
Cadmium	7.95E-01	1.10E-01	6.37E-03	1.10E+01	4.26E+00	5.79E-02	4.32E+00	2.05E+00	2.10E+00	27.30%
Calcium	9.09E + 04	7.00E-01	4.63E+03	1.00E+00	4.43E+04	6.61E+03	5.55E+04	No TRV	No TRV	No HQ
Copper	3.19E + 01	8.00E-02	1.86E-01	1.60E-01	2.49E+00	2.32E+00	5.00E+00	3.24E+01	1.54E-01	2.00%
Magnesium	3.51E + 04	2.00E-01	5.12E+02	1.00E+00	1.71E+04	2.56E+03	2.02E+04	No TRV	No TRV	No HQ
Selenium	3.20E-01	5.00E-03	1.16E-04	7.60E-01	1.18E-01	2.33E-02	1.42E-01	4.26E-01	3.33E-01	4.32%
Silver	3.74E-01	8.00E-02	2.18E-03	1.50E-01	2.73E-02	2.72E-02	5.68E-02	No TRV	No TRV	No HQ
Organics										
Acenaphthene	1.77E-02	2.00E-02	2.58E-05	5.00E-02	4.31E-04	1.29E-03	1.74E-03	No TRV	No TRV	No HQ
Acenaphthylene	2.47E-02	2.00E-02	3.59E-05	5.00E-02	6.01E-04	1.80E-03	2.43E-03	No TRV	No TRV	No HQ
Anthracene	1.07E-01	2.00E-02	1.56E-04	5.00E-02	2.61E-03	7.81E-03	1.06E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	5.70E-01	3.90E-03	1.62E-04	5.00E-02	1.39E-02	4.15E-02	5.56E-02	No TRV	No TRV	No HQ
Benzo(a)pyrene	6.85E-01	2.60E-03	1.30E-04	5.00E-02	1.67E-02	4.99E-02	6.67E-02	1.15E+00	5.79E-02	0.75%
Benzo(b)fluoranthene	7.06E-01	2.30E-03	1.18E-04	5.00E-02	1.72E-02	5.14E-02	6.87E-02	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	3.20E-01	1.20E-03	2.79E-05	5.00E-02	7.79E-03	2.33E-02	3.11E-02	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	9.40E-01	2.30E-03	1.57E-04	5.00E-02	2.29E-02	6.84E-02	9.15E-02	No TRV	No TRV	No HQ
Butylbenzylphthalate	1.20E-02	2.00E-02	1.74E-05	5.00E-02	2.92E-04	8.72E-04	1.18E-03	No TRV	No TRV	No HQ
Carbazole	2.88E-02	2.00E-02	4.19E-05	5.00E-02	7.00E-04	2.09E-03	2.84E-03	No TRV	No TRV	No HQ
Chyrsene	1.10E + 00	3.90E-03	3.12E-04	5.00E-02	2.68E-02	8.01E-02	1.07E-01	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	1.80E-01	1.40E-03	1.84E-05	5.00E-02	4.39E-03	1.31E-02	1.75E-02	No TRV	No TRV	No HQ
Dibenzofuran	2.80E-02	2.00E-02	4.07E-05	5.00E-02	6.82E-04	2.04E-03	2.76E-03	No TRV	No TRV	No HQ
Di-n-butylphthalate	1.53E-02	7.60E-03	8.44E-06	5.00E-02	3.71E-04	1.11E-03	1.49E-03	6.34E+02	2.35E-06	0.00%
Fluoranthene	5.52E-01	2.00E-02	8.04E-04	5.00E-02	1.35E-02	4.02E-02	5.45E-02	No TRV	No TRV	No HQ
Fluorene	4.72E-02	2.00E-02	6.87E-05	5.00E-02	1.15E-03	3.43E-03	4.65E-03	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	5.33E-01	1.20E-03	4.66E-05	5.00E-02	1.30E-02	3.88E-02	5.19E-02	No TRV	No TRV	No HQ
2-Methylnaphthalene	8.68E-02	2.00E-02	1.26E-04	5.00E-02	2.12E-03	6.32E-03	8.56E-03	No TRV	No TRV	No HQ
Naphthalene	4.23E-02	2.00E-02	6.15E-05	5.00E-02	1.03E-03	3.08E-03	4.17E-03	No TRV	No TRV	No HQ
Phenanthrene	3.28E-01	2.00E-02	4.78E-04	5.00E-02	7.99E-03	2.39E-02	3.24E-02	No TRV	No TRV	No HQ
Pyrene	1.25E + 00	6.70E-03	6.09E-04	5.00E-02	3.04E-02	9.09E-02	1.22E-01	No TRV	No TRV	No HQ
								HI =	7.71E+00	

RME = Reasonable maximum exposure
SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.28E-02
AUF = 1.00E+00
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 4.87E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 7.28E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 3. Hazard Quotient Table for American Robin at EI Site 6 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_r	ADD_P (mg/kgBW/d) RME *x* Sp_r *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total}/ TRV	%HI HQ/HI *x* 100
Inorganics										
Arsenic	9.59E+00	1.20E-03	8.75E-03	6.60E-03	4.81E-02	1.52E+00	1.57E+00	9.66E+00	1.63E-0l	5.48%
Cadmium	7.95E-01	3.00E-02	1.81E-02	1.10E+01	6.65E+00	1.26E-01	6.79E+00	2.83E+00	2.40E+00	80.76%
Calcium	9.09E+04	7.00E-02	4.83E+03	1.00E+00	6.90E+04	1.44E+04	8.82E+04	No TRV	No TRV	No HQ
Copper	3.19E+01	5.00E-02	1.21E+00	1.60E-01	3.88E+00	5.04E+00	1.01E+01	7.55E+01	1.34E-01	4.51%
Magnesium	3.51E+04	1.10E-01	2.94E+03	1.00E+00	2.67E+04	5.56E+03	3.52E+04	No TRV	No TRV	No HQ
Selenium	3.20E-01	5.00E-03	1.22E-03	7.60E-01	1.85E-01	5.06E-02	2.37E-01	9.40E-01	2.52E-01	8.46%
Silver	3.74E-01	2.00E-02	5.69E-03	1.50E-01	4.27E-02	5.91E-02	1.07E-01	No TRV	No TRV	No HQ
Organics										
Acenaphthene	1.77E-02	2.00E-02	2.69E-04	5.00E-02	6.72E-04	2.80E-03	3.74E-03	No TRV	No TRV	No HQ
Acenaphthylene	2.47E-02	2.00E-02	3.75E-04	5.00E-02	9.37E-04	3.90E-03	5.21E-03	No TRV	No TRV	No HQ
Anthracene	1.07E-01	2.00E-02	1.63E-03	5.00E-02	4.07E-03	1.69E-02	2.27E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	5.70E-01	3.90E-03	1.69E-03	5.00E-02	2.17E-02	9.01E-02	1.13E-01	No TRV	No TRV	No HQ
Benzo(a)pyrene	6.85E-01	2.60E-03	1.35E-03	5.00E-02	2.60E-02	1.08E-01	1.36E-01	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	7.06E-01	2.30E-03	1.23E-03	5.00E-02	2.68E-02	1.12E-01	1.40E-01	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	3.20E-01	1.20E-03	2.91E-04	5.00E-02	1.21E-02	5.05E-02	6.30E-02	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	9.40E-01	2.30E-03	1.64E-03	5.00E-02	3.57E-02	1.49E-01	1.86E-01	No TRV	No TRV	No HQ
Butylbenzylphthalate	1.20E-02	2.00E-02	1.82E-04	5.00E-02	4.55E-04	1.89E-03	2.53E-03	No TRV	No TRV	No HQ
Carbazole	2.88E-02	2.00E-02	4.37E-04	5.00E-02	1.09E-03	4.55E-03	6.07E-03	No TRV	No TRV	No HQ
Chrysene	1.10E+00	3.90E-03	3.26E-03	5.00E-02	4.18E-02	1.74E-01	2.19E-01	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	1.80E-01	1.40E-03	1.92E-04	5.00E-02	6.86E-03	2.85E-02	3.56E-02	No TRV	No TRV	No HQ
Dibenzofuran	2.80E-02	2.00E-02	4.25E-04	5.00E-02	1.06E-03	4.42E-03	5.91E-03	No TRV	No TRV	No HQ
Di-n-butylphthalate	1.53E-02	7.60E-03	8.81E-05	5.00E-02	5.80E-04	2.41E-03	3.08E-03	1.31E-01	2.35E-02	0.79%
Fluoranthene	5.52E-01	2.00E-02	8.39E-03	5.00E-02	2.10E-02	8.73E-02	1.17E-01	No TRV	No TRV	No HQ
Fluorene	4.72E-02	2.00E-02	7.17E-04	5.00E-02	1.79E-03	7.46E-03	9.97E-03	No TRY	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	5.33E-01	1.20E-03	4.86E-04	5.00E-02	2.03E-02	8.43E-02	1.05E-01	No TRV	No TRV	No HQ
2-Methylnaphthalene	8.68E-02	2.00E-02	1.32E-03	5.00E-02	3.30E-03	1.37E-02	1.83E-02	No TRV	No TRV	No HQ
Naphthalene	4.23E-02	2.00E-02	6.42E-04	5.00E-02	1.61E-03	6.68E-03	8.93E-03	No TRV	No TRY	No HQ
Phenanthrene	3.28E-01	2.00E-02	4.99E-03	5.00E-02	1.25E-02	5.19E-02	6.93E-02	No TRV	No TRV	No HQ
Pyrene	1.25E+00	6.70E-03	6.36E-03	5.00E-02	4.75E-02	1.97E-01	2.51E-01	No TRV	No TRV	No HQ
								HI =	2.98E+00	

RME = Reasonable maximum exposure
SP_r = Soil-to-plant; reproductive
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.60E-01
AUF = 1.00E+00
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 7.60E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.58E-01
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 4. Hazard Quotient Table for Eastern Cottontail at EI Site 6 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	**EI Site concentration RME** (mg/kg)	**SP_v**	**ADD_P** (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	**BAF_v**	**ADD_A** (mg/kgBW/d) RME *x* BAF_v *x* I_A *x* AUF	**ADD_S** (mg/kgBW/d) RME *x* I_S *x* AUF	**ADD_{total}** (mg/kgBW/d) ADD_P + ADD_A + ADD_S	**Body Weight Adjusted TRV** (mg/kgBW/d)	**EI Site HQ** ADD_{total}/ TRV	**%HI** HQ/HI *x* 100
Inorganics										
Arsenic	9.59E+00	8.00E-03	6.03E-03	1.00E-01	0.00E+00	4.75E-02	5.35E-02	4.98E-02	1.08E+00	94.03%
Cadmium	7.95E-01	1.10E-01	6.87E-03	2.80E-02	0.00E+00	3.94E-03	1.08E-02	7.05E-01	1.53E-02	1.34%
Calcium	9.09E+04	7.00E-01	5.00E+03	1.00E+00	0.00E+00	4.50E+02	5.45E+03	No TRV	No TRV	No HQ
Copper	3.19E+01	8.00E-02	2.01E-01	5.00E-01	0.00E+00	1.58E-01	3.59E-01	1.11E+01	3.22E-02	2.82%
Magnesium	3.51E+04	2.00E-01	5.52E+02	1.00E+00	0.00E+00	1.74E+02	7.26E+02	No TRV	No TRV	No HQ
Selenium	3.20E-01	5.00E-03	1.26E-04	7.50E-01	0.00E+00	1.58E-03	1.71E-03	1.46E-01	1.17E-02	1.02%
Silver	3.74E-01	8.00E-02	2.35E-03	1.50E-01	0.00E+00	1.85E-03	4.20E-03	No TRV	No TRV	No HQ
Organics										
Acenaphthene	1.77E-02	2.00E-02	2.78E-05	1.20E-02	0.00E+00	8.76E-05	1.15E-04	No TRV	No TRV	No HQ
Acenaphthylene	2.47E-02	2.00E-02	3.88E-05	1.90E-02	0.00E+00	1.22E-04	1.61E-04	No TRV	No TRV	No HQ
Anthracene	1.07E-01	2.00E-02	1.69E-04	4.80E-02	0.00E+00	5.31E-04	6.99E-04	No TRV	No TRV	No HQ
Benzo(a)anthracene	5.70E-01	3.90E-03	1.75E-04	7.60E-01	0.00E+00	2.82E-03	3.00E-03	No TRV	No TRV	No HQ
Benzo(a)pyrene	6.85E-01	2.60E-03	1.40E-04	1.50E+00	0.00E+00	3.39E-03	3.53E-03	3.95E-01	8.94E-03	0.78%
Benzo(b)fluoranthene	7.06E-01	2.30E-03	1.28E-04	1.90E+00	0.00E+00	3.50E-03	3.62E-03	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	3.20E-01	1.20E-03	3.01E-05	6.00E+00	0.00E+00	1.58E-03	1.61E-03	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	9.40E-01	2.30E-03	1.70E-04	1.90E+00	0.00E+00	4.65E-03	4.82E-03	No TRV	NoTRV	No HQ
Butylbenzylphthalate	1.20E-02	2.00E-02	1.88E-05	1.20E-01	0.00E+00	5.93E-05	7.82E-05	No TRV	No TRV	No HQ
Carbazole	2.88E-02	2.00E-02	4.52E-05	8.70E-03	0.00E+00	1.42E-04	1.88E-04	No TRV	No TRV	No HQ
Chrysene	1.10E+00	3.90E-03	3.37E-04	7.60E-01	0.00E+00	5.45E-03	5.78E-03	No TRV	No TRY	No HQ
Dibenzo(a,h)anthracene	1.80E-01	1.40E-03	1.98E-05	4.80E+00	0.00E+00	8.93E-04	9.13E-04	No TRV	No TRV	No HQ
Dibenzofuran	2.80E-02	2.00E-02	4.40E-05	1.90E-02	0.00E+00	1.39E-04	1.82E-04	No TRV	No TRV	No HQ
Di-n-butylphthalate	1.53E-02	7.60E-03	9.11E-06	2.40E-01	0.00E+00	7.55E-05	8.46E-05	2.17E+02	3.89E-07	0.00%
Fluoranthene	5.52E-01	2.00E-02	8.68E-04	1.30E-01	0.00E+00	2.73E-03	3.60E-03.	No TRV	No TRV	No HQ
Fluorene	4.72E-02	2.00E-02	7.41E-05	2.40E-02	0.00E+00	2.34E-04	3.08E-04	No TRV	No TRV	No HQ
Indeno(l,2,3-cd)pyrene	5.33E-01	1.20E-03	5.03E-05	6.00E+00	0.00E+00	2.64E-03	2.69E-03	No TRV	No TRV	No HQ
2-Methylnaphthalene	8.68E-02	2.00E-02	1.36E-04	1.90E-08	0.00E+00	4.30E-04	5.66E-04	No TRV	No TRV	No HQ
Naphthalene	4.23E-02	2.00E-02	6.64E-05	6.00E-03	0.00E+00	2.09E-04	2.76E-04	No TRV	No TRV	No HQ
Phenanthrene	3.28E-01	2.00E-02	5.16E-04	4.80E-02	0.00E+00	1.62E-03	2.14E-03	No TRV	No TRV	No HQ
Pyrene	1.25E+00	6.70E-03	6.58E-04	3.00E-01	0.00E+00	6.18E-03	6.84E-03	No TRV	No TRV	No HQ
								HI =	1.14E+00	

SP_v = Soil-to-plant; vegatative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 2.05E-01
AUF = 3.83E-01
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.29E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 5. Hazard Quotient Table for Earthworms at EI Site 19 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	**EI Site concentration RME** (mg/kg)	**Earthworm TRV** (mg/kg)	**EI Site HQ** RME / TRV	**%HI** HQ/HI *x* 100
Organics				
Aldrin	5.85E-03	No TRV	No TRV	No HQ
gamma BHC (Lindane)	2.48E-03	No TRV	No TRV	No HQ
alpha-Chlordane	6.79E-02	No TRV	No TRV	No HQ
gamma-Chlordane	4.53E-02	No TRV	No TRV	No HQ
4,4'-DDE	1.31E-02	No TRV	No TRV	No HQ
4,4' DDT	2.41E-02	No TRV	No TRV	No HQ
Dalapon	5.62E-02	No TRV	No TRV	No HQ
Dichloroprop	7.24E-02	No TRV	No TRV	No HQ
Dieldrin	9.08E-03	No TRV	No TRV	No HQ
Heptachlor Epoxide	2.12E-03	No TRV	No TRV	No HQ
MCPP	9.27E-02	No TRV	No TRV	No HQ
		HI =	0.00E+00	

TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 6. Hazard Quotient Table for Short-tailed Shrew at EI Site 19 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	**EI Site concentration RME** (mg/kg)	**SP_v**	**ADD_P** (mg/kgBW/d) RME *x* Sp_v *x* I_P *x* AUF	**BAF_i**	**ADD_A** (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	**ADD_S** (mg/kgBW/d) RME *x* I_S *x* AUF	**ADD_{total}** (mg/kgBW/d) ADD_P + ADD_A + ADD_S	**Body Weight Adjusted TRV** (mg/kgBW/d)	**EI Site HQ** ADD_{total}/TRV	**%HI** HQ/HI *x* 100
Organics										
Aldrin	5.85E-03	2.00E-02	6.63E-06	5.00E-02	1.11E-04	3.31E-04	4.49E-04	4.26E-01	1.05E-03	0.22%
gamma-BHC (Lindane)	2.48E-03	2.00E-02	2.81E-06	2.00E-02	1.88E-05	1.40E-04	1.62E-04	1.70E+01	9.51E-06	0.00%
alpha-Chlordane	6.79E-02	5.10E-03	1.96E-05	1.60E+00	4.12E-02	3.85E-03	4.50E-02	5.28E+00	8.53E-03	1.79%
gamma-Chlordane	4.53E-02	5.10E-03	1.31E-05	1.60E+00	2.75E-02	2.56E-03	3.00E-02	5.28E+00	5.69E-03	1.20%
4,4'-DDE	1.31E-02	2.00E-03	1.48E-06	1.70E+00	8.44E-03	7.42E-04	9.18E-03	No TRV	No TRV	No HQ
4,4'-DDT	2.41E-02	7.70E-04	1.05E-06	5.70E-01	5.20E-03	1.36E-03	6.56E-03	1.70E+00	3.85E-03	0.81%
Dalapon	5.62E-02	1.00E+00	3.18E-03	1.00E+00	2.13E-02	3.18E-03	2.77E-02	No TRV	No TRV	No HQ
Dichloroprop	7.24E-02	1.00E+00	4.10E-03	1.00E+00	2.75E-02	4.10E-03	3.57E-02	No TRV	No TRV	No HQ
Dieldrin	9.08E-03	2.00E-02	1.03E-05	5.50E+00	1.89E-02	5.14E-04	1.94E-02	4.26E-02	4.56E-01	95.97%
Heptachlor Epoxide	2.12E-03	5.90E-03	7.09E-07	1.00E+00	8.04E-04	1.20E-04	9.25E-04	No TRV	No TRV	No HQ
MCPP	9.27E-02	1.00E+00	5.25E-03	1.00E+00	3.51E-02	5.25E-03	4.56E-02	No TRV	No TRV	No HQ
									HI = 4.75E-01	

RME = Reasonable maximum exposure
SP_v = Soil-to-plant; vegatative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.28E-02
AUF = 7.78E-01
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 4.87E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 7.28E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 7. Hazard Quotient Table for American Robin at EI Site 19 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_r	ADD_P (mg/kgBW/d) RME *x* SP_r *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Organics										
Aldrin	5.85E-03	2.00E-02	5.93E-05	5.00E-02	1.48E-04	6.17E-04	8.25E-04	No TRV	No TRV	No HQ
gamma-BHC (Lindane)	2.48E-03	2.00E-02	2.51E-05	2.00E-02	2.51E-05	2.61E-04	3.12E-04	3.76E+00	8.29E-05	0.01%
alpha-Chlordane	6.79E-02	5.10E-03	1.75E-04	1.60E+00	5.51E-02	7.16E-03	6.24E-02	2.02E+00	3.08E-02	1.94%
gamma-Chlordane	4.53E-02	5.10E-03	1.17E-04	1.60E+00	3.67E-02	4.77E-03	4.16E-02	2.02E+00	2.06E-02	1.29%
4,4'-DDE	1.31E-02	2.00E-03	1.33E-05	1.70E+00	1.13E-02	1.38E-03	1.27E-02	No TRV	No TRV	No HQ
4,4'-DDT	2.41E-02	7.70E-04	9.39E-06	5.70E-01	6.95E-03	2.54E-03	9.50E-03	7.20E-03	1.32E+00	82.92%
Dalapon	5.62E-02	1.00E+00	2.85E-02	1.00E+00	2.85E-02	5.92E-03	6.29E-02	No TRV	No TRV	No HQ
Dichloroprop	7.24E-02	1.00E+00	3.67E-02	1.00E+00	3.67E-02	7.63E-03	8.10E-02	No TRV	No TRV	No HQ
Dieldrin	9.08E-03	2.00E-02	9.20E-05	5.50E+00	2.53E-02	9.56E-04	2.63E-02	1.20E-01	2.20E-01	13.84%
Heptachlor Epoxide	2.12E-03	5.90E-03	6.35E-06	1.00E+00	1.08E-03	2.24E-04	1.31E-03	No TRV	No TRV	No HQ
MCPP	9.27E-02	1.00E+00	4.69E-02	1.00E+00	4.69E-02	9.76E-03	1.04E-01	No TRV	No TRV	No HQ
									HI =	1.59E+00

RME = Reasonable maximum exposure
SP_r = Soil-to-plant; reproductive
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.60E-01
AUF = 6.67E-01
BAF_i = Soil to-animal; invertebrates
I_A(kg/kgBW/d) = 7.60E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.58E-01
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient

Table 8. Hazard Quotient Table for Eastern Cottontail at EI Site 19 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	**EI Site concentration RME** (mg/kg)	**SP_v**	**ADD_P** (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	**BAF_v**	**ADD_A** (mg/kgBW/d) RME *x* BAF_v *x* I_A *x* AUF	**ADD_S** (mg/kgBW/d) RME *x* I_S *x* AUF	**ADD_{total}** (mg/kgBW/d) ADD_P + ADD_A + ADD_S	**Body Weight Adjusted TRV** (mg/kgBW/d)	**EI Site HQ** ADD_{total} / TRV	**%HI** HQ/HI *x* 100
Organics										
Aldrin	5.85E-03	2.00E-02	2.24E-06	2.90E+00	0.00E+00	7.06E-06	9.30E-06	1.46E-01	6.36E-05	5.38%
gamma-BHC (Lindane)	2.48E-03	2.00E-02	9.49E-07	2.90E+00	0.00E+00	2.99E-06	3.94E-06	5.84E+00	6.74E-07	0.06%
alpha-Chlordane	6.79E-02	5.10E-03	6.63E-06	2.90E+00	0.00E+00	8.19E-05	8.85E-05	1.81E+00	4.89E-05	4.13%
gamma-Chlordane	4.53E-02	5.10E-03	4.42E-06	2.90E+00	0.00E+00	5.46E-05	5.90E-05	1.81E+00	3.26E-05	2.76%
4,4'-DDE	1.31E-02	2.00E-03	5.01E-07	2.90E+00	0.00E+00	1.58E-05	1.63E-05	No TRV	No TRV	No HQ
4,4'-DDT	2.41E-02	7.70E-04	3.55E-07	2.90E+00	0.00E+00	2.90E-05	2.94E-05	5.84E-01	5.03E-05	4.25%
Dalapon	5.62E-02	1.00E+00	1.08E-03	1.00E+00	0.00E+00	6.78E-05	1.14E-03	No TRV	No TRV	No HQ
Dichloroprop	7.24E-02	1.00E+00	1.39E-03	1.00E+00	0.00E+00	8.73E-05	1.47E-03	No TRV	No TRV	No HQ
Dieldrin	9.08E-03	2.00E-02	3.47E-06	2.90E+00	0.00E+00	1.09E-05	1.44E-05	1.46E-02	9.87E-04	83.42%
Heptachlor Epoxide	2.12E-03	5.90E-03	2.40E-07	2.90E+00	0.00E+00	2.56E-06	2.80E-06	No TRV	No TRV	No HQ
MCPP	9.27E-02	1.00E+00	1.77E-03	1.00E+00	0.00E+00	1.12E-04	1.88E-03	No TRV	No TRV	No HQ
								HI =	1.59E+00	

SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 2.05E-01
AUF = 9.33E-02
BAF_i = Soil to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.29E-02
ADD_{total}= Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 9. Hazard Quotient Table for Earthworms at EI Site 25i Surface Soil - Baseline Round 1

Ecological constituent of potential concern	**EI Site concentration RME** (mg/kg)	**Earthworm TRV** (mg/kg)	**EI Site HQ** RME / TRV	**%HI** HQ / HI *x* 100
Inorganics				
Calcium	1.04E+05	No TRV	No TRV	No HQ
Magnesium	4.38E+04	No TRV	No TRV	No HQ
Sodium	4.77E+02	No TRV	No TRV	No HQ
Organics				
Acenaphthylene	1.80E-01	No TRV	No TRV	No HQ
Benzo(a)anthracene	7.75E-02	No TRV	No TRV	No HQ
Benzo(a)pyrene	2.00E-01	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	1.70E-01	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	1.90E-01	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	7.25E-02	No TRV	No TRV	No HQ
Chrysene	1.90E-01	No TRV	No TRV	No HQ
4,4'-DDD	7.55E-02	No MV	No MV	No HQ
4,4'-DDE	7.08E-02	No TRV	No TRV	No HQ
4,4'-DDT	4.60E-02	No TRV	No TRV	No HQ
Dicamba	7.68E-03	No TRV	No TRV	No HQ
Fluoranthene	1.90E-01	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	1.80E-01	No TRV	No TRV	No HQ
MCPP	1.54E-01	No TRV	No TRV	No HQ
Pyrene	1.90E-01	No TRV	No TRV	No HQ
		HI =	0.00E+00	

TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 10. Hazard Quotient Table for Short-tailed Shrew at EI Site 25i Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Calcium	1.04E+05	7.00E-01	1.91E+03	1.00E+00	1.83E+04	2.73E+03	2.29E+04	No TRV	No TRV	No HQ
Magnesium	4.38E+04	2.00E-01	2.31E+02	1.00E+00	7.71E+03	1.15E+03	9.10E+03	No TRV	No TRV	No HQ
Sodium	4.77E+02	1.50E-02	1.88E-01	1.00E+00	8.38E+01	1.25E+01	9.66E+01	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	1.80E-01	2.00E-02	9.46E-05	5.00E-02	1.58E-03	4.73E-03	6.41E-03	No TRV	No TRV	No HQ
Benzo(a)anthracene	7.75E-02	3.90E-03	7.95E-06	5.00E-02	6.82E-04	2.04E-03	2.73E-03	No TRV	No TRV	No HQ
Benzo(a)pyrene	2.00E-01	2.60E-03	1.37E-05	5.00E-02	1.76E-03	5.26E-03	7.03E-03	1.15E+00	6.10E-03	64.09%
Benzo(b)fluoranthene	1.70E-01	2.30E-03	1.03E-05	5.00E-02	1.50E-03	4.47E-03	5.97E-03	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	1.90E-01	1.20E-03	5.99E-06	5.00E-02	1.67E-03	4.99E-03	6.67E-03	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	7.25E-02	2.30E-03	4.38E-06	5.00E-02	6.38E-04	1.91E-03	2.55E-03	No TRV	No TRV	No HQ
Chrysene	1.90E-01	3.90E-03	1.95E-05	5.00E-02	1.67E-02	4.99E-03	6.69E-03	No TRV	No TRV	No HQ
4,4'-DDD	7.55E-02	1.30E-03	2.58E-06	3.30E+00	4.38E-02	1.98E-03	4.58E-02	No TRV	No TRV	No HQ
4,4'-DDE	7.08E-02	2.00E-03	3.72E-06	1.70E+00	2.12E-02	1.86E-03	2.31E-02	No TRV	No TRV	No HQ
4,4'-DDT	4.60E-02	7.70E-04	9.31E-07	5.70E-01	4.61E-03	1.21E-03	5.82E-03	1.70E+00	3.42E-03	35.91%
Dicamba	7.68E-03	1.00E+00	2.02E-04	1.00E+00	1.35E-03	2.02E-04	1.75E-03	No TRV	No TRV	No HQ
Fluoranthene	1.90E-01	2.00E-02	9.99E-05	5.00E-02	1.67E-03	4.99E-03	6.77E-03	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	1.80E-01	1.20E-03	5.68E-06	5.00E-02	1.58E-03	4.73E-03	6.32E-03	No TRV	No TRV	No HQ
MCPP	1.54E-01	1.00E+00	4.04E-03	1.00E+00	2.70E-02	4.04E-03	3.51E-02	No TRV	No TRV	No HQ
Pyrene	1.90E-01	6.70E-03	3.35E-05	5.00E-02	1.67E-03	4.99E-03	6.70E-03	No TRV	No TRV	No HQ
									HI =	9.52E-03

RME = Reasonable maximum exposure
SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.28E-02
AUF = 3.61E-01
BAF_i = Soil to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 4.87E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 7.28E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 11. Hazard Quotient Table for American Robin at El Site 25i Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_r	ADD_P (mg/kgBW/d) RME *x* SP_r *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	El Site HQ ADD_{total} /TRV	%HI HQ/HI *x* 100
Inorganics										
Calcium	1.04E+05	7.00E-02	1.71E+03	1.00E+00	2.45E+04	5.09E+03	3.13E+04	No TRV	No TRV	No HQ
Magnesium	4.38E+04	1.10E-01	1.13E+03	1.00E+00	1.03E+04	2.15E+03	1.36E+04	No TRV	No TRV	No HQ
Sodium	4.77E+02	1.10E-02	1.23E+00	1.00E+00	1.12E+02	2.33E+01	1.37E+02	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	1.80E-01	2.00E-02	8.47E-04	5.00E-02	2.12E-03	8.81E-03	1.18E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	7.75E-02	3.90E-03	7.11E-05	5.00E-02	9.12E-04	3.79E-04	4.77E-03	No TRV	No TRV	No HQ
Benzo(a)pyrene	2.00E-01	2.60E-03	1.22E-04	5.00E-02	2.35E-03	9.79E-03	1.23E-02	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	1.70E-01	2.30E-03	9.20E-05	5.00E-02	2.00E-03	8.32E-03	1.04E-02	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	1.90E-01	1.20E-03	5.36E-05	5.00E-02	2.23E-03	9.30E-03	1.16E-02	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	7.25E-02	2.30E-03	3.92E-05	5.00E-02	8.53E-04	3.55E-03	4.44E-03	No TRV	No TRV	No HQ
Chrysene	1.90E-01	3.90E-03	1.74E-04	5.00E-02	2.23E-03	9.30E-03	1.17E-02	No TRV	No TRV	No HQ
4,4'-DDD	7.55E-02	1.30E-03	2.31E-05	3.30E+00	5.86E-02	3.69E-03	6.23E-02	No TRV	No TRV	No HQ
4,4'-DDE	7.08E-02	2.00E-03	3.33E-05	1.70E+00	2.83E-02	3.47E-03	3.18E-02	No TRV	No TRV	No HQ
4,4'-DDT	4.60E-02	7.70E-04	8.33E-06	5.70E-01	6.17E-03	2.25E-03	8.43E-03	7.20E-03	1.17E+00	100.00%
Dicamba	7.68E-03	1.00E+00	1.81E-03	1.00E+00	1.81E-03	3.76E-04	3.99E-03	No TRV	No TRV	No HQ
Fluoranthene	1.90E-01	2.00E-02	8.94E-04	5.00E-02	2.23E-03	9.30E-03	1.24E-02	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	1.80E-01	1.20E-03	5.08E-05	5.00E-02	2.12E-03	8.81E-03	1.10E-02	No TRV	No TRV	No HQ
MCPP	1.54E-01	1.00E+00	3.61E-02	1.00E+00	3.61E-02	7.51E-03	7.97E-02	No TRV	No TRV	No HQ
Pyrene	1.90E-01	6.70E-03	2.99E-04	5.00E-02	2.23E-03	9.30E-03	1.18E-02	No TRV	No TRV	No HQ
								HI =	1.17E+00	

RME = Reasonable maximum exposure
SP_r = Soil-to-plant; reproductive
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.60E-01
AUF = 3.10E-01
BAF_i = Soil to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 7.60E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.58E-01
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 12. Hazard Quotient Table for Eastern Cottontail at EI Site 25i Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_p *x* AUF	BAF_v	ADD_A (mg/kgBW/d) RME *x* BAF_v *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_p + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Calcium	1.04E+05	7.00E-01	6.47E+02	1.00E+00	0.00E+00	5.82E+01	7.05E+02	No TRV	No TRV	No HQ
Magnesium	4.38E+04	2.00E-01	7.79E+01	1.00E+00	0.00E+00	2.45E+01	1.02E+02	No TRV	No TRV	No HQ
Sodium	4.77E+02	1.50E-02	6.35E-02	1.00E+00	0.00E+00	2.67E-01	3.30E-01	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	1.80E-01	2.00E-02	3.20E-05	1.90E-02	0.00E+00	1.01E-04	1.33E-04	No TRV	No TRV	No HQ
Benzo(a)anthracene	7.75E-02	3.90E-03	2.68E-06	7.60E-01	0.00E+00	4.34E-05	4.61E-05	No TRV	No TRV	No HQ
Benzo(a)pyrene	2.00E-01	2.60E-03	4.62E-06	1.50E+00	0.00E+00	1.12E-04	1.17E-04	3.95E-01	2.95E-04	86.86%
Benzo(b)fluoranthene	1.70E-01	2.30E-03	3.47E-06	1.90E+00	0.00E+00	9.51E-05	9.86E-05	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	1.90E-01	1.20E-03	2.03E-06	6.00E+00	0.00E+00	1.06E-04	1.08E-04	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	7.25E-02	2.30E-03	1.48E-06	1.90E+00	0.00E+00	4.06E-05	4.21E-05	No TRV	No TRV	No HQ
Chrysene	1.90E-01	3.90E-03	6.58E-06	7.60E-01	0.00E+00	1.06E-04	1.13E-04	No TRV	No TRV	No HQ
4,4'-DDD	7.55E-02	1.30E-03	8.72E-07	2.90E+00	0.00E+00	4.23E-05	4.31E-05	No TRV	No TRV	No HQ
4,4'-DDE	7.08E-02	2.00E-03	1.26E-06	2.90E+00	0.00E+00	3.96E-05	4.09E-05	No TRV	No TRV	No HQ
4,4'-DDT	4.60E-02	7.70E-04	3.15E-07	2.90E+00	0.00E+00	2.58E-05	2.61E-05	5.84E-01	4.46E-05	13.14%
Dicamba	7.68E-03	1.00E+00	6.82E-05	1.00E+00	0.00E+00	4.30E-06	7.25E-05	No TRV	No TRV	No HQ
Fluoranthene	1.90E-01	2.00E-02	3.38E-05	1.30E-01	0.00E+00	1.06E-04	1.40E-04	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	1.80E-01	1.20E-03	1.92E-06	6.00E+00	0.00E+00	1.01E-04	1.03E-04	No TRV	No TRV	No HQ
MCPP	1.54E-01	1.00E+00	1.36E-03	1.00E+00	0.00E+00	8.59E-05	1.45E-03	No TRV	No TRV	No HQ
Pyrene	1.90E-01	6.70E-03	1.13E-05	3.00E-01	0.00E+00	1.06E-04	1.18E-02	No TRV	No TRV	No HQ
								HI =	3.40E-04	

SP_v = Soil-to-plant; vegetative
ADD_p = Average daily dose; plant
I_p (kg/kgBW/d) = 2.05E-01
AUF = 4.33E-02
BAF_i = Soil to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.29E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 13. Hazard Quotient Table for Earthworms at EI Site 30 Surface Soil Baseline Round 1

Ecological constituent of potential concern	**EI Site concentration RME** (mg/kg)	**Earthworm TRV** (mg/kg)	**EI Site HQ** RME / TRV	**%HI** HQ / HI *x* 100
Inorganics				
Antimony	3.81E+00	No TRV	No TRV	No HQ
Cadmium	3.76E-01	2.00E-01	1.88E-02	100.00%
Magnesium	5.66E+04	No TRV	No TRV	No HQ
Silver	3.92E-01	No TRV	No TRV	No HQ
Organics				
Acenaphthylene	2.58E-02	No TRV	No TRV	No HQ
Anthracene	4.52E-01	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.57E+00	No TRV	No TRV	No HQ
Benzo(a)pyrene	2.13E+00	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	2.50E+00	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	1.22E+00	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.00E+00	No TRV	No TRV	No HQ
Bis(2-ethylhexyl)phthala	2.79E-02	No TRV	No TRV	No HQ
Carbazole	1.27E-01	No TRV	No TRV	No HQ
Chrysene	4.90E+00	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	7.27E-01	No TRV	No TRV	No HQ
Dibenzofuran	6.02E-02	No TRV	No TRV	No HQ
Fluoranthene	5.60E+00	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	1.10E+00	No TRV	No TRV	No HQ
2-Methylnapthalene	5.31E-02	No TRV	No TRV	No HQ
Naphthalene	1.21E-01	No TRV	No TRV	No HQ
Phenanthrene	2.06E+00	No TRV	No TRV	No HQ
Pyrene	1.20E-01	No TRV	No TRV	No HQ
		HI =	1.88E-02	

TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 14. Hazard Quotient Table for Short-tailed Shrew at EI Site 30 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Antimony	3.81E+00	4.00E-02	1.11E-02	5.00E-02	9.28E-02	2.77E-01	3.81E-01	1.44E-01	2.65E+00	69.23%
Cadmium	3.76E-01	1.10E-01	3.01E-03	1.10E+01	2.02E+00	2.74E-02	2.05E+00	2.05E+00	9.96E-01	26.05%
Magnesium	5.66E+04	2.00E-01	8.24E+02	1.00E+00	2.76E+04	4.12E+03	3.25E+04	No TRV	No TRV	No HQ
Silver	3.92E-01	8.00E-02	2.28E-03	1.50E-01	2.86E-02	2.85E-02	5.95E-02	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.58E-02	2.00E-02	3.76E-05	5.00E-02	6.29E-04	1.88E-03	2.55E-03	No TRV	No TRV	No HQ
Anthracene	4.52E-01	2.00E-02	6.58E-04	5.00E-02	1.10E-02	3.29E-02	4.45E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.57E+00	3.90E-03	7.29E-04	5.00E-02	6.25E-02	1.87E-01	2.50E-01	No TRV	No TRV	No HQ
Benzo(a)pyrene	2.13E+00	2.60E-03	4.03E-04	5.00E-02	5.19E-02	1.55E-01	2.07E-01	1.15E+00	1.80E-01	4.71%
Benzo(b)fluoranthene	2.50E+00	2.30E-03	4.18E-04	5.00E-02	6.08E-02	1.82E-01	2.43E-01	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	1.22E+00	1.20E-03	1.06E-04	5.00E-02	2.96E-02	8.85E-02	1.18E-01	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.00E+00	2.30E-03	3.36E-04	5.00E-02	4.88E-02	1.46E-01	1.95E-01	No TRV	No TRV	No HQ
Bis(2-ethylhexyl)phthalate	2.79E-02	8.70E-03	1.77E-05	5.00E-02	6.79E-04	2.03E-03	2.73E-03	2.11E+01	1.29E-04	0.00%
Carbazole	1.27E-01	2.00E-02	1.84E-04	5.00E-02	3.08E-03	9.21E-03	1.25E-02	No TRV	No TRV	No HQ
Chrysene	4.90E+00	3.90E-03	1.39E-03	5.00E-02	1.19E-01	3.56E-01	4.77E-01	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	7.27E-01	1.40E-03	7.41E-05	5.00E-02	1.77E-02	5.29E-02	7.07E-02	No TRV	No TRV	No HQ
Dibenzofuran	6.02E-02	2.00E-02	8.77E-05	5.00E-02	1.47E-03	4.38E-03	5.94E-03	No TRV	No TRV	No HQ
Fluoranthene	5.60E+00	2.00E-02	8.15E-03	5.00E-02	1.36E-01	4.08E-01	5.52E-01	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	1.10E+00	1.20E-03	9.64E-05	5.00E-02	2.69E-02	8.04E-02	1.07E-01	No TRV	No TRV	No HQ
2-Methylnaphthalene	5.31E-02	2.00E-02	7.73E-05	5.00E-02	1.29E-03	3.86E-03	5.23E-03	No TRV	No TRV	No HQ
Naphthalene	1.21E-01	2.00E-02	1.76E-04	5.00E-02	2.94E-03	8.80E-03	1.19E-02	No TRV	No TRV	No HQ
Phenanthrene	2.06E+00	2.00E-02	3.01E-03	5.00E-02	5.03E-02	1.50E-01	2.04E-01	No TRV	No TRV	No HQ
Pyrene	1.20E+01	6.70E-03	5.85E-05	5.00E-02	2.92E-01	8.74E-01	1.17E+00	No TRV	No TRV	No HQ
								HI =	3.82E+00	

RME = Reasonable maximum exposure
SP_v = Soil-to-plant; vegetative
ADD_p = Average daily dose; plant
I_P (kg/kgBW/d) = 7.28E-02
AUF = 1.00E+00
BAF_i = Soil to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 4.87E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 7.28E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 15. Hazard Quotient Table for American Robin at EI Site 30 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_r	ADD_P (mg/kgBW/d) RME *x* SP_r *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Antimony	3.81E+00	6.00E-03	1.74E-02	5.00E-02	1.45E-01	6.02E-01	7.64E-01	No TRV	No TRV	No HQ
Cadmium	3.76E-01	3.00E-02	8.58E-03	1.10E+01	3.14E+00	5.95E-02	3.21E+00	2.83E+00	1.14E+00	99.62%
Magnesium	5.66E+04	1.10E-01	4.73E+03	1.00E+00	4.30E+04	8.95E+03	5.67E+04	No TRV	No TRV	No HQ
Silver	3.92E-01	2.00E-02	5.96E-03	1.50E-01	4.47E-02	6.20E-02	1.13E-01	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.58E-02	2.00E-02	3.92E-04	5.00E-02	9.81E-04	4.08E-03	5.45E-03	No TRV	No TRV	No HQ
Anthracene	4.52E-01	2.00E-02	6.87E-03	5.00E-02	1.72E-02	7.14E-02	9.54E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.57E+00	3.90E-03	7.61E-03	5.00E-02	9.76E-02	4.06E-01	5.11E-01	No TRV	No TRV	No HQ
Benzo(a)pyrene	2.13E+00	2.60E-03	4.21E-03	5.00E-02	8.09E-02	3.37E-01	4.22E-01	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	2.50E+00	2.30E-03	4.37E-03	5.00E-02	9.49E-02	3.95E-01	4.94E-01	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	1.22E+00	1.20E-03	1.11E-03	5.00E-02	4.62E-02	1.92E-01	2.40E-01	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.00E+00	2.30E-03	3.50E-03	5.00E-02	7.61E-02	3.17E-01	3.96E-01	No TRV	No TRV	No HQ
Bis(2-ethylhexyl)phthalate	2.79E-02	8.70E-03	1.84E-04	5.00E-02	1.06E-03	4.41E-01	5.65E-03	1.30E+00	4.36E-03	0.38%
Carbazole	1.27E-01	2.00E-02	1.92E-03	5.00E-02	4.81E-03	2.00E-02	2.67E-02	No TRV	No TRV	No HQ
Chrysene	4.90E+00	3.90E-03	1.45E-02	5.00E-02	1.86E-01	7.74E-01	9.74E-01	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	7.27E-01	1.40E-03	7.73E-04	5.00E-02	2.76E-02	1.15E-01	1.43E-01	No TRV	No TRV	No HQ
Dibenzofuran	6.02E-02	2.00E-02	9.15E-04	5.00E-02	2.29E-03	9.52E-03	1.27E-02	No TRV	No TRV	No HQ
Fluoranthene	5.60E+00	2.00E-02	8.51E-02	5.00E-02	2.13E-01	8.85E-01	1.18E+00	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	1.10E+00	1.20E-03	1.01E-03	5.00E-02	4.20E-02	1.75E-01	2.17E-01	No TRV	No TRV	No HQ
2-Methylnaphthalene	5.31E-02	2.00E-02	8.06E-04	5.00E-02	2.02E-03	8.39E-03	1.12E-02	No TRV	No TRV	No HQ
Naphthalene	1.21E-01	2.00E-02	1.84E-03	5.00E-02	4.59E-03	1.91E-02	2.55E-02	No TRV	No TRV	No HQ
Phenanthrene	2.06E+00	2.00E-02	3.14E-02	5.00E-02	7.84E-02	3.26E-01	4.36E-01	No TRV	No TRV	No HQ
Pyrene	1.20E+01	6.70E-03	6.11E-02	5.00E-02	4.56E-01	1.90E+00	2.41E+00	No TRV	No TRV	No HQ
								HI =	1.14E+00	

RME = Reasonable maximum exposure
SP_r = Soil-to-plant; reproductive
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.60E-01
AUF = 1.00E+00
BAF_i = Soil to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 7.60E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.58E-01
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 16. Hazard Quotient Table for Eastern Cottontail at EI Site 30 Surface Soil - Baseline Round 1

Ecological constituent of potential concern	EI Site concentration RME (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	BAF_v	ADD_A (mg/kgBW/d) RME *x* BAF_v *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Antimony	3.81E+00	4.00E-02	3.12E-02	5.00E-02	0.00E+00	4.92E-02	8.04E-02	4.94E-02	1.63E+00	94.68%
Cadmium	3.76E-01	1.10E-01	8.48E-03	2.80E-02	0.00E+00	4.86E-03	1.33E-02	7.05E-01	1.89E-02	1.10%
Magnesium	5.66E+04	2.00E-01	2.32E+03	1.00E+00	0.00E+00	7.31E+02	3.05E+03	No TRV	No TRV	No HQ
Silver	3.92E-01	8.00E-02	6.43E-03	1.50E-01	0.00E+00	5.06E-03	1.15E-02	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.58E-02	2.00E-02	1.06E-04	1.90E-02	0.00E+00	3.33E-04	4.39E-04	No TRV	No TRV	No HQ
Anthracene	4.52E-01	2.00E-02	1.85E-03	4.80E-02	0.00E+00	5.83E-03	7.69E-03	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.57E+00	3.90E-03	2.05E-03	7.60E-01	0.00E+00	3.32E-02	3.52E-02	No TRV	No TRV	No HQ
Benzo(a)pyrene	2.13E+00	2.60E-03	1.14E-03	1.50E+00	0.00E+00	2.75E-02	2.86E-02	3.95E-01	7.25E-02	4.21%
Benzo(b)fluoranthene	2.50E+00	2.30E-03	1.18E-03	1.90E+00	0.00E+00	3.23E-02	3.34E-02	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	1.22E+00	1.20E-03	2.99E-04	6.00E+00	0.00E+00	1.57E-02	1.60E-02	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.00E+00	2.30E-03	9.45E-04	1.90E+00	0.00E+00	2.59E-02	2.68E-02	No TRV	No TRV	No HQ
Bis(2-ethylhexyl)phthalate	2.79E-02	8.70E-03	4.97E-05	1.90E-01	0.00E+00	3.60E-04	4.10E-04	7.23E+00	5.67E-05	0.00%
Carbazole	1.27E-01	2.00E-02	5.19E-04	8.70E-03	0.00E+00	1.63E-03	2.15E-03	No TRV	No TRV	No HQ
Chrysene	4.90E+00	3.90E-03	3.91E-03	7.60E-01	0.00E+00	6.32E-02	6.71E-02	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	7.27E-01	1.40E-03	2.09E-04	4.80E+00	0.00E+00	9.38E-03	9.59E-03	No TRV	No TRV	No HQ
Dibenzofuran	6.02E-02	2.00E-02	2.47E-04	1.90E-02	0.00E+00	7.78E-04	1.02E-03	No TRV	No TRV	No HQ
Fluoranthene	5.60E+00	2.00E-02	2.30E-02	1.30E-01	0.00E+00	7.23E-02	9.53E-02	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	1.10E+00	1.20E-03	2.72E-04	6.00E+00	0.00E+00	1.43E-02	1.45E-02	No TRV	No TRV	No HQ
2-Methylnaphthalene	5.31E-02	2.00E-02	2.18E-04	1.90E-08	0.00E+00	6.85E-04	9.03E-04	No TRV	No TRV	No HQ
Naphthalene	1.21E-01	2.00E-02	4.95E-04	6.00E-03	0.00E+00	1.56E-03	2.06E-03	No TRV	No TRV	No HQ
Phenanthrene	2.06E+00	2.00E-02	8.46E-03	4.80E-02	0.00E+00	2.67E-02	3.51E-02	No TRV	No TRV	No HQ
Pyrene	1.20E+01	6.70E-03	1.65E-02	3.00E-01	0.00E+00	1.55E-01	1.71E-01	No TRV	No TRV	No HQ
								HI =	1.72E+00	

SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 2.05E-01
AUF = 1.00E+00
BAF_i = Soil to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.29E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 17. Hazard Quotient Table for Earthworms at EI Site 6 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	**Arithmetic Mean** (mg/kg)	**Earthworm TRV** (mg/kg)	**EI Site HQ** RME / TRV	**%HI** HQ / HI *x* 100
Inorganics				
Arsenic	6.67E+00	6.00E+01	1.11E-01	18.91%
Cadmium	5.60E-01	2.00E+01	2.80E-02	4.76%
Calcium	4.75E+04	No TRV	No TRV	No HQ
Copper	2.24E+01	5.00E+01	4.47E-01	76.10%
Magnesium	1.95E+04	No TRV	No TRV	No HQ
Silver	3.20E-01	No TRV	No TRV	No HQ
Sodium	3.65E+02	No TRV	No TRV	No HQ
Organics				
Acenaphthene	1.00E-02	No TRV	No TRV	No HQ
Acenaphthylene	2.00E-02	No TRV	No TRV	No HQ
Anthracene	8.00E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.80E-01	No TRV	No TRV	No HQ
Benzo(a)pyrene	3.00E-01	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	3.50E-01	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	2.20E-01	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.90E-01	No TRV	No TRV	No HQ
Butylbenzylphthalate	2.00E-02	No TRV	No TRV	No HQ
Carbazole	2.00E-02	No TRV	No TRV	No HQ
Chrysene	3.50E-01	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	1.30E-02	No TRV	No TRV	No HQ
Dibenzofuran	2.00E-02	No TRV	No TRV	No HQ
Di-n-butylphthalate	1.00E-02	No TRV	No TRV	No HQ
Fluoranthene	4.00E-01	No TRV	No TRV	No HQ
Fluorene	4.00E-02	3.00E+01	1.33E-03	0.23%
Indeno(1,2,3-cd)pyrene	2.10E-01	No TRV	No TRV	No HQ
2-Methylnapthalene	6.00E-01	No TRV	No TRV	No HQ
Naphthalene	3.00E-02	No TRV	No TRV	No HQ
Phenanthrene	2.70E-01	No TRV	No TRV	No HQ
Pyrene	5.00E-01	No TRV	No TRV	No HQ
			HI = 5.88E-01	

TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 18. Hazard Quotient Table for Short-tailed Shrew at EI Site 6 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_P x AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Arsenic	6.67E+00	8.00E-03	3.88E-03	6.60E-03	2.14E-02	4.86E-01	5.11E-01	1.45E-01	3.52E+00	68.52%
Cadmium	5.60E-01	1.10E-01	4.48E-03	1.10E+01	3.00E+00	4.08E-02	3.05E+00	2.05E+00	1.48E+00	28.88%
Calcium	4.75E+04	7.00E-01	2.42E+03	1.00E+00	2.31E+04	3.46E+03	2.90E+04	No TRV	No TRV	No HQ
Copper	2.24E+01	8.00E-02	1.30E-01	1.60E-01	1.74E+00	1.63E+00	3.50E+00	3.24E+01	1.08E-01	2.10%
Magnesium	1.95E+04	2.00E-01	2.84E+02	1.00E+00	9.50E+03	1.42E+03	1.12E+04	No TRV	No TRV	No HQ
Silver	3.20E-01	8.00E-02	1.86E-03	1.50E-01	2.34E-02	2.33E-02	4.85E-02	No TRV	No TRV	No HQ
Sodium	3.65E+02	1.50E-02	3.99E-01	1.00E+00	1.78E+02	2.66E+01	2.05E+02	No TRV	No TRV	No HQ
Organics										
Acenaphthene	1.00E-02	2.00E-02	1.46E-05	5.00E-02	2.44E-04	7.28E-04	9.86E-04	No TRV	No TRV	No HQ
Acenaphthylene	2.00E-02	2.00E-02	2.91E-05	5.00E-02	4.87E-04	1.46E-03	1.97E-03	No TRV	No TRV	No HQ
Anthracene	8.00E-02	2.00E-02	1.16E-04	5.00E-02	1.95E-03	5.82E-03	7.89E-03	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.80E-01	3.90E-03	7.95E-05	5.00E-02	6.82E-03	2.04E-02	2.73E-02	No TRV	No TRV	No HQ
Benzo(a)pyrene	3.00E-01	2.60E-03	5.68E-05	5.00E-02	7.31E-03	2.18E-02	2.92E-02	1.15E+00	2.53E-02	0.49%
Benzo(b)fluoranthene	3.50E-01	2.30E-03	5.86E-05	5.00E-02	8.53E-03	2.55E-02	3.41E-02	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	2.20E-01	1.20E-03	1.92E-05	5.00E-02	5.36E-03	1.60E-02	2.14E-02	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.90E-01	2.30E-03	4.86E-05	5.00E-02	7.06E-03	2.11E-02	2.82E-02	No TRV	No TRV	No HQ
Butylbenzylphthalate	2.00E-02	2.00E-02	2.91E-05	5.00E-02	4.87E-04	1.46E-03	1.97E-03	No TRV	No TRV	No HQ
Carbazole	2.00E-02	2.00E-02	2.91E-05	5.00E-02	4.87E-04	1.46E-03	1.97E-03	No TRV	No TRV	No HQ
Chrysene	3.50E-01	3.90E+03	9.94E-05	5.00E-02	8.53E-03	2.55E-02	3.41E-02	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	1.30E-01	1.40E-03	1.32E-05	5.00E-02	3.17E-03	9.46E-03	1.26E-02	5.99E+01	2.11E-04	0.00%
Dibenzofuran	2.00E-02	2.00E-02	2.91E-05	5.00E-02	4.87E-04	1.46E-03	1.97E-03	6.39E+01	3.09E-05	0.00%
Di-n-butylphthalate	1.00E-02	7.60E-03	5.53E-06	5.00E-02	2.44E-04	7.28E-04	9.77E-04	6.34E+02	1.54E-06	0.00%
Fluoranthene	4.00E-01	2.00E-02	5.82E-04	5.00E-02	9.74E-03	2.91E-02	3.94E-02	No TRV	No TRV	No HQ
Fluorene	4.00E-02	2.00E-02	5.82E-05	5.00E-02	9.74E-04	2.91E-03	3.94E-03	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	2.10E-01	1.20E-03	1.83E-05	5.00E-02	5.12E-03	1.53E-02	2.04E-02	No TRV	No TRV	No HQ
2-Methylnaphthalene	6.00E-01	2.00E-02	8.74E-04	5.00E-02	1.46E-02	4.37E-02	5.92E-02	No TRV	No TRV	No HQ
Naphthalene	3.00E-02	2.00E-02	4.37E-05	5.00E-02	7.31E-04	2.18E-03	2.96E-03	No TRV	No TRV	No HQ
Phenanthrene	2.70E-01	2.00E-02	3.93E-04	5.00E-02	6.58E-03	1.97E-02	2.66E-02	No TRV	No TRV	No HQ
Pyrene	5.00E-01	6.70E-03	2.44E-04	5.00E-02	1.22E-02	3.64E-02	4.88E-02	No TRV	No TRV	No HQ
								HI =	5.13E+00	

SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.28E-02
AUF = 1.00E+00
BAF_i = Soil to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 4.87E+01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 7.28E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 19. Hazard Quotient Table for American Robin at EI Site 6 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_r	ADD_P (mg/kgBW/d) RME *x* Sp_r *x* I_p *x* AUF	BAF_1	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} /TRV	%HI HQ/HI *x* 100
Inorganics										
Arsenic	6.67E+00	1.20E-03	6.08E-03	6.60E-03	3.35E-02	1.05E+00	1.09E+00	9.66E+00	1.13E-01	5.91%
Cadmium	5.60E-01	3.00E-02	1.28E-02	1.10E+01	4.68E+00	8.85E-02	4.78E+00	2.83E+00	1.69E+00	88.37%
Calcium	4.75E+04	7.00E-02	2.53E+03	1.00E+00	3.61E+04	7.51E+03	4.61E+04	No TRV	No TRV	No HQ
Copper	2.24E+01	5.00E-02	8.50E-01	1.60E-01	2.72E+00	3.54E+00	7.11E+00	7.55E+01	9.41E-02	4.91%
Magnesium	1.95E+04	1.10E-01	1.63E+03	1.00E+00	1.48E+04	3.08E+03	1.95E+04	No TRV	No TRV	No HQ
Silver	3.20E-01	2.00E-02	4.86E-03	1.50E-01	3.65E-02	5.06E-02	9.19E-02	No TRV	No TRV	No HQ
Sodium	3.65E+02	1.10E-02	3.05E+00	1.00E+00	2.77E+02	5.77E+01	3.38E+02	No TRV	No TRV	No HQ
Organics										
Acenaphthene	1.00E-02	2.00E-02	1.52E-04	5.00E-02	3.80E-04	1.58E-03	2.11E-03	No TRV	No TRV	No HQ
Acenaphthylene	2.00E-02	2.00E-02	3.04E-04	5.00E-02	7.60E-04	3.16E-03	4.23E-03	No TRV	No TRV	No HQ
Anthracene	8.00E-02	2.00E-02	1.22E-03	5.00E-02	3.04E-03	1.26E-02	1.69E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.80E-01	3.90E-03	8.30E-04	5.00E-02	1.06E-02	4.43E-02	5.57E-02	No TRV	No TRV	No HQ
Benzo(a)pyrene	3.00E-01	2.60E-03	5.93E-04	5.00E-02	1.14E-02	4.74E-02	5.94E-02	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	3.50E-01	2.30E-03	6.12E-04	5.00E-02	1.33E-02	5.53E-02	6.92E-02	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	2.20E-01	1.20E-03	2.01E-04	5.00E-02	8.36E-03	3.48E-02	4.33E-02	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.90E-01	2.30E-03	5.07E-04	5.00E-02	1.10E-02	4.58E-02	5.74E-02	No TRV	No TRV	No HQ
Butylbenylphthalate	2.00E-02	2.00E-02	3.04E-04	5.00E-02	7.60E-04	3.16E-03	4.23E-03	No TRV	No TRV	No HQ
Carbazole	2.00E-02	2.00E-02	3.04E-04	5.00E-02	7.60E-04	3.16E-03	4.23E-03	No TRV	No TRV	No HQ
Chrysene	3.50E-01	3.90E-03	1.04E-03	5.00E-02	1.33E-02	5.53E-02	6.97E-02	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	1.30E-01	1.40E-03	1.38E-04	5.00E-02	4.94E-03	2.06E-02	2.56E-02	No TRV	No TRV	No HQ
Dibenzofuran	2.00E-02	2.00E-02	3.04E-04	5.00E-02	7.60E-04	3.16E-03	4.23E-03	No TRV	No TRV	No HQ
Di-n-butylphthalate	1.00E-02	7.60E-03	5.78E-05	5.00E-02	3.80E-04	1.58E-03	2.02E-03	1.31E-01	1.54E-02	0.80%
Fluoranthene	4.00E-01	2.00E-02	6.08E-03	5.00E-02	1.52E-02	6.32E-02	8.45E-02	No TRV	No TRV	No HQ
Fluorene	4.00E-02	2.00E-02	6.08E-04	5.00E-02	1.52E-03	6.32E-03	8.45E-03	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	2.10E-01	1.20E-03	1.92E-04	5.00E-02	7.98E-03	3.32E-02	4.14E-02	No TRV	No TRV	No HQ
2-Methylnaphthalene	6.00E-01	2.00E-02	9.12E-03	5.00E-02	2.28E-02	9.48E-02	1.27E-01	No TRV	No TRV	No HQ
Naphthalene	3.00E-02	2.00E-02	4.56E-04	5.00E-02	1.14E-03	4.74E-03	6.34E-03	No TRV	No TRV	No HQ
Phenanthrene	2.70E-01	2.00E-02	4.10E-03	5.00E-02	1.03E-02	4.27E-02	5.70E-02	No TRV	No TRV	No HQ
Pyrene	5.00E-01	6.70E-03	2.55E-03	5.00E-02	1.90E-02	7.90E-02	1.01E-01	No TRV	No TRV	No HQ
								HI=	1.92E+00	

RME = Reasonable maximum exposure
SP_r = Soil-to-plant; reproductive
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = 7.60E-01
AUF = 1.00E+00
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 7.60E-01
ADD_S =Average daily dose; soil
I_S (kg/kgBW/d) = 1.58E-01
ADD_{total}= Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 20. Hazard Quotient Table for Eastern Cottontail at EI Site 6 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME x SP_v x I_P x AUF	BAF_v	ADD_A (mg/kgBW/d) RME x BAF_v x I_A x AUF	ADD_S (mg/kgBW/d)RME x I_S x AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} /TRV	%HI HQ/HI x 100
Inorganics										
Arsenic	6.67E+00	8.00E-03	4.19E-03	1.00E-01	0.00E+00	3.30E-02	3.72E-02	4.98E-02	7.47E-01	95.24%
Cadmium	5.60E-01	1.10E-01	4.84E-03	2.80E-02	0.00E+00	2.77E-03	7.61E-03	7.05E-01	1.08E-02	1.38%
Calcium	4.75E+04	7.00E-01	2.61E+03	1.00E+00	0.00E+00	2.35E+02	2.85E+03	No TRV	No TRV	No HQ
Copper	2.24E+01	8.00E-02	1.41E-01	5.00E-01	0.00E+00	1.11E-01	2.51E-01	1.11E+01	2.26E-02	2.88%
Magnesium	1.95E+04	2.00E-01	3.06E+02	1.00E+00	0.00E+00	9.65E+01	4.03E+02	No TRV	No TRV	No HQ
Silver	3.20E-01	8.00E-02	2.01E-03	1.50E-01	0.00E+00	1.58E-03	3.60E-03	No TRV	No TRV	No HQ
Sodium	3.65E+02	1.50E-02	4.30E-01	1.00E+00	0.00E+00	1.81E+00	2.24E+00	No TRV	No TRV	No HQ
Organics										
Acenaphthene	1.00E-02	2.00E-02	1.57E-05	1.20E-02	0.00E+00	4.95E-05	6.52E-05	No TRV	No TRV	No HQ
Acenaphthylene	2.00E-02	2.00E-02	3.14E-05	1.90E-02	0.00E+00	9.90E-05	1.30E-04	No TRV	No TRV	No HQ
Anthracene	8.00E-02	2.00E-02	1.26E-04	4.80E-02	0.00E+00	3.96E-04	5.22E-04	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.80E-01	3.90E-03	8.58E-05	7.60E-01	0.00E+00	1.39E-03	1.47E-03	No TRV	No TRV	No HQ
Benzo(a)pyrene	3.00E-01	2.60E-03	6.13E-05	1.50E+00	0.00E+00	1.49E-03	1.55E-03	3.95E-01	3.91E-03	0.50%
Benzo(b)fluoranthene	3.50E-01	2.30E-03	6.33E-05	1.90E+00	0.00E+00	1.73E-03	1.80E-03	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	2.20E-01	1.20E-03	2.07E-05	6.00E+00	0.00E+00	1.09E-03	1.11E-03	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.90E-01	2.30E-03	5.24E-05	1.90E+00	0.00E+00	1.44E-03	1.49E-03	No TRV	No TRV	No HQ
Butylbenzylphthalate	2.00E-02	2.00E-02	3.14E-05	1.20E-01	0.00E+00	9.90E-05	1.30E-04	No TRV	No TRV	No HQ
Carbazole	2.00E-02	2.00E-02	3.14E-05	8.70E-03	0.00E+00	9.90E-05	1.30E-04	No TRV	No TRV	No HQ
Chrysene	3.50E-01	3.90E-03	1.07E-04	7.60E-01	0.00E+00	1.73E-03	1.84E-03	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	1.30E-01	1.40E-03	1.43E-05	4.80E+00	0.00E+00	6.44E-04	6.58E-04	No TRV	No TRV	No HQ
Dibenzofuran	2.00E-02	2.00E-02	3.14E-05	1.90E-02	0.00E+00	9.90E-05	1.30E-04	No TRV	No TRV	No HQ
Di-n-butylphthalate	1.00E-02	7.60E-03	5.97E-06	2.40E-01	0.00E+00	4.95E-05	5.55E-05	2.17E+02	2.55E-07	0.00%
Fluoranthene	4.00E-01	2.00E-02	6.29E-04	1.30E-01	0.00E+00	1.98E-03	2.61E-03	No TRV	No TRV	No HQ
Flourene	4.00E-02	2.00E-02	6.29E-05	2.40E-02	0.00E+00	1.98E-04	2.61E-04	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	2.10E-01	1.20E-03	1.98E-05	6.00E+00	0.00E+00	1.04E-03	1.06E-03	No TRV	No TRV	No HQ
2-Methylnaphthalene	6.00E-01	2.00E-02	9.43E-04	1.90E-08	0.00E+00	2.97E-03	3.91E-03	No TRV	No TRV	No HQ
Naphthalene	3.00E-02	2.00E-02	4.72E-05	6.00E-03	0.00E+00	1.49E-04	1.96E-04	No TRV	No TRV	No HQ
Phenanthrene	2.70E-01	2.00E-02	4.24E-04	4.80E-02	0.00E+00	1.34E-03	1.76E-03	No TRV	No TRV	No HQ
Pyrene	5.00E-01	6.70E-03	2.63E-04	3.00E-01	0.00E+00	2.48E-03	2.74E-03	No TRV	No TRV	No HQ
								HI =	7.85E-01	

Sp_v = soil-to-plant; vegetative
ADD_P =Average daily dose; plant
I_P (kg/kgBWd) = 2.05E-01
AUF = 3.83E-01
BAF_i = Soil-to-animal; invertabrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.29E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 21. Hazard Quotient Table for Earthworms at EI Site 19 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	**Arithmetic Mean** (mg/kg)	**Earthworm TRV** (mg/kg)	**EI Site HQ** RME /TRV	**%HI** HQ / HI *x* 100
Inorganics				
Aldrin	3.44E-03	No TRV	No TRV	No HQ
gamma-BHC (Lindane)	1.96E-03	No TRV	No TRV	No HQ
alpha-Chlordane	1.33E-02	No TRV	No TRV	No HQ
gamma-Chlordane	1.19E-02	No TRV	No TRV	No HQ
Dalapon	2.50E-02	No TRV	No TRV	No HQ
4,4'-DDE	6.71E-03	No TRV	No TRV	No HQ
4,4'-DDT	8.48E-03	No TRV	No TRV	No HQ
Dichloroprop	2.29E-02	No TRV	No TRV	No HQ
Dieldrin	4.33E-03	No TRV	No TRV	No HQ
Heptachlor Epoxide	1.77E-03	No TRV	No TRV	No HQ
MCPP	7.08E-02	No TRV	No TRV	No HQ
		HI =	0.00E+00	

TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 22. Hazard Quotient Table for Short-tailed Shrew at EI Site 19 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	**Arithmetic Mean** (mg/kg)	**SP_v**	**ADD_P** (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	**BAF_i**	**ADD_A** (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	**ADD_S** (mg/kgBW/d) RME *x* I_S *x* AUF	**ADD_{total}** (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	**Body Weight Adjusted TRV** (mg/kgBW/d)	**EI Site HQ** ADD_{total} /TRV	**%HI** HQ/HI *x* 100
Inorganics										
Aldrin	3.44E-03	2.00E-02	3.89E-06	5.00E-02	6.52E-05	1.95E-04	2.64E-04	4.26E-01	6.19E-04	0.28%
gamma-BHC (Lindane)	1.96E-03	2.00E-02	2.21E-06	2.00E-02	1.48E-05	1.11E-04	1.28E-04	1.70E+01	7.50E-06	0.00%
alpha-Chlordane	1.33E-02	5.10E-03	3.85E-06	1.60E+00	8.09E-03	7.55E-04	8.84E-03	5.28E+00	1.68E-03	0.75%
gamma-Chloradane	1.19E-02	5.10E-03	3.44E-06	1.60E+00	7.22E-03	6.75E-04	7.90E-03	5.28E+00	1.50E-03	0.67%
Dalapon	2.50E-02	1.00E+00	1.42E-03	1.00E+00	9.47E-03	1.42E-03	1.23E-02	No TRV	No TRV	No HQ
4,4'-DDE	6.71E-03	2.00E-03	7.59E-07	1.70E+00	4.32E-03	3.80E-04	4.70E-03	No TRV	No TRV	No HQ
4,4'-DDT	8.48E-03	7.70E-04	3.70E-07	5.70E-01	1.83E-03	4.80E-04	2.31E-03	1.70E+00	1.36E-03	0.61%
Dichloroprop	2.29E-02	1.00E+00	1.30E-03	1.00E+00	8.68E-03	1.30E-03	1.13E-02	No TRV	No TRV	No HQ
Dieldrin	4.33E-03	2.00E-02	4.91E-06	5.50E+00	9.03E-03	2.45E-04	9.28E-03	4.26E-02	2.18E-01	97.69%
Heptachlor Epoxide	1.77E-03	5.90E-03	5.91E-07	1.00E+00	6.71E-04	1.00E-04	7.72E-04	No TRV	No TRV	No HQ
MCPP	7.08E-02	1.00E+00	4.01E-03	1.00E+00	2.68E-02	4.01E-03	3.49E-02	No TRV	No TRV	No HQ
								HI =	2.23E-01	

SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P(kg/kgBW/D) = 7.28E-02
AUF = 7.78E-01
BAF_i = Soil-to-animal; invertebrates
ADD_A= Average daily dose; animal
I_A (kg/kgBW/D) = 4.87E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 7.28E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 23. Hazard Quotient Table for American Robin at EI Site 19 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	**Arithmetic Mean** (mg/kg)	**SP_r**	**ADD_P** (mg/kgBW/d) RME *x* SP_r *x* I_P *x* AUF	**BAF_i**	**ADD_A** (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	**ADD_S** (mg/kgBW/d) RME *x* I_S *x* AUF	**ADD_{total}** (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	**Body Weight Adjusted TRV** (mg/kgBW/d)	**EI Site HQ** ADD_{total} /TRV	**%HI** HQ/HI *x* 100
Inorganics										
Aldrin	3.44E-03	2.00E-02	3.49E-06	5.00E-02	8.71E-05	3.62E-04	4.84E-04	No TRV	No TRV	No HQ
gamma-BHC (Lindane)	1.96E-03	2.00E-02	1.98E-05	2.00E-02	1.98E-05	2.06E-04	2.46E-04	3.76E+00	6.53E-05	0.01%
alpha-Chlordane	1.33E-02	5.10E-03	3.45E-05	1.60E+00	1.08E-02	1.14E-03	1.23E-02	2.02E+00	6.05E-03	1.04%
gamma-Chloradane	1.19E-02	5.10E-03	3.08E-05	1.60E+00	9.66E-03	1.26E-03	1.09E-02	2.02E+00	5.41E-03	0.93%
Dalapon	2.50E-02	1.00E+00	1.27E-02	1.00E+00	1.27E-02	2.63E-03	2.80E-02	No TRV	No TRV	No HQ
4,4'-DDE	6.71E-03	2.00E-03	6.80E-06	1.70E+00	5.78E-03	7.07E-04	6.49E-03	No TRV	No TRV	No HQ
4,4'-DDT	8.48E-03	7.70E-04	3.31E-06	5.70E-01	2.45E-03	8.93E-04	3.34E-03	7.20E-03	4.64E-01	79.92%
Dichloroprop	2.29E-02	1.00E+00	1.16E-02	1.00E+00	1.16E-02	2.42E-03	2.56E-02	No TRV	No TRV	No HQ
Dieldrin	4.33E-03	2.00E-02	4.39E-05	5.50E+00	1.21E-02	4.57E-04	1.26E-02	1.20E-01	1.05E-01	18.10%
Heptachlor Epoxide	1.77E-03	5.90E-03	5.29E-06	1.00E+00	8.97E-04	1.87E-04	1.09E-03	No TRV	No TRV	No HQ
MCPP	7.08E-02	1.00E+00	3.59E-02	1.00E+00	3.59E-02	7.46E-03	7.92E-02	No TRV	No TRV	No HQ
									HI =	5.81E-01

RME = Reasonable maximum exposure
SP_r = Soil-to-plant; reproductive
ADD_P = Average daily dose; plant
I_P(kg/kgBW/D) = 7.60E-01
AUF = 6.67E-01
BAF_i = Soil-to-animal; invertebrates
I_A (kg/kgBW/D) = 7.60E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.58E-01
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient

Table 24. Hazard Quotient Table for Eastern Cottontail at EI Site 19 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	**Arithmetic Mean** (mg/kg)	**SP_v**	**ADD_P** (mg/kgBW/d) RME *x* SP_v *x* I_p *x* AUF	**BAF_v**	**ADD_A** (mg/kgBW/d) RME *x* BAF_v *x* I_A *x* AUF	**ADD_S** (mg/kgBW/d) RME *x* I_S *x* AUF	**ADD_{total}** (mg/kgBW/d) ADD_P + ADD_A + ADD_S	**Body Weight Adjusted TRV** (mg/kgBW/d)	**EI Site HQ** ADD_{total} /TRV	**%HI** HQ/HI *x* 100
Inorganics										
Aldrin	3.44E-03	2.00E-02	1.32E-06	2.90E+00	0.00E+00	4.15E-06	5.46E-06	1.46E-01	3.74E-05	6.86%
gamma-BHC (Lindane)	1.96E-03	2.00E-02	7.48E-07	2.90E+00	0.00E+00	2.36E-06	3.10E-06	5.84E+00	5.31E-07	0.10%
alpha-Chlordane	1.33E-02	5.10E-03	1.30E-06	2.90E+00	0.00E+00	1.61E-05	1.74E-05	1.81E+00	9.60E-06	1.76%
gamma-Chloradane	1.19E-02	5.10E-03	1.16E-06	2.90E+00	0.00E+00	1.44E-05	1.55E-05	1.81E+00	8.58E-06	1.57%
Dalapon	2.50E-02	1.00E+00	4.78E-04	1.00E+00	0.00E+00	3.01E-05	5.08E-04	No TRV	No TRV	No HQ
4,4'-DDE	6.71E-03	2.00E-03	2.57E-07	2.90E+00	0.00E+00	8.08E-06	8.34E-06	No TRV	No TRV	No HQ
4,4'-DDT	8.48E-03	7.70E-04	1.25E-07	2.90E+00	0.00E+00	1.02E-05	1.03E-05	5.84E-01	1.77E-05	3.25%
Dichloroprop	2.29E-02	1.00E+00	4.38E-04	1.00E+00	0.00E+00	2.76E-05	4.66E-04	No TRV	No TRV	No HQ
Dieldrin	4.33E-03	2.00E-02	1.66E-06	2.90E+00	0.00E+00	5.22E-06	6.88E-06	1.46E-02	4.71E-04	86.46%
Heptachlor Epoxide	1.77E-03	5.90E-03	2.00E-07	2.90E+00	0.00E+00	2.13E-06	2.33E-06	No TRV	No TRV	No HQ
MCPP	7.08E-02	1.00E+00	1.36E-03	1.00E+00	0.00E+00	8.54E-05	1.44E-03	No TRV	No TRV	No HQ
								HI =	5.45E-04	

SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_p(kg/kgBW/d) = 2.05E-01
AUF = 9.33E-02
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A (kg/kgBW/D) = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.29E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 25. Hazard Quotient Table for Earthworms at EI Site 25i Surface Soil - Baseline Round 2

Ecological constituent of potential concern	**Arithmetic Mean** (mg/kg)	**Earthworm TRV** (mg/kg)	**EI Site HQ** RME /TRV	**%HI** HQ / HI *x* 100
Inorganics				
Calcium	5.27E+01	No TRV	No TRV	No HQ
Magnesium	2.39E+01	No TRV	No TRV	No HQ
Sodium	4.47E-01	No TRV	No TRV	No HQ
Organics				
Acenaphthylene	2.93E-04	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.63E-04	No TRV	No TRV	No HQ
Benzo(a)pyrene	3.00E-04	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	2.38E-04	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	3.32E-04	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.61E-04	No TRV	No TRV	No HQ
Chrysene	2.43E-04	No TRV	No TRV	No HQ
4,4'-DDD		No TRV	No TRV	No HQ
4,4'-DDE		No TRV	No TRV	No HQ
4,4'-DDT		No TRV	No TRV	No HQ
Dicamba	1.00E-05	No TRV	No TRV	No HQ
Fluoranthene	1.50E-04	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	3.06E-04	No TRV	No TRV	No HQ
MCPP	2.00E-04	No TRV	No TRV	No HQ
Pyrene	2.00E-04	No TRV	No TRV	No HQ
		HI =	0.00E+00	

TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 26. Hazard Quotient Table for Short-tailed Shrew at EI Site 25i Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} /TRV	%HI HQ/HI *x* 100
Inorganics										
Calcium	5.27E+01	7.00E-01	9.70E-01	1.00E+00	9.27E+00	1.39E+00	1.16E+01	No TRV	No TRV	No HQ
Magnesium	2.39E+01	2.00E-01	1.26E-01	1.00E+00	4.20E+00	6.28E-01	4.96E+00	No TRV	No TRV	No HQ
Sodium	4.47E-01	1.50E-02	1.76E-04	1.00E+00	7.86E-02	1.18E-02	9.06E-02	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.93E-04	2.00E-02	1.54E-07	5.00E-02	2.58E-06	7.70E-06	1.04E-05	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.63E-04	3.90E-03	2.70E-08	5.00E-02	2.31E-06	6.91E-06	9.25E-06	No TRV	No TRV	No HQ
Benzo(a)pyrene	3.00E-04	2.60E-03	2.05E-08	5.00E-02	2.64E-06	7.89E-06	1.05E-05	1.15E+00	9.15E-06	99.52%
Benzo(b)flouranthene	2.38E-04	2.30E-03	1.44E-08	5.00E-02	2.09E-06	6.26E-06	8.36E-06	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	3.32E-04	1.20E-03	1.05E-08	5.00E-02	2.92E-06	8.73E-06	1.17E-05	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.61E-04	2.30E-03	1.58E-08	5.00E-02	2.30E-06	6.86E-06	9.17E-06	No TRV	No TRV	No HQ
Chrysene	2.43E-04	3.90E-03	2.49E-08	5.00E-02	2.14E-06	6.39E-06	8.55E-06	No TRV	No TRV	No HQ
4,4'-DDD		1.30E-03	0.00E+00	3.30E+00	0.00E+00	0.00E+00	0.00E+00	No TRV	No TRV	No HQ
4,4'-DDE		2.00E-03	0.00E+00	1.70E+00	0.00E+00	0.00E+00	0.00E+00	No TRV	No TRV	No HQ
4,4'-DDT		7.70E-04	0.00E+00	5.70E-01	0.00E+00	0.00E+00	0.00E+00	1.70E+00	0.00E+00	0.00%
Dicamba	1.00E-05	1.00E+00	2.63E-07	1.00E+00	1.76E-06	2.63E-07	2.29E-06	5.21E+01	4.39E-08	0.48%
Fluoranthene	1.50E-04	2.00E-02	7.89E-08	5.00E-02	1.32E-06	3.94E-06	5.34E-06	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	3.06E-04	1.20E-03	9.65E-09	5.00E-02	2.69E-06	8.04E-06	1.07E-05	No TRV	No TRV	No HQ
MCPP	2.00E-04	1.00E+00	5.26E-06	1.00E+00	3.52E-05	5.26E-06	4.57E-05	No TRV	No TRV	No HQ
Pyrene	2.00E-04	6.70E-03	3.52E-08	5.00E-02	1.76E-06	5.26E-06	7.05E-06	No TRV	No TRV	No HQ
								HI =	9.19E-06	

SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P(kg/kgBW/d) = 7.28E-02
AUF = 3.61E-01
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 4.87E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 7.28E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 27. Hazard Quotient Table for American Robin at EI Site 25i Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_r *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} /TRV	%HI HQ/HI *x* 100
Inorganics										
Inorganics										
Calcium	5.27E+01	7.00E-02	8.68E-01	1.00E+00	1.24E+01	2.58E+00	1.58E+01	No TRV	No TRV	No HQ
Magnesium	2.39E+01	1.10E-01	6.18E-01	1.00E+00	5.62E+00	1.17E+00	7.41E+00	No TRV	No TRV	No HQ
Sodium	4.47E-01	1.10E-02	1.16E-03	1.00E+00	1.05E-01	2.19E-02	1.28E-01	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.93E-04	2.00E-02	1.38E-06	5.00E-02	3.45E-06	1.43E-05	1.92E-05	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.63E-04	3.90E-03	2.41E-07	5.00E-02	3.09E-06	1.29E-05	1.62E-05	No TRV	No TRV	No HQ
Benzo(a)pyrene	3.00E-04	2.60E-03	1.83E-07	5.00E-02	3.53E-06	1.47E-05	1.84E-05	No TRV	No TRV	No HQ
Benzo(b)flouranthene	2.38E-04	2.30E-03	1.29E-07	5.00E-02	2.80E-06	1.16E-05	1.46E-05	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	3.32E-04	1.20E-03	9.37E-08	5.00E-02	3.90E-06	1.62E-05	2.02E-05	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.61E-04	2.30E-03	1.41E-07	5.00E-02	3.07E-06	1.28E-05	1.60E-05	No TRV	No TRV	No HQ
Chrysene	2.43E-04	3.90E-03	2.23E-07	5.00E-02	2.86E-06	1.19E-05	1.50E-05	No TRV	No TRV	No HQ
4,4'-DDD		1.30E-03	0.00E+00	3.30E+00	0.00E+00	0.00E+00	0.00E+00	No TRV	No TRV	No HQ
4,4'-DDE		2.00E-03	0.00E+00	1.70E+00	0.00E+00	0.00E+00	0.00E+00	No TRV	No TRV	No HQ
4,4'-DDT		7.70E-04	0.00E+00	5.70E-01	0.00E+00	0.00E+00	0.00E+00	7.20E-03	0.00E+00	#DIV/0!
Dicamba	1.00E-05	1.00E+00	2.35E-06	1.00E+00	2.35E-06	4.89E-07	5.19E-06	No TRV	No TRV	No HQ
Fluoranthene	1.50E-04	2.00E-02	7.06E-07	5.00E-02	1.76E-06	7.34E-06	9.81E-06	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	3.06E-04	1.20E-03	8.64E-08	5.00E-02	3.60E-06	1.50E-05	1.87E-05	No TRV	No TRV	No HQ
MCPP	2.00E-04	1.00E+00	4.70E-05	1.00E+00	4.70E-05	9.79E-06	1.04E-04	No TRV	No TRV	No HQ
Pyrene	2.00E-04	6.70E-03	3.15E-07	5.00E-02	2.35E-06	9.79E-06	1.25E-05	No TRV	No TRV	No HQ
									HI =	0.00E+00

RME = Reasonable maximum exposure
SP_r = Soil-to-plant; reproductive
ADD_P = Average daily dose; plant
I_P(kg/kgBW/d) = 7.60E-01
AUF = 3.10E-01
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A (kg/kgBW/d) = 7.60E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.58E-01
ADD_{total}= Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 28. Hazard Quotient Table for Eastern Cottontail at EI Site 25i Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	BAF_v	ADD_A (mg/kgBW/d) RME *x* BAF_v *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Calcium	5.27E+01	7.00E-01	3.28E-01	1.00E+00	0.00E+00	2.95E-02	3.57E-01	No TRV	No TRV	No HQ
Magnesium	2.39E+01	2.00E-01	4.25E-02	1.00E+00	0.00E+00	1.34E-02	5.58E-02	No TRV	No TRV	No HQ
Sodium	4.47E-01	1.50E-02	5.96E-05	1.00E+00	0.00E+00	2.50E-04	3.10E-04	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.93E-04	2.00E-02	5.21E-08	1.90E-02	0.00E+00	1.64E-07	2.16E-07	No TRV	No TRV	No HQ
Benzo(a)anthracene	2.63E-04	3.90E-03	9.11E-09	7.60E-01	0.00E+00	1.47E-07	1.56E-07	No TRV	No TRV	No HQ
Benzo(a)pyrene	3.00E-04	2.60E-03	6.93E-09	1.50E+00	0.00E+00	1.68E-07	1.75E-07	3.95E-01	4.42E-07	100.00%
Benzo(b)flouranthene	2.38E-04	2.30E-03	4.86E-09	1.90E+00	0.00E+00	1.33E-07	1.38E-07	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	3.32E-04	1.20E-03	3.54E-09	6.00E+00	0.00E+00	1.86E-07	1.89E-07	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	2.61E-04	2.30E-03	5.33E-09	1.90E+00	0.00E+00	1.46E-07	1.51E-07	No TRV	No TRV	No HQ
Chrysene	2.43E-04	3.90E-03	8.42E-09	7.60E-01	0.00E+00	1.36E-07	1.44E-07	No TRV	No TRV	No HQ
4,4'-DDD		1.30E-03	0.00E+00	2.90E+00	0.00E+00	0.00E+00	0.00E+00	No TRV	No TRV	No HQ
4,4'-DDE		2.00E-03	0.00E+00	2.90E+00	0.00E+00	0.00E+00	0.00E+00	No TRV	No TRV	No HQ
4,4'-DDT		7.70E-04	0.00E+00	2.90E+00	0.00E+00	0.00E+00	0.00E+00	5.84E-01	0.00E+00	0.00%
Dicamba	1.00E-05	1.00E+00	8.88E-08	1.00E+00	0.00E+00	5.60E-09	9.44E-08	No TRV	No TRV	No HQ
Fluoranthene	1.50E-04	2.00E-02	2.67E-08	1.30E-01	0.00E+00	8.39E-08	1.11E-07	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	3.06E-04	1.20E-03	3.26E-06	6.00E+00	0.00E+00	1.71E-07	1.75E-07	No TRV	No TRV	No HQ
MCPP	2.00E-04	1.00E+00	1.78E-06	1.00E+00	0.00E+00	1.12E-07	1.89E-06	No TRV	No TRV	No HQ
Pyrene	2.00E-04	6.70E-03	1.19E-08	3.00E-01	0.00E+00	1.12E-07	1.24E-07	No TRV	No TRV	No HQ
								HI =	4.42E-07	

SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P(kg/kgBW/d) = 2.05E-01
AUF = 4.33E-02
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.29E-02
ADD_{total}= Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 29 . Hazard Quotient Table for Earthworms at EI Site 30 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	**Arithmetic Mean** (mg/kg)	**Earthworm TRV** (mg/kg)	**EI Site HQ** RME / TRV	**%HI** HQ / HI *x* 100
Inorganics				
Antimony	3.26E+00	No TRV	No TRV	No HQ
Cadmium	3.25E-01	2.00E+01	1.63E-02	100.00%
Magnesium	1.33E+04	No TRV	No TRV	No HQ
Silver	3.32E-01	No TRV	No TRV	No HQ
Organics				
Acenaphthylene	2.29E-02	No TRV	No TRV	No HQ
Anthracene	1.87E-01	No TRV	No TRV	No HQ
Benzo(a)anthracene	9.78E-01	No TRV	No TRV	No HQ
Benzo(a)pyrene	8.67E-01	No TRV	No TRV	No HQ
Benzo(b)fluoranthene	8.16E-01	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	5.48E-01	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	7.29E-01	No TRV	No TRV	No HQ
bis(2-Ethylhexyl)phthalate	2.28E-02	No TRV	No TRV	No HQ
Carbozole	8.93E-02	No TRV	No TRV	No HQ
Chrysene	1.25E+00	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	3.62E-01	No TRV	No TRV	No HQ
Dibenzofuran	5.03E-02	No TRV	No TRV	No HQ
Fluoranthene	7.52E-01	No TRV	No TRV	No HQ
2-Methylnaphthalene	4.50E-02	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	5.48E-01	No TRV	No TRV	No HQ
Naphthalene	7.94E-02	No TRV	No TRV	No HQ
Phenanthrene	3.98E-01	No TRV	No TRV	No HQ
Pyrene	2.03E+00	No TRV	No TRV	No HQ
			HI =	1.63E-02

TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 30. Hazard Quotient Table for Short-tailed Shrew at EI Site 30 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Antimony	3.26E+00	4.00E-02	9.50E-03	5.00E-02	7.95E-02	2.38E-01	3.26E-01	1.44E-01	2.27E+00	70.81%
Cadmium	3.25E-01	1.10E-01	2.60E-03	1.10E+01	1.74E+00	2.37E-02	1.77E+00	2.05E+00	8.60E-01	26.89%
Magnesium	1.33E+04	2.00E-01	1.93E+02	1.00E+00	6.47E+03	9.67E+02	7.63E+03	No TRV	No TRV	No HQ
Silver	3.32E-01	8.00E-02	1.93E-03	1.50E-01	2.42E-02	2.41E-02	5.03E-02	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.29E-02	2.00E-02	3.34E-05	5.00E-02	5.58E-04	1.67E-03	2.26E-03	No TRV	No TRV	No HQ
Anthracene	1.87E-01	2.00E-02	2.72E-04	5.00E-02	4.55E-03	1.36E-02	1.84E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	9.78E-01	3.90E-03	2.78E-04	5.00E-02	2.38E-02	7.12E-02	9.53E-02	No TRV	No TRV	No HQ
Benzo(a)perylene	8.67E-01	2.60E-03	1.64E-04	5.00E-02	2.11E-02	6.31E-02	8.44E-02	1.15E+00	7.32E-02	2.29%
Benzo(b)pyrene	8.16E-01	2.30E-03	1.37E-04	5.00E-02	1.99E-02	5.94E-02	7.94E-02	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	5.48E-01	1.20E-03	4.79E-05	5.00E-02	1.34E-02	3.99E-02	5.33E-02	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	7.29E-01	2.30E-03	1.22E-04	5.00E-02	1.78E-02	5.31E-02	7.10E-02	No TRV	No TRV	No HQ
bis(2-Ethylhexyl)phthalate	2.28E-02	8.70E-03	1.44E-05	5.00E-02	5.55E-04	1.66E-03	2.23E-03	No TRV	No TRV	No HQ
Carbazole	8.93E-02	2.00E-02	1.30E-04	5.00E-02	2.17E-03	6.50E-03	8.80E-03	No TRV	No TRV	No HQ
Chrysene	1.25E+00	3.90E-03	3.55E-04	5.00E-02	3.05E-02	9.10E-02	1.22E-01	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	3.62E-01	1.40E-03	3.69E-05	5.00E-02	8.81E-03	2.63E-02	3.52E-02	5.99E+01	5.87E-04	0.02%
Dibenzofuran	5.03E-02	2.00E-02	7.32E-05	5.00E-02	1.22E-03	3.66E-03	4.96E-03	6.39E+01	7.75E-05	0.00%
Fluoranthene	7.52E-01	2.00E-02	1.10E-03	5.00E-02	1.83E-02	5.48E-02	7.42E-02	No TRV	No TRV	No HQ
2-Methynaphthalene	4.50E-02	2.00E-02	6.55E-05	5.00E-02	1.10E-03	3.28E-03	4.44E-03	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	5.48E-01	1.20E-03	4.79E-05	5.00E-02	1.33E-02	3.99E-02	5.33E-02	No TRV	No TRV	No HQ
Naphthalene	7.94E-02	2.00E-02	1.16E-04	5.00E-02	1.93E-03	5.78E-03	7.83E-02	No TRV	No TRV	No HQ
Phenanthrene	3.98E-01	2.00E-02	5.80E-04	5.00E-02	9.71E-03	2.90E-02	3.93E-02	No TRV	No TRV	No HQ
Pyrene	2.03E+00	6.70E-03	9.90E-04	5.00E-02	4.94E-02	1.48E-01	1.98E-01	No TRV	No TRV	No HQ
								HI =	3.20E+00	

SP_v = Soil-to-plant; vegetative
ADD_P = Average daily dose; plant
I_P(kg/kgBW/d) = 7.28E-02
AUF = 1.00E+00
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 4.87E-01
ADD_S= Average daily dose; soil
I_S (kg/kgBW/d) = 7.28E-02
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 31. Hazard Quotient Table for American Robin at EI Site 30 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_r	ADD_p (mg/kgBW/d) RME *x* SP_r *x* I_p *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} / TRV	%HI HQ/HI *x* 100
Inorganics										
Antimony	3.26E+00	6.00E-03	1.49E-02	5.00E-02	1.24E-01	5.16E-01	6.55E-01	No TRV	No TRV	No HQ
Cadmium	3.25E-01	3.00E-02	7.41E-03	1.10E+01	2.72E+00	5.14E-02	2.78E+00	2.83E+00	9.83E-01	99.64%
Magnesium	1.33E+04	1.10E-01	1.11E+03	1.00E+00	1.01E+04	2.10E+03	1.33E+04	No TRV	No TRV	No HQ
Silver	3.32E-01	2.00E-02	5.04E-03	1.50E-01	3.78E-02	5.24E-02	9.53E-02	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.29E-02	2.00E-02	3.48E-04	5.00E-02	8.71E-04	3.62E-03	4.84E-03	No TRV	No TRV	No HQ
Anthracene	1.87E-01	2.00E-02	2.84E-03	5.00E-02	7.10E-03	2.95E-02	3.95E-02	No TRV	No TRV	No HQ
Benzo(a)anthracene	9.78E-01	3.90E-03	2.90E-03	5.00E-02	3.72E-02	1.55E-01	1.95E-01	No TRV	No TRV	No HQ
Benzo(a)pyrene	8.67E-01	2.60E-03	1.71E-03	5.00E-02	3.29E-02	1.37E-01	1.72E-01	No TRV	No TRV	No HQ
Benzo(b)flouranthene	8.16E-01	2.30E-03	1.43E-03	5.00E-02	3.10E-02	1.29E-01	1.61E-01	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	5.48E-01	1.20E-03	5.00E-04	5.00E-02	2.08E-02	8.67E-02	1.08E-01	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	7.29E-01	2.30E-03	1.27E-03	5.00E-02	2.77E-02	1.15E-01	1.44E-01	No TRV	No TRV	No HQ
bis(2-Ethylhexyl)phthalate	2.28E-02	8.70E-03	1.51E-04	5.00E-02	8.66E-04	3.60E-03	4.62E-03	1.30E+00	3.56E-03	0.36%
Carbazole	8.93E-02	2.00E-02	1.36E-03	5.00E-02	3.39E-03	1.41E-02	1.89E-02	No TRV	No TRV	No HQ
Chrysene	1.25E+00	3.90E-03	3.71E-03	5.00E-02	4.75E-02	1.98E-01	2.49E-01	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	3.62E-01	1.40E-03	3.85E-04	5.00E-02	1.37E-02	5.72E-02	7.13E-02	No TRV	No TRV	No HQ
Dibenzofuran	5.03E-02	2.00E-02	7.64E-04	5.00E-02	1.91E-03	7.94E-03	1.06E-02	No TRV	No TRV	No HQ
Fluoranthene	7.52E-01	2.00E-02	1.14E-02	5.00E-02	2.86E-02	1.19E-01	1.59E-01	No TRV	No TRV	No HQ
2-Methylnaphthalene	4.50E-02	2.00E-02	6.84E-04	5.00E-02	1.71E-03	7.11E-03	9.51E-03	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	5.48E-01	1.20E-03	5.00E-04	5.00E-02	2.08E-02	8.66E-02	1.08E-01	No TRV	No TRV	No HQ
Naphthalene	7.94E-02	2.00E-02	1.21E-03	5.00E-02	3.02E-03	1.26E-02	1.68E-02	No TRV	No TRV	No HQ
Phenanthrene	3.98E-01	2.00E-02	6.06E-03	5.00E-02	1.51E-02	6.30E-02	8.42E-02	No TRV	No TRV	No HQ
Pyrene	2.03E+00	6.70E-03	1.03E-02	5.00E-02	7.71E-02	3.21E-01	4.08E-01	No TRV	No TRV	No HQ
								HI =	9.86E-01	

RME = Reasonable maximum exposure
SP_r = Soil-to-plant; reproductive
ADD_p = Average daily dose; plant
I_p(kg/kgBW/D) = 7.60E-01
AUF = 1.00E+00
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/d) = 7.60E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.58E-01
ADD_{total} = Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)

Table 32. Hazard Quotient Table for Eastern Cottontail at EI Site 30 Surface Soil - Baseline Round 2

Ecological constituent of potential concern	Arithmetic Mean (mg/kg)	SP_v	ADD_p (mg/kgBW/d) RME *x* SP_v *x* I_p *x* AUF	BAF_v	ADD_A (mg/kgBW/d) RME *x* BAF_v *x* I_A *x* AUF	ADD_S (mg/kgBW/d)RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	Body Weight Adjusted TRV (mg/kgBW/d)	EI Site HQ ADD_{total} /TRV	%HI HQ/HI *x* 100
Inorganics										
Antimony	3.26E+00	4.00E-02	2.68E-02	5.00E-02	0.00E+00	4.21E-02	6.89E-02	4.94E-02	1.39E+00	96.81%
Cadmium	3.25E-01	1.10E-01	7.33E-03	2.80E-02	0.00E+00	4.20E-03	1.15E-02	7.05E-01	1.64E-02	1.14%
Magnesium	1.33E+04	2.00E-01	5.44E+02	1.00E+00	0.00E+00	1.72E+02	7.16E+02	No TRV	No TRV	No HQ
Silver	3.32E-01	8.00E-02	5.44E-03	1.50E-01	0.00E+00	4.28E-03	9.72E-03	No TRV	No TRV	No HQ
Organics										
Acenaphthylene	2.29E-02	2.00E-02	9.40E-05	1.90E-02	0.00E+00	2.96E-04	3.90E-04	No TRV	No TRV	No HQ
Anthracene	1.87E-01	2.00E-02	7.66E-04	4.80E-02	0.00E+00	2.41E-03	3.18E-03	No TRV	No TRV	No HQ
Benzo(a)anthracene	9.78E-01	3.90E-03	7.82E-04	7.60E-01	0.00E+00	1.26E-02	1.34E-02	No TRV	No TRV	No HQ
Benzo(a)pyrene	8.67E-01	2.60E-03	4.62E-04	1.50E+00	0.00E+00	1.12E-02	1.17E-02	3.95E-01	2.95E-02	2.05%
Benzo(b)fluoranthene	8.16E-01	2.30E-03	3.85E-04	1.90E+00	0.00E+00	1.05E-02	1.09E-02	No TRV	No TRV	No HQ
Benzo(g,h,i)perylene	5.48E-01	1.20E-03	1.35E-04	6.00E+00	0.00E+00	7.08E-03	7.22E-03	No TRV	No TRV	No HQ
Benzo(k)fluoranthene	7.29E-01	2.30E-03	3.44E-04	1.90E+00	0.00E+00	9.42E-03	9.76E-03	No TRV	No TRV	No HQ
bis(2-Ethylhexyl)phthalate	2.28E-02	8.70E-03	4.06E-05	1.90E-01	0.00E+00	2.94E-04	3.35E-04	7.23E+00	4.63E-05	0.00%
Carbazole	8.93E-02	2.00E-02	3.66E-04	8.70E-03	0.00E+00	1.15E-03	1.52E-03	No TRV	No TRV	No HQ
Chrysene	1.25E+00	3.90E-03	1.00E-03	7.60E-01	0.00E+00	1.61E-02	1.71E-02	No TRV	No TRV	No HQ
Dibenzo(a,h)anthracene	3.62E-01	1.40E-03	1.04E-04	4.80E+00	0.00E+00	4.67E-03	4.78E-03	No TRV	No TRV	No HQ
Dibenzofuran	5.03E-02	2.00E-02	2.06E-04	1.90E-02	0.00E+00	6.49E-04	8.55E-04	No TRV	No TRV	No HQ
Fluoranthene	7.52E-01	2.00E-02	3.08E-03	1.30E-01	0.00E+00	9.71E-03	1.28E-02	No TRV	No TRV	No HQ
2-Methylnaphthalene	4.50E-02	2.00E-02	1.85E-04	1.90E-08	0.00E+00	5.81E-04	7.66E-04	No TRV	No TRV	No HQ
Indeno(1,2,3-cd)pyrene	5.48E-01	1.20E-03	1.35E-04	6.00E+00	0.00E+00	7.08E-03	7.21E-03	No TRV	No TRV	No HQ
Naphthalene	7.94E-02	2.00E-02	3.26E-04	6.00E-03	0.00E+00	1.03E-03	1.35E-03	No TRV	No TRV	No HQ
Phenanthrene	3.98E-01	2.00E-02	1.63E-03	4.80E-02	0.00E+00	5.15E-03	6.78E-03	No TRV	No TRV	No HQ
Pyrene	2.03E+00	6.70E-03	2.79E-03	3.00E-01	0.00E+00	2.62E-02	2.90E-02	No TRV	No TRV	No HQ
								HI =	1.44E+00	

SP_v = Soil-to-plant; vegetative
ADD_p = Average daily dose; plant
I_p(kg/kgBW/d) = 2.05E-01
AUF = 1.00E+00
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_A(kg/kgBW/D) = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = 1.29E-02
ADD_{total}= Average daily dose; total
TRV = Toxicity reference value
HQ = Hazard quotient
HI = Hazard index (Sum of HQs)