

INSTALLATION RESTORATION PROGRAM

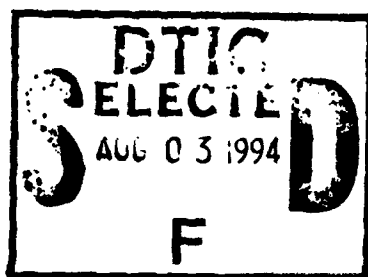
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IDAHO AIR NATIONAL GUARD
GOWEN FIELD, BOISE, IDAHO

SITE INSPECTION ADDENDUM - 2

FINAL



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13. Abstract (maximum 200 words) This Site Inspection Addendum - 2 Report documents the additional Site inspection (SI) activities conducted by Science Applications International Corporation (SAIC) at the Idaho Air National Guard (IANG), 124th Reconnaissance Group, Gowen Field, Boise, Idaho, under the U.S. Department of Defense (DOD) Installation Restoration Program (IRP). The results of the SI activities conducted by SAIC were used to prepare a baseline risk assessment and determine the vertical migration of site-specific contaminants using a U.S. Environmental Protection Agency (EPA) computer transport model (Pesticide Root Zone Model - 2) The findings of the baseline human health risk assessment presented in this report are used in evaluating the need for site remediation.					
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INSTALLATION RESTORATION PROGRAM
IDAHO AIR NATIONAL GUARD
124TH RECONNAISSANCE GROUP
GOWEN FIELD, BOISE, IDAHO**

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SITE INSPECTION ADDENDUM - 2

FINAL

Submitted to:

**Air National Guard Readiness Center
Andrews Air Force Base, Maryland 20331**

Submitted by:

**Hazardous Waste Remedial Actions Program
Martin Marietta Energy Systems, Inc.
Oak Ridge, Tennessee 37830**

For the:

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LIST OF ACRONYMS AND ABBREVIATIONS

AFFF	Aqueous Film-Forming Foam
AMSL	Above Mean Sea Level
ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
ARAR	Applicable or Relevant and Appropriate Requirement
BLS	Below Land Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CDC	Center for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
CRAVE	Carcinogenic Risk Assessment Verification Endeavor
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
CSF	Cancer Scope Factor
1,2-DCE	1,2-Dichloroethene
DOD	U.S. Department of Defense
DQO	Data Quality Objective
EA	Environmental Assessment
EE/CA	Engineering Evaluation/Cost Analysis
ELCR	Excess Lifetime Cancer Risk
Energy Systems	Martin Marietta Energy Systems, Inc.
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
FAA	Federal Aviation Administration
GC	Gas Chromatograph
GC/MS	Gas Chromatography/Mass Spectrometry
HAZWRAP	Hazardous Waste Remedial Actions Program
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HMTC	Hazardous Materials Technical Center
HQ	Hazard Quotient
HWMA	Hazardous Waste Management Act
IANG	Idaho Air National Guard
IDEQ	Idaho Department of Environmental Quality
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
K _d	Soil/Water Partition Coefficient
K _h	Vapor/Water Partition Coefficient
LCS	Laboratory Control Sample
LOAEL	Lowest-Observable-Adverse-Effect Level
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per Liter

MLE	Most Likely Exposure
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
ng/kg	nanograms per kilogram
NOAEL	No-Observable-Adverse-Effect Level
O.D.	Outside Diameter
ORD	Office of Research and Development
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzodioxin
PCDF	Polychlorinated Dibenzofuran
PMCL	Proposed Maximum Contaminant Level
PMCLG	Proposed Maximum Contaminant Level Goal
POL	Petroleum, Oils, and Lubricants
PRZM-2	Pesticide Root Zone Model-2
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QAPP	Quality Assurance Project Plan
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RME	Reasonable Maximum Exposure
RPD	Relative Percent Difference
SAIC	Science Applications International Corporation
SI	Site Inspection
SOP	Standard Operating Procedure
SOW	Statement of Work
SVOC	Semivolatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compounds
TPH	Total Petroleum Hydrocarbon
UCL	Upper Confidence Level
μg/kg	micrograms per kilogram
μg/dl	micrograms per deciliter
USAF	U.S. Air Force
UST	Underground Storage Tank
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This Site Inspection (SI) Report is an addendum to the Final Site Inspection Report (SAIC 1989) and Final Site Inspection Report Addendum (June 1992), prepared for the U.S. Department of Defense (DOD) Installation Restoration Program (IRP) at Idaho Air National Guard (IANG), 124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho. Six sites were identified at IANG, Gowen Field during the Preliminary Assessment (PA) (Hazardous Materials Technical Center [HMTTC] 1985). SI activities were initiated in 1987 to address potential contamination at four of the sites identified in the PA. These four sites were Site 1 - Current Fire Training Area, Site 2 - Former Fire Training Area, Site 5 - Former Wood Preserving Operation, and Site 6 - Tar Pit. The purpose of the SI was to:

- Confirm the presence or absence of contamination at the sites
- Identify the sources and nature of contamination at these sites
- Provide a preliminary assessment of the extent, magnitude, and movement of contamination
- Identify the potential threat of contamination to human health or the environment.

At the conclusion of the 1987 SI, data gaps existed at the four studied sites that required an additional phase of investigation activities. A data gap is defined as the data required to progress to the next step in the IRP process. Additional activities were conducted during the 1990 phase of the SI. In addition, it was determined that information was necessary to evaluate Site 3 - Central Drainage Ditch.

Results from the 1990 SI activities confirmed the overall results of the 1987 program and provided additional information concerning the extent of contamination at the sites. The data generated from the 1987 and 1990 SI activities were sufficient to characterize and evaluate the sites studied during this period at IANG, Gowen Field. The collected data indicated the absence of chemical contaminants at concentrations exceeding guidelines for risk to public health established by the U.S. Environmental Protection Agency.

No further data collection or remedial action activities were recommended for these sites under the IRP based on the data and the preliminary human health risk evaluation. The presence of visible surface soil contamination, a noticeable odor associated with volatile compounds, and the consideration of future land use at Site 1 - Current Fire Training Area warranted that a surface soils investigation be considered for the soils at this site. Additional data collection activities were deemed necessary so that this additional information could be used to augment the current risk calculations so that a baseline risk assessment could be developed, and so that a computer contaminant transport model could be used to determine the potential for vertical migration of site-specific contaminants to this underlying groundwater. The activities to accomplish these objectives were conducted in September 1992. The 1992 field program consisted of:

- Drilling one soil boring 160 feet BLS to collect soil samples for geotechnical analysis. Results were to be used in the computer contaminant transport model.
- Sampling of the stockpiled soils from Site 4 - Oil Patch in Drainage Field.
- Backhoe test pit sampling a total of 11 locations at Site 1 - Current Fire Training Area and IANG Gowen Field background locations.

Both current and future land use have been considered in the risk assessment of Site 1 (which included three areas of concern: Fire Training Pit Area, Underground Storage Tank Area, and Stockpiled Site 4 Soils), Sites 2, 3, and 6 at IANG, Gowen Field. The land use analysis of IANG, Gowen Field indicates that future residential and agricultural use of Sites 1, 2, 3, and 6 is precluded by the presence of, and proximity to the air field. Current land use and existing exposure pathways are appropriate as the basis for long-term human health risk assessment of the IANG, Gowen Field sites. In general, the results of the risk assessment indicate that there is no immediate or substantial endangerment to human health due to the presence of chemicals in groundwater, soils, or sediments at IANG, Gowen Field Sites 1, 2, 3, and 6.

The original soils at Site 4 that were removed and stockpiled at Site 1 in 1985 were analyzed as part of the September 1992 field program. The analytical results of the Stockpiled Site 4 Soils were evaluated as part of the risk assessment and the risk assessment results indicated that there is no immediate or substantial endangerment to human health due to the presence of

any chemicals. Based on the fact that all of the contaminated soils that were present at Site 4 were removed from the original site and stockpiled at Site 1, and these stockpiled soils showed no risk, it is anticipated that Site 4 presents no risk to human health.

The results of the baseline human health risk assessment *do not* indicate the need for remediation at IANG, Gowen Field Sites 1, 2, 3, or 6. The fact that the risk assessment indicates no remediation is required for the Stockpiled Site 4 Soils, no remedial action is recommended for Site 4 - Oil Patch in Drainage Field. Risks to human health of exposure to soils and sediments fall within the target risk ranges established by EPA for waste site remediation. Contaminants in the soil column will not result in degradation of the groundwater resource over time. Therefore, it is recommended that decision documents be prepared for Site 2, Site 3, Site 4, and Site 6 indicating that no further IRP investigations or remediation are required at the sites.

It is recommended that the Underground Storage Tank Area present at Site 1 be closed in accordance with relevant State of Idaho requirements. It also is recommended that the soils that were generated during the SI field program be spread at the sites where they were generated. This recommendation is based on TCLP analytical results of the soil and guidance from IDEQ.

The presence of Site 6 - Tar Pit presents a safety hazard to humans and animals who may enter the area. Though no further IRP activities are warranted based on the baseline risk assessment, it is recommended that disposal options for the tar be developed. This potential course of action would eliminate the safety hazard associated with the tar pit.

The SI Addendum - 2 and the recommendations outlined above have been reviewed by IDEQ, the Air National Guard Readiness Center (ANGRC), and IANG regarding the thoroughness and completeness of data collection, data evaluation, and analysis. In addition, the IRP investigation at Gowen Field has been reviewed by IDEQ, ANGRC, and IANG to ensure that all aspects of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Federal Resource Conservation and Recovery Act (RCRA), and the Idaho Hazardous Waste Management Act (HWMA) have been addressed.

Following their review of the SI Addendum - 2, IDEQ, ANGRC, and IANG concurred with the proposed recommendations for each of the IRP sites of concern. IDEQ stated in their review of the SI Addendum - 2 that all applicable RCRA/HWMA concerns were addressed and that the data contained in the SI Addendum - 2 indicated that hazardous waste constituents were below regulatory levels at the sites of concern. The IDEQ review letter is presented as an Attachment and appended to Section 6.

The next step in the IRP process will be to prepare individual Decision Documents for Sites 2, 3, 4, and 6. The Decision Document for Site 5 was prepared in September 1992. Site 1 will be closed in accordance with State of Idaho regulatory requirements, and the appropriate Closure Reports and Decision Documents will be prepared. The site-specific Decision Documents for the areas of concern will present the investigation activities conducted at the site, summarize the results, and detail the recommendations and rationale to support the proposed recommendations.

1. INTRODUCTION

This Site Inspection Addendum - 2 Report documents the additional site inspection (SI) activities conducted by Science Applications International Corporation (SAIC) at the Idaho Air National Guard (IANG), 124th Reconnaissance Group, Gowen Field, Boise, Idaho, under the U.S. Department of Defense (DOD) Installation Restoration Program (IRP). SAIC was retained by Martin Marietta Energy Systems, Inc. (Energy Systems) under the Hazardous Waste Remedial Actions Program (HAZWRAP) to collect additional data to supplement the results obtained during previous activities. The previous activities included a Preliminary Assessment (PA) that was conducted in 1985, SI activities that were conducted in 1987, and a second phase of SI activities that were performed in 1990. All activities were conducted with concurrence and approval of the Idaho Department of Environmental Quality (IDEQ).

Additional SI data were collected in 1992 in order to determine the disposal fate of drill cuttings generated during previous SI investigation activities, to prepare a baseline risk assessment, to run a computer contaminant transport model to determine the vertical migration of contaminants, and provide information to help determine the need for removal actions at specific sites. The surface/subsurface sampling activities for this investigation were conducted from September 21 through 25, 1992. Field activities, described in this addendum, were performed in accordance with the Sampling Work Plan - Addendum - 2, which was approved by the Air National Guard Readiness Center (ANGRC) and Energy Systems in September 1992, and with the concurrence of the IDEQ. The following subsections describe the purpose of the SI program, outline the organization of the Addendum - 2 Report, provide information on the sites under investigation, and summarize previous IRP activities conducted at Gowen Field.

1.1 PURPOSE OF STUDY

The objectives of the IRP are to identify, quantify, and evaluate the development of feasible remedies for environmental problems caused by hazardous materials used or disposed of at DOD installations, and to remediate these problems. During the SI conducted by SAIC at IANG, Gowen Field in 1987 and 1990, soil contamination was detected at several sites. It

was determined that additional data were needed to fill in data gaps relative to near surface contaminant concentrations.

This Addendum Report presents the results of the additional data collection activities conducted in September 1992, and provides guidance on the disposal fate of the soil cuttings from previous investigations. The results of the SI activities conducted by SAIC were used to prepare a baseline risk assessment and determine the vertical migration of site-specific contaminants using a U.S. Environmental Protection Agency (EPA) computer transport model (Pesticide Root Zone Model-2). The baseline risk assessment and results of the transport model also are presented in this document.

The purpose of the baseline risk assessment of the identified sites is to evaluate and support the determination of the need for site remediation. The baseline risk assessment focuses on potential noncancer and cancer health effects from long-term, low-level exposure of humans to site-related contaminants. The risk assessment also compares site environmental data with applicable or relevant and appropriate Federal and state requirements (ARARs). For the investigation conducted at IANG, Gowen Field, ecological risks are not used in the evaluation and determination of the need for remedial alternatives because of the absence of endangered species and critical habitats at the sites under investigation (ANG 1991). The findings of the baseline human health risk assessment presented in this report are used in evaluating the need for site remediation.

1.2 REPORT ORGANIZATION

The Site Inspection Addendum - 2 contains the following sections:

- **Section 1. Introduction.** The remainder of this section summarizes the history of IANG, Gowen Field; the specifics of each individual site; and the previous studies conducted at IANG, Gowen Field.
- **Section 2. Field Program.** This section describes the activities, methods, and procedures used to determine the contaminant characteristics of the surficial soils at background locations; the soils at Site 1 - Current Fire Training Area; the stockpiled drill cuttings at Site 2 - Former Fire Training Area; the stockpiled Site 4 - Oil Patch in Drainage field soils; and Site 6 - Tar Pit that remain from previous investigations.

- **Section 3. Significance of Results.** This section provides the geologic, hydrogeologic, and chemical results obtained during the additional sampling program, the data quality objectives obtained during the field activities, and the significance of these results.
- **Section 4 - Baseline Human Health Risk Assessment.** This section presents the methods used to evaluate human health risks, presents the results of the baseline risk characterization, and provides analysis relating to the significance of the reported health risks.
- **Section 5 - Conclusions and Recommendations.** This section presents site-specific conclusions and recommendations for any future IRP activities.

1.3 FACILITY DESCRIPTION

The history of IANG, Gowen Field and a description of each IRP site are provided in the following subsections. The focus of this field investigation was to collect surface soils at areas within Site 1 - Current Fire Training Area, the stockpiled soils from Site 4 - Oil Patch in Drainage Field, and various background locations. In addition, samples were collected from the stockpiled drill cuttings at Site 2 - Former Fire Training Area and Site 6 - Tar Pit.

The risk assessment focused on Site 1 - Current Fire Training Area, Site 2 - Former Fire Training Area, Site 3 - Central Drainage Ditch, the stockpiled soils from Site 4 - Oil Patch in Drainage Field, and Site 6 - Tar Pit. The contaminant transport modeling efforts were concentrated at the fire training pit at Site 1 because this area has the highest concentration of contaminants of concern. Site 5 - Former Wood Preserving Operation is not considered in the baseline risk assessment because this site is scheduled to be capped.

1.3.1 Facility History

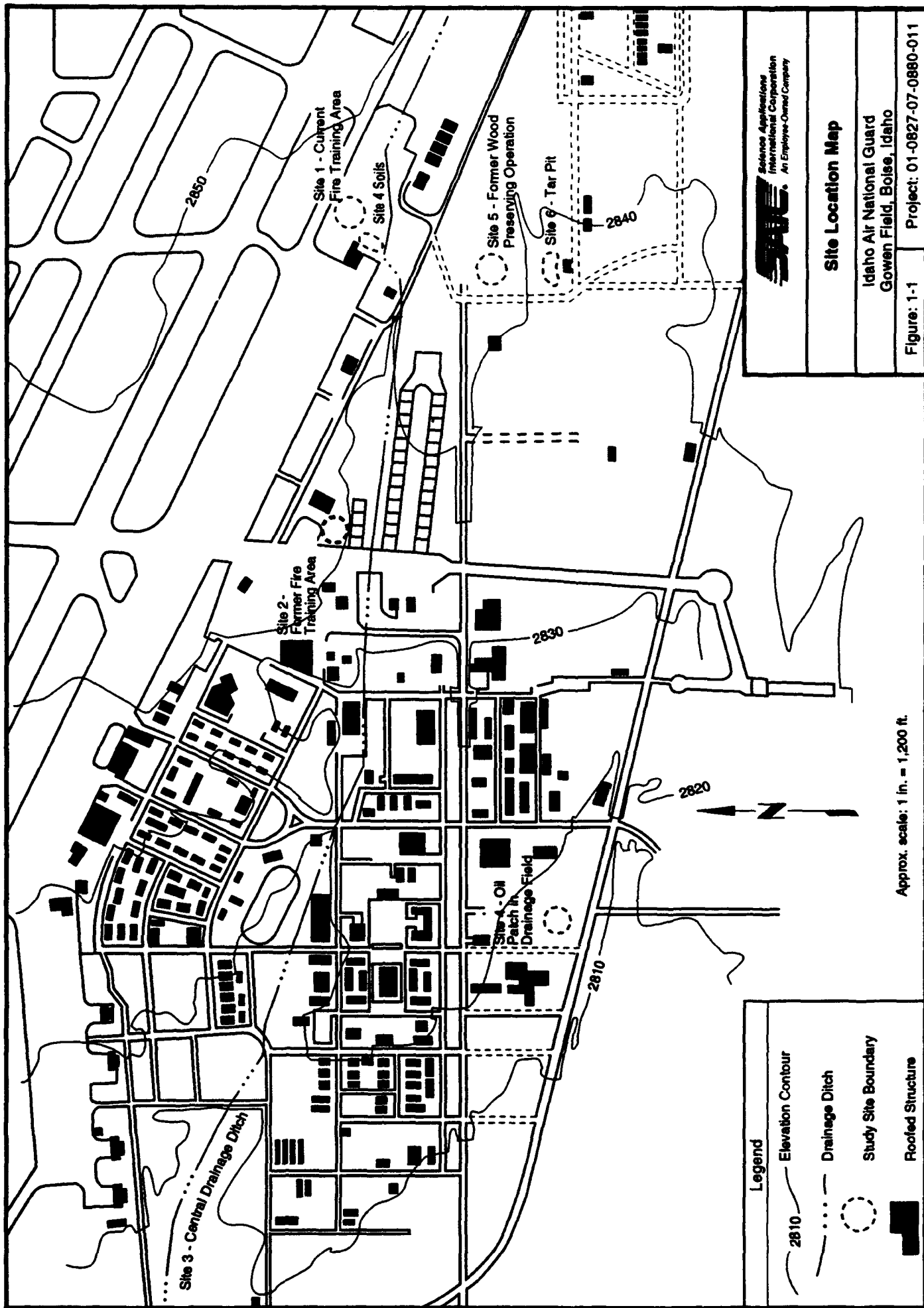
LANG, Gowen Field is located within the boundaries of Boise Air Terminal and the southern limits of the city of Boise in Ada County, Idaho. The Greater Boise area, with a population in excess of 150,000, extends north of LANG, Gowen Field and has expanded west and northwest of the Base. LANG, Gowen Field consists of approximately 570 acres; an additional 1,425 acres, including the runways, are in joint use with Boise Air Terminal. LANG, Gowen Field is located at 43 degrees and 33 minutes north and 116 degrees and 13 minutes west longitude at an elevation of 2,850 feet above sea level. Precipitation in the area of Gowen Field

averages 11.5 inches per year, with a net precipitation of negative 22.5 inches per year due to the high total annual evaporation. The maximum precipitation occurs during the winter months as a result of rain and snowfall (HMTc 1985).

1.3.1.1 Site 1 - Current Fire Training Area

Site 1 - Current Fire Training Area is located between Taxiway K and the central drainage ditch, approximately 200 feet northeast of Building NG 1515. Because of its close proximity to the taxiway, access to Site 1 is restricted. The IANG Fire Department and the Boise Air Terminal Fire Department used the fire training pit at Site 1 specifically for training activities between 1974 and 1989. Currently, Site 1 is not used by either Fire Department for training exercises, nor are Base-related training or construction activities conducted in this area of the nearby vicinity. The fire training pit is a bermed, circular site approximately 100 feet in diameter with a metal culvert pipe placed in the center of the pit to simulate an aircraft fuselage. Approximately 50 fire-fighting exercises were held in the pit area each year, during which between 15,000 and 20,000 gallons of unusable fuel were burned per year. These fuels were stored in two underground storage tanks located adjacent to the fire training pit on its western edge. During exercises, the fuels were pumped through a series of underground pipes to a sprinkler system in the middle of the pit that dispersed the fuels. From 1979 to 1985, fuel usage increased to between 50,000 and 75,000 gallons per year for the same number of exercises. Thus, an estimated 400,000 gallons (HMTc 1985) of flammable material had been burned in this pit through 1985. From 1985 through 1989, limited training occurred in this area and the quantity of flammable material used is unknown.

Of the 400,000 gallons of flammable material burned in the pit, the Hazardous Materials Technical Center (HMTc 1985) estimated that 300,000 gallons were unusable fuel, including JP-4 fuel, which was not suitable for use in fighter aircraft; 80,000 gallons were waste oil; and the remaining 20,000 gallons were mineral spirits and halogenated solvents. The fire-fighting agents used include aqueous film-forming foam (AFFF) and bromochloromethane. Assuming that 80 percent (HMTc 1985) of the material was consumed in combustion, 80,000 gallons of flammable liquids may have soaked into the soils below the site. The location of Site 1 - Current Fire Training Area is shown in Figure 1-1.



Results from the soil investigations conducted at Site 1 in 1987, 1990, and 1992, indicated contamination was concentrated in the bermed fire training pit and the areas located near the underground fuel storage tanks (USTs) and their related piping. Because the two areas are distinctive based on the activities that were conducted at each area, and the fact that the fire training pit is segregated from the surrounding area by an approximately 1.5 foot high berm, these two areas are evaluated separately in the baseline risk assessment presented in Section 4. The fire training pit and its associated sampling points are designated as the Fire Training Pit Area, and the sampling points related to the USTs and associated piping are designated as the Underground Storage Tank Area.

1.3.1.2 Site 2 - Former Fire Training Area

Site 2 - Former Fire Training Area is located adjacent to Taxiway M, approximately 450 feet east of the current petroleum, oils, and lubricants (POL) area. A portion of the site area has since been paved over for vehicle parking and a helicopter apron. The Fire Department used Site 2 for training activities between 1953 and 1974. An average of 16 fire-fighting events were held each year, and between 50 and 100 gallons of waste fuels, oils, and solvents were used for each exercise. The total amount of wastes disposed of in this pit was estimated to be 26,400 gallons (HMTc 1985).

The chemical makeup of the 26,400 gallons of waste is similar to that of the waste at Site 1 - Current Fire Training Area. Again, assuming that 80 percent (HMTc 1985) of the material was consumed in combustion, approximately 5,300 gallons of flammable liquids may have soaked into the soils below the site. The location of Site 2 - Former Fire Training Area is shown in Figure 1-1. Results from the previous investigations at Site 2 showed virtually no site-related soil contamination. No contamination was detected in the groundwater at Site 2.

Currently, Site 2 - Former Fire Training Area is an area of exposed soil bordered by Taxiway M, Building 1500, and a helicopter landing/parking area. No Base-related activities occur in the area designated as Site 2. Access to this area is restricted because of its close proximity to the helicopter landing/parking area.

1.3.1.3 Site 3 - Central Drainage Ditch

Site 3 - Central Drainage Ditch encompasses the east-west drainage ditch that runs the length of the Base from an upstream point east of Site 1 - Current Fire Training Area to where the ditch exits the Base at Dorman Street. Site 3 only carries intermittent flow as a result of rainfall and does not consistently transport running water. The limited rainfall in the Boise area (an average of 11.5 inches per year [HMTC 1985]), does not support the ditch as a major pathway for water flow. Water in the ditch primarily percolates into the porous near surface soils. A segment of the ditch is in close proximity to Site 1 and Site 2 - Former Fire Training Area. SI field investigation activities have been conducted at Site 3 to determine the potential for contamination of the ditch as a result of runoff from these two IRP sites. Fuel spills and aircraft washdown are reported to have entered the ditch, however, the magnitude, frequency, and location of the spills are unrecorded. Ten sediment samples were collected from this ditch during the 1990 field investigation. Results from the 1990 investigation activities at Site 3 showed elevated concentrations of metals and organic contaminants present in the sediments. The compounds were detected in areas on the western portion of the Base that would not be affected by any of the IRP investigated sites. Currently there is no major area of the Base that discharges to the ditch; Site 3 is not considered a point source of contamination. Figure 1-1 shows the location of the Central Drainage Ditch.

1.3.1.4 Site 4 - Oil Patch in Drainage Field

Site 4 - Oil Patch in Drainage Field was an area of visibly stained soil located at the end of an abandoned underground drain pipe in a dry depression of a drainage field, located midway between Ingalls and Farman Streets.

This spill site was discovered during the PA. The visible oil patch measured approximately 6 by 100 feet and was free of most vegetation. Stunted plant growth was observed around the periphery of the spill site. The oily substance was consolidated with sand throughout the greater portion of the site with saturated patches located nearest to the end of the drain pipe. A distinct hydrocarbon odor was apparent in the discolored soil. Erosion of the dry ditch appeared minimal; however, any runoff flow was expected to concentrate in the ditch and

exit the field in a westward direction. The size of the visible oil patch suggested a small total volume of waste was spilled (HMTC 1985).

The original location of Site 4 - Oil Patch in Drainage Field is currently covered by grass and exposed soils. In 1985, the contaminated soils at the original site were excavated and stockpiled adjacent to the fire training pit at Site 1 - Current Fire Training Area. These soils have remained undisturbed at Site 1 since they were stockpiled in 1985. Figure 1-1 shows the original location of these soils and their current location. The stockpiled soils are evaluated in the baseline risk assessment and are designated as Stockpiled Site 4 Soils.

1.3.1.5 Site 5 - Former Wood Preserving Operation

Site 5 - Former Wood Preserving Operation was located almost 500 feet due south of Building NG 1515 in the field across from the Western Steel Manufacturing Company. This site consisted of a 200-square foot patch of discolored earth. Three opened, 55-gallon drums were buried to the rim in the central portion of this patch and were used to treat fenceposts with a creosote preparation (HMTC 1985). These drums have since been removed. Figure 1-1 shows the location of this site. Results from the soil investigations at Site 5 in 1987 and 1990 showed limited contamination extending to approximately 50 feet below land surface (BLS). The highest concentrations of contamination consisted of wood preserving chemicals and were detected in the upper 5 to 10 feet of the soil column. No site-related groundwater contamination was detected.

A Decision Document has been completed for Site 5 that outlines the process and rationale that no further IRP action is required at Site 5 (National Guard Bureau 1992). Based on the current status of Site 5, no additional sampling activities and no risk assessment evaluation activities were warranted as part of this investigation.

1.3.1.6 Site 6 - Tar Pit

Site 6 - Tar Pit is located immediately south of the abandoned railway spur at the former site of an asphalt distribution company that operated between 1947 and 1977. During that 30-year period, waste asphalt products were accumulated in an open pit that currently measures

approximately 100 by 200 feet with an estimated depth of 8 to 10 feet. The volume of viscous sludge contained in the pit could potentially exceed 6,500 cubic yards (HMTc 1985). Currently, no Base-related activities are conducted in the area of Site 6, and access is restricted by a fence that surrounds the entire area. The location of Site 6 is shown in Figure 1-1. No significant site-related soil or groundwater contamination was detected at Site 6 during the SI activities previously conducted at the site.

1.4 PREVIOUS PROGRAM ACTIVITIES

HMTc conducted the PA in 1985 and six sites of concern were identified. SAIC investigated four of these sites in 1987 during the first phase of the SI program. The 1987 SI field program consisted of:

- Conducting soil gas surveys at Site 1 - Current Fire Training Area and Site 2 - Former Fire Training Area
- Installing and sampling a total of four monitoring wells at Site 1 - Current Fire Training Area, Site 5 - Former Wood Preserving Operation, and Site 6 - Tar Pit
- Drilling and sampling a total of 10 shallow borings at Site 1 - Current Fire Training Area, Site 2 - Former Fire Training Area, and Site 5 - Former Wood Preserving Operation
- Screening environmental samples using an onsite gas chromatograph (GC) at all four sites
- Sampling stream sediments and surface soils at Site 1 - Current Fire Training Area and tar at Site 6 - Tar Pit
- Conducting aquifer testing and collecting water level measurements for all installed monitoring wells.

Results from the 1987 SI activities are summarized as follows:

- Contaminated soils were detected at Site 1 - Current Fire Training Area consisting of fuel constituents and metals. Based on limited sampling above and below the upper cobble/gravel layer, the vertical extent of contamination was inferred to extend no deeper than 45 feet BLS, with the highest concentrations detected in the upper 5 to 10 feet BLS. Three source locations were identified: a fuel transfer pipe, an area northwest of the burn pit where underground piping is present and where fire truck discharge occurred, and the burn pit itself. No site-related groundwater contamination was detected at the site.

- Soils investigated at Site 2 - Former Fire Training Area showed virtually no site-related contamination. A groundwater investigation was not deemed necessary at the site.
- Soils investigated at Site 5 - Former Wood Preserving Operation showed limited contamination extending approximately 35 to 55 feet BLS. The highest concentrations of contamination, consisting of wood preserving chemicals, were detected in the upper 5 to 10 feet BLS. The contaminated soils are located in the circular, soil-stained area at the site. No site-related groundwater contamination was detected.
- No significant site-related soil or groundwater contamination was detected at Site 6 - Tar Pit.
- The preliminary risk evaluation indicated that no adverse noncarcinogenic effects would be anticipated due to exposure to contaminated soils and sediments. Carcinogenic risks associated with exposure to soils and sediments were calculated as 10^{-6} or less, which is an acceptable range established by the EPA guidelines (SAIC 1989).

At the conclusion of the 1987 SI, it was determined that additional soil, groundwater, and hydrogeologic data were required to more fully characterize the sites of concern. Additional SI activities were conducted in 1990 to provide the additional information. The 1990 phase of the SI program consisted of:

- Installing and sampling a total of seven monitoring wells at Site 1 - Current Fire Training Area, Site 2 - Former Fire Training Area, Site 5 - Former Wood Preserving Operation, and Site 6 - Tar Pit
- Drilling and sampling a total of 26 soil borings at Site 1 - Current Fire Training Area, Site 2 - Former Fire Training Area, Site 5 - Former Wood Preserving Operation, and Site 6 - Tar Pit
- Screening environmental samples using a GC at all four sites
- Sampling stream sediments at Site 3 - Central Drainage Ditch
- Conducting aquifer testing and collecting water levels for all installed monitoring wells.

Results from the 1990 SI activities confirmed the overall results of the 1987 program and provided additional information concerning the extent of contamination at the sites. The results of the 1990 investigation are summarized below:

- Soils investigated at Site 1 - Current Fire Training Area showed shallow contamination to be concentrated in the area of the burn pit and in the area of the UST and

associated piping. The contamination was inferred to extend to a depth of approximately 55 feet BLS based on limited sampling above and below the cobble/gravel layer and based on detected tentatively identified compound (TIC) concentrations at 55 feet. Identified soil contamination in both areas at Site 1 is generally restricted to the upper four feet of soil, with the highest contaminant concentrations occurring at or near the surface. No groundwater contamination was detected in the monitoring wells at Site 1 except for the presence of selenium at a maximum concentration of 39.35 $\mu\text{g/L}$ (ARAR = 10 $\mu\text{g/L}$; EPA 1990). The source of selenium in the groundwater is considered to be naturally occurring. Selenium in the groundwater is not considered to be site related because it was not detected in the soil column at Site 1.

- No significant soil contamination was detected at Site 2 - Former Fire Training Area. Onsite GC analyses of the site soils detected minor contamination. However, organic contamination was not detected in the subsequent confirmatory laboratory analyses of the soils at this site. Metals were detected at concentrations considered typical of the soils in the Boise area. No contamination was detected in the groundwater at Site 2.
- The sediments investigated at Site 3 - Central Drainage Ditch showed elevated concentrations of metals and organic contaminants. These compounds were detected in the areas that would not be affected by any of the sites investigated or were at concentrations considered to be typical of sediments in the Boise area.
- Soils investigated at Site 5 - Former Wood Preserving Operation showed limited contamination, extending approximately 50 feet BLS. The highest concentrations of contamination, consisting of wood preserving chemicals, were detected in the upper 5 to 10 feet BLS. The contaminated soils are located in the circular, soil-stained area at the site. No site-related groundwater contamination was detected.
- No significant site-related soil or groundwater contamination was detected at Site 6 - Tar Pit.
- The preliminary risk evaluation indicated that no adverse noncarcinogenic effects would be anticipated due to exposure to contaminated soils and sediments. Carcinogenic risks associated with exposure to soils and sediments were within the acceptable range established by the EPA guidelines for waste site remediation (SAIC 1992).

Figure 1-2 shows all of the sampling points of the 1987 and 1990 IRP field investigations. Table 1-1 presents all previously implemented SI field activities.

Results from the 1990 SI activities confirmed the overall results of the 1987 program and provided additional information concerning the extent of contamination at the sites. The data generated from the 1987 and 1990 SI activities were sufficient to characterize and evaluate the four sites studied during this period at IANG, Gowen Field. The collected data indicated the

**Table 1-1. Summary of Site Inspection Program Activities for
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho**

	SITE 1		SITE 2		SITE 3		SITE 5		SITE 6	
	1987	1992	1987	1992	1987	1992	1987	1992	1987	1992
SOIL GAS SURVEY POINTS	32	0	0	0	0	0	0	0	0	0
ONSITE GC SCREENING (SOIL BORING) TARGETED CHEMICALS	TPH, BTEX, TCE, PCE, COI, BrClCH 1,1,1-TCA	BTEX C ₂ H ₄ Cl ₂	TPH, BTEX, TCE, PCE, COI, BrClCH 1,1,1-TCA	BTEX C ₂ H ₄ Cl ₂	TPH, BTEX, TCE, PCE, COI, BrClCH 1,1,1-TCA	BTEX C ₂ H ₄ Cl ₂	TPH, BTEX, TCE, PCE, COI, BrClCH 1,1,1-TCA	BTEX C ₂ H ₄ Cl ₂	TPH, BTEX, TCE, PCE, COI, BrClCH 1,1,1-TCA	BTEX C ₂ H ₄ Cl ₂
SOIL BORINGS (# OF BORINGS)	5	14	1	4	0	0	0	1	3	0
SAMPLING INTERVAL	5 feet	5/10 feet	20 feet	5 feet	N/A	N/A	N/A	5 feet	5/10 feet	N/A
TOTAL SOIL SAMPLES/BORING (a)	4 to 8	2 to 5	7	4 to 5	N/A	N/A	N/A	5	2 to 3	N/A
TOTAL SOIL SAMPLES/SITE (a)	30	39	15	17	N/A	N/A	N/A	5	7	N/A
MONITORING WELLS	2	2	0	0	0	0	0	1	1	0
SOIL SAMPLES COLLECTED/WELL (a) (FOR CHEMICAL ANALYSIS)	3 to 4	0	0	N/A	N/A	N/A	N/A	4	0	N/A
GW SAMPLES COLLECTED/WELL (NUMBER OF ROUNDS)	1	2	0	N/A	N/A	N/A	N/A	1	2	N/A
SURFACE SOIL SAMPLES	6(b)	0	4(b)	0	0	0	0	0	0	0
SEDIMENT SAMPLES (a,c)	4(c)*	0	0	0	0	0	0	0	0	0
TAR PIT SAMPLES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	0
BACKGROUND SOIL SAMPLES (d)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AQUIFER TESTS	2	2	0	0	N/A	N/A	N/A	1	1	0
TEST PIT SAMPLES	0	0	11(c)	0	0	0	0	0	0	0

(a) - Totals include duplicates
 (b) - Surface soil was collected from Site 4 - Oil Patch in Drainage Field;
 soil relocated to Site 1 - Current Fire Training Area
 (c) - Sediment samples were collected from Site 3 - Central Drainage Ditch
 (d) - Two Off-Base Background soil samples were collected during 1987 Field Program
 (e) - Three On-Base Background soil samples collected in 1992
 N/A - Not Applicable
 TPH = Total Petroleum Hydrocarbons
 BTEX = benzene, toluene, ethylbenzene, xylenes
 TCE = trichloroethene
 PCE = tetrachloroethene
 COI = carbon tetrachloride
 BrClCH = bromochloroethane
 1,1,1-TCA = 1,1,1-trichloroethane
 C₂H₄Cl₂ = 1,2-Dichloroethane
 * - Includes duplicate sample results

absence of chemical contaminants at concentrations exceeding guidelines for risk to public health established by the EPA. No further data collection or remedial action activities were recommended for these sites under the IRP based on the data and the preliminary human health risk evaluation. The presence of visible surface soil contamination, a noticeable odor associated with volatile compounds, and the consideration of future land use at Site 1 - Current Fire Training Area warranted that a surface soils investigation be considered for this site. Additional data collection activities were deemed necessary so that this additional information could be used to augment the current risk calculations so that a baseline risk assessment could be developed, and so that a computer contaminant transport model could be used to determine the potential for vertical migration of site-specific contaminants to the underlying groundwater. The activities to accomplish these objectives were conducted in September 1992. The 1992 field program consisted of:

- Drilling one soil boring 160 feet BLS to collect soil samples for geotechnical analysis. Results were to be used in the computer contaminant transport model.
- Sampling of the stockpiled soils from Site 4 - Oil Patch in Drainage Field.
- Backhoe test pit sampling a total of 11 locations at Site 1 - Current Fire Training Area and IANG Gowen Field background locations.

No evidence of site-related contamination was detected during previous SI investigation activities at Site 6 that would warrant additional IRP study. It was recommended that disposal options for the tar at Site 6 - tar pit be developed. Removal of the tar would eliminate the physical safety hazard associated with the site.

2. FIELD PROGRAM

2.1 FIELD PROGRAM SUMMARY

The additional site inspection (SI) field program activities that Science Applications International Corporation (SAIC) implemented at Idaho Air National Guard (IANG), Gowen Field, Boise, Idaho in September 1992 are described in this section. The field program developed by SAIC consisted of drilling a soil boring to collect geotechnical samples, test pit sampling of surface soils, sampling drill cuttings generated during the SI for toxicity characteristic leaching procedure (TCLP) analysis, and measuring groundwater levels. Sections 2.2 and 2.3 describe the methods and procedures used for performing these data collection activities. The 1992 field investigation activities are summarized in Table 2-1.

2.2 CONFIRMATION AND DELINEATION ACTIVITIES

The objective of the sampling activities conducted at IANG, Gowen Field in September 1992 was to collect data on soil properties and characteristics so that a computer contaminant transport model could be run to evaluate vertical migration of contaminants; to collect data on the surficial soils to help support a baseline risk assessment; and to collect data to determine the disposal fate of drill cutting soils generated during the SI. A thorough chemical characterization is required of these drill cutting soils before a decision can be made regarding their disposal. The most thorough analysis for soil characterization that is generally accepted by licensed, regulated disposal facilities is TCLP analysis dictated by 40 CFR 261.24. The results of this analysis were used to determine the fate of the drill cutting soils generated during the previous SI activities.

The 1992 field program consisted of the following activities:

- Soil boring drilling and sampling of soils for geotechnical analysis
- Backhoe test pit sampling
- Surface sampling
- Water level measurement.

Table 2-1. Summary of Implemented Additional Site Activities at Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho

Implemented Field Activities			
	Activity	Number of Sample Points	Parameters
Site 1 - Fire Training Area Pit	1 soil boring (160 feet in depth)	• 1 geotechnical sample collected at the cobble/sand interface (50 feet BLS) • 6 geotechnical samples collected at 20-foot intervals (50, 80, 100, 120, 140, and 160 feet)	Grain size Moisture content Total Bulk Density Organic carbon
	4 test pits (4 feet in depth)	• 1 sample collected at 0.5 feet BLS at each test pit • 1 sample collected at 4 feet BLS at each test pit	VOCs SVOCs metals Dioxins PCBs TPH
	1 TCLP sample	• 1 composite sample	CFR 261.24
	4 test pits (4 feet in depth)	• 1 sample collected at 0.5 feet BLS at each test pit • 1 sample collected at 4 feet BLS at each test pit	VOCs SVOCs metals TPH
Site 1 - Underground Storage Tank Area	1 TCLP sample	• 1 composite sample	CFR 261.24
	4 hand auger/surface samples	• 4 samples collected at random depths from the stockpiled soil	VOCs SVOCs metals PCBs TPH
Site 2 - Former Fire Training Area Site 6 - Tar Pit	1 TCLP sample	• 1 composite sample	CFR 261.24
	1 TCLP sample	• 1 composite sample	CFR 261.24
	1 TCLP sample	• 1 composite sample	CFR 261.24
Nonsite Specific Activities	3 background test pits (4 feet in depth)	• 1 sample collected at 0.5 feet BLS at each test pit • 1 sample collected at 4 feet BLS at each test pit	VOCs SVOCs metals Dioxins PCBs TPH
	Water level elevations	• 1 water level measurement taken at each well of each site	NA

All environmental samples were analyzed in the laboratory using standard operating procedures (SOPs), approved analytical methods, and standard quality assurance/quality control (QA/QC) procedures that meet Hazardous Waste Remedial Actions Program (HAZWRAP) Level C analytical and reporting requirements. Tables 2-2, 2-3, and 2-4 summarize the sample containment and preservation methods for soil samples, water samples, and site-specific analytical parameters, respectively. Details of the field program activities and procedures are described below.

2.2.1 Soil Boring Drilling and Sampling Methods and Procedures

One soil boring (GT-1-1) was drilled adjacent to and northeast of the berm that encircles the fire training pit. Because of the homogeneity of the subsurface soil characteristics as identified by previous SI borehole logging activities in this area, it was not necessary to locate the boring within the pit proper to obtain information on the soils below the pit. The purpose of this boring was to collect geotechnical data to be used for contaminant migration modeling, not to provide additional data on the presence or concentrations of contamination. The drilling technique used was a dual-walled, reverse circulation, percussion hammer method (Becker system). This method proved to be superior during previous activities in penetrating the upper 50-foot cobble zone. To determine soil characteristics that would affect contaminant migration to the groundwater, this boring was drilled to a depth of 160 feet below land surface (BLS). (Groundwater had been encountered previously in this area at approximately 170 feet BLS.) Samples were collected at the cobble/sand interface, approximately 50 feet BLS, and at 80, 100, 120, 140, and 160 feet BLS.

Samples were analyzed for grain size, natural moisture content, bulk density, and total organic carbon. Results from this analysis were used in a computer transport model and are presented with the results of the baseline risk assessment in Section 4. Samples were collected using standard 2-inch outside diameter (O.D.), 24-inch-long stainless steel split spoons. All boring samples were examined and logged for at least the following characteristics: headspace organic vapor concentrations (using an HNu), lithology, grain size (visual), color (Munsell color chart), consistency and texture, moisture (visual), and any other distinctive features. The log of this boring is presented in Appendix A. Once the drilling of the boring was complete, the

Table 2-2. Summary of Sample Containment and Sample Preservation Methods for Soil Samples

Parameter	Analytical Method	Sample Container		Preservation Methods	Holding Times
		Quantity	Type		
VOCs	CLP SOW 3/90	1	4-ounce, wide-mouth, glass, Teflon®-lined cap	Cool, 4°C	14 days
SVOCs	CLP SOW 3/90	1	16-ounce, wide-mouth, glass, Teflon®-lined cap	Cool, 4°C	Extraction: 14 days Analysis: 40 days
Pesticides/PCBs	SW 3550/8080	1	16-ounce, wide-mouth, glass, Teflon®-lined cap	Cool, 4°C	Extraction: 14 days Analysis: 40 days
Total Petroleum Hydrocarbons	SW 3550/E418.1	1	16-ounce, wide-mouth, glass, Teflon®-lined cap	Cool, 4°C	28 days
Metals	SW 3050/6010	1	16-ounce, wide-mouth, glass, Teflon®-lined cap	Cool, 4°C	6 months
• Be, Cd, Cr, Cu, Ni, Ag, and Zn	SW 3005/7041				
• Antimony (Sb)	SW 3050/7060				
• Arsenic (As)	SW 3050/7421				
• Lead (Pb)	SW 7471				
• Selenium (Se)	SW 3050/7740				
• Thallium (Tl)	SW 3050/7841				
Dioxins/Furans	SW 8290	1	16-ounce, wide-mouth, glass, Teflon®-lined cap	Cool, 4°C	Extraction: 30 days Analysis: 45 days
TCCLP	CFR.261.24	2	16-ounce, wide-mouth, glass, Teflon®-lined cap	Cool, 4°C	Leaching: 14 days (SVOC, Pest. Herb) Extraction: 14 days (SVOC, Pest. Herb) Analysis: 40 days (SVOC, Pest. Herb) 14 days (VOC) 6 months all metals except mercury: 28 days

Table 2-3. Summary of Sample Containment and Sample Preservation Methods for Quality Control (QC) Water Samples

Parameter	Analytical Method	Sample Container		Preservation Methods	Holding Times
		Quantity	Type		
VOCs	CLP SOW 3/90	2	40-mL glass, Teflon®-lined septum cap	HCl to pH < 2, Cool, 4°C	14 days
SVOCs	CLP SOW 3/90	1	1-liter, narrow-mouth, amber glass, Teflon®-lined cap	Cool, 4°C	Extraction: 7 days Analysis: 40 days
Pesticides/PCBs	CLP SOW 3/90	1	1-liter, narrow-mouth, amber glass, Teflon®-lined cap	Cool, 4°C	Extraction: 7 days Analysis: 40 days
Total Petroleum Hydrocarbons	SOP (E418.1)	1	1-liter, narrow-mouth, amber glass, Teflon®-lined cap	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
Metals	SW 3005/6010	1	1-liter, polyethylene bottle	HNO ₃ to pH < 2	6 months Mercury - 28 days
• Be, Cd, Cr, Cu, Ni, Ag, and Zn					
• Antimony (Sb)	SW 3005/7041				
• Arsenic (As)	SW 7060				
• Lead (Pb)	SW 7470				
• Selenium (Se)	SW 3020/7740				
• Thallium (Tl)	SW 3020/7841				
Dioxins/Furans	SW 8290	1	1-liter, narrow-mouth, amber glass, Teflon®-lined cap	Cool, 4°C	Extraction: 30 days Analysis: 45 days

**Table 2-4. Summary of Site Specific Field Activities and Analytical Requirements
for Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho**

Site	Sample Points	Sample Intervals	Total Samples	Sample Parameters							
				VOCs	SVOCs	Metals	PCBs	Dioxins	TPH	TCLP	
Background	3	2	6	6	6	6	6	6	6	0	
Fire Training Pit Area	4	2	8*	8	8	8	8	8	8	1	
UST Area	4	2	8*	8	8	8	0	0	8	1	
Stockpiled Site 4 Soils	4	1	4*	4	4	4	4	0	4	1	
Site 2	1	N/A	0*	0	0	0	0	0	0	1	
Site 6	1	N/A	0*	0	0	0	0	0	0	1	
Totals			26*	26	26	26	18	14	26	5	

* Does not include TCLP sample.

boring was abandoned by grouting using a cement/bentonite slurry. Because the boring was located outside the area of known contamination, and onsite HNu photoionization screening results of the drill cuttings were zero, cuttings generated during borehole drilling were spread on top of the current berm at Site 1 - Current Fire Training Area. The location of boring GT-1-1 is shown in Figure 2-1.

2.2.2 Backhoe Test Pit Sampling Methods and Procedures

Test pits were dug at Site 1 - Current Fire Training Area to collect data on the surficial soils to help support the baseline risk assessment. Test pits were excavated using a backhoe because of the ease in which the backhoe was able to penetrate the near surface geologic conditions of boulders and cobbles. Conventional shallow drilling methods (i.e., auger drilling) employed during previous investigations were not able to penetrate these cobbles and boulders. The Becker drilling system, which proved effective in this subsurface environment during previous investigations, was not deemed cost effective because of the intended shallow sampling depths. In addition, using the Becker system to collect samples at these shallow depths could potentially result in the loss of volatile compounds due to the retrieval of samples by forced air that is required by this drilling method in the cobble ridden near surface soils at the Base. Excavation with the backhoe allowed for a controlled collection of samples and avoided the loss of volatile compounds by collecting the sample directly from the subsurface soil.

Four test pits were dug within the pit proper and four test pits were dug within the area of the nearby underground storage tanks (USTs) and at locations where contamination was identified during previous investigations (see Figure 2-1). The test pits were excavated to a maximum depth of 4 feet BLS. Soil samples were collected from approximately 0.5 feet BLS and 4 feet BLS. Efforts were made to collect the samples directly from undisturbed soils so a loss of volatile compounds did not occur. If it was impossible to collect the sample directly from the bottom of the pit without disturbing the soil, samples were collected directly from the middle of undisturbed soil retrieved in the backhoe bucket. All samples were collected using decontaminated stainless steel sampling tools. Samples for volatile organic compound (VOC) analysis were collected immediately upon identifying the sample point and prior to the collection of other parameters. Table 2-4 summarizes the analytical parameters sampled at the sites of

concern. Following completion of the test pit, all soils that were removed during the excavation were returned to the hole and compacted using the backhoe. All attempts were made to restore the sample location to its original condition. Appendix A contains the logs for these test pits.

2.2.3 Surface Sampling Methods and Procedures

Surficial samples were collected for TCLP analysis from the Site 4 - Oil Patch in Drainage Field soils stockpiled at Site 1 - Current Fire Training Area, three areas within the bermed soil at Site 1, the stained soils overlying the USTs at Site 1, stockpiled Site 1 monitoring well drill cuttings, stockpiled monitoring well drill cuttings at Site 2 - Former Fire Training Area, and stockpiled and drummed monitoring well and soil boring cuttings at Site 6 - Tar Pit. Composite samples were collected with stainless steel spoons and trowels at random depths from the sampling locations since the soil was not adhesive enough to catch in a hand auger.

Each TCLP sample was collected at various site locations and then combined into a single composite sample. All TCLP samples were collected using the following procedure. Using decontaminated stainless steel sampling tools a volume of soil from each sample area (i.e., stockpile or drum) was placed directly into the appropriate sample container. Additional soil was then collected from the stockpile or drum and composited (i.e., mixed) in a stainless steel bowl. The remainder of the sample container was then filled with this composited soil. This sampling technique allowed for the collection of soils for volatile organic analysis in a manner that would minimize volatilization (i.e., placing the soils directly into the sample container), in addition to collecting a representative sample for the remaining TCLP analysis (i.e., compositing/mixing additional soil).

Four samples were collected from undisturbed soils at random depths within the Site 4 - Oil Patch in Drainage Field soils stockpiled at Site 1 - Current Fire Training Area. Areas within the pile were exposed by the backhoe and then samples were collected using stainless steel tools, placed in a stainless steel bowl, composited, and then transferred into the appropriate sample containers. Samples were analyzed to determine the contaminant characteristics of this soil, in addition to TCLP characteristics. Sample locations are shown in Figure 2-1. Table 2-4 summarizes the analytical parameters sampled for at the stockpiled soils.

A single composite soil sample was collected from the bermed soil surrounding the fire training area proper (i.e., the fire training pit) and the stained soils overlying the USTs present in the area of Site 1 - Current Fire Training Area. The berm surrounding the pit proper had been used previously as an area where soils generated during previous drilling activities were stockpiled. The sample was collected using the sampling procedures outlined above and was analyzed for TCLP characteristics. Results of this analysis were used to help determine the disposal fate of these soils.

Composite samples also were collected for TCLP analysis from stockpiled and drummed drill cuttings at Site 1 - Current Fire Training Area, Site 2 - Former Fire Training Area, and Site 6 - Tar Pit. These drill cuttings were from monitoring wells and/or soil borings drilled at these sites during previous investigations. These cuttings had been stockpiled on plastic sheeting or placed in drums. The samples were collected using the sampling procedures outline above. Results from this analysis were used to help determine the disposal fate of these soils.

2.2.4 Static Groundwater Measurements

Groundwater elevation measurements were collected at IANG, Gowen Field to confirm groundwater flow directions that had been established during previous investigations. These measurements were taken from each existing monitoring well. Twenty-four hours prior to taking the measurements, all wells were opened to allow the water level to stabilize.

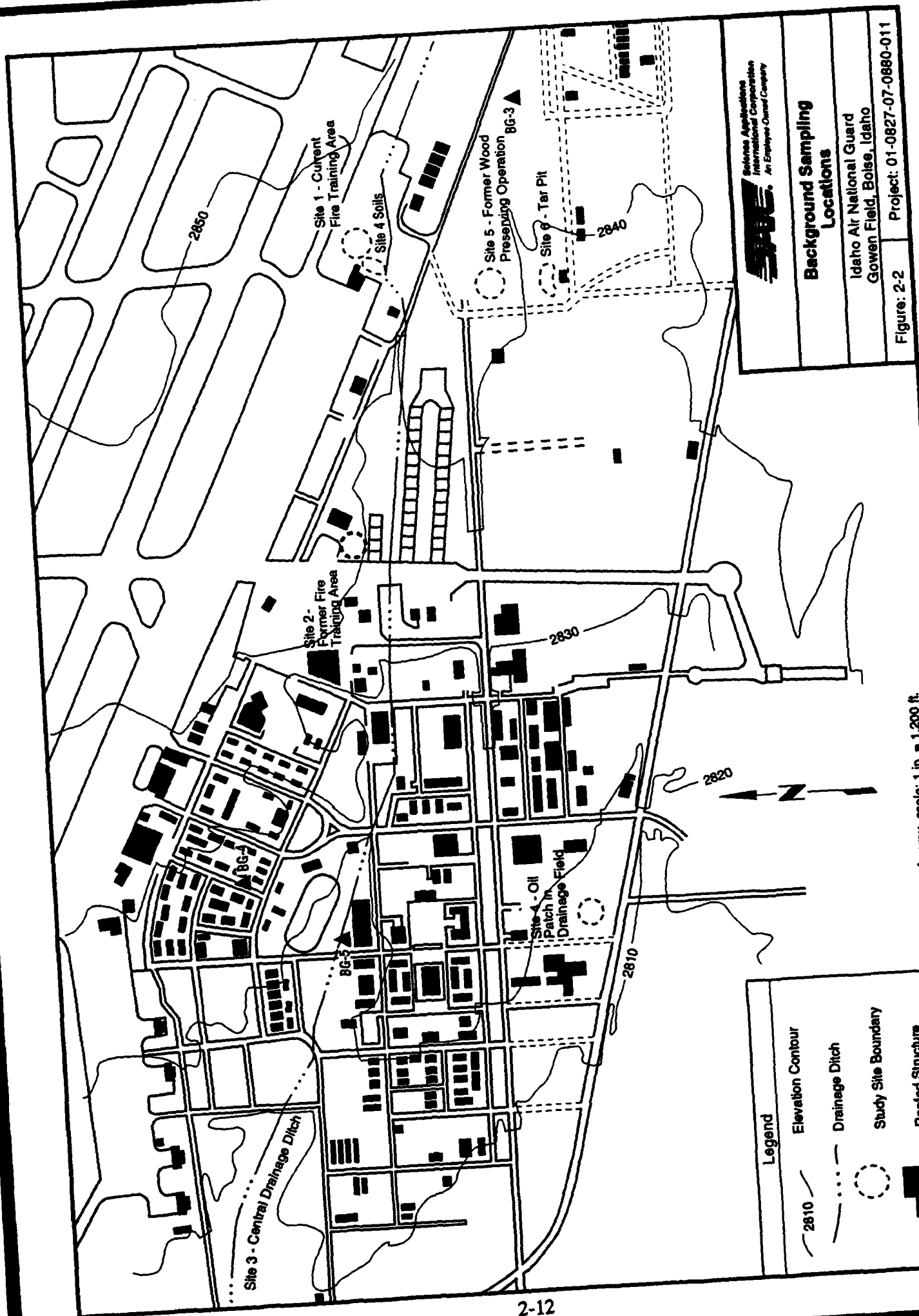
The groundwater level measurements were recorded at each monitoring well with an electric water level indicator. The indicator was lowered into the well and a circuit was completed upon submersion in water, triggering the buzzer. The water level was then read off the indicator's graduated 0.01-foot tape at a surveyed notch on the top of the monitoring well casing. Groundwater levels for the 1992 field investigation and the 1990 SI field investigation are presented in Section 3.1.2.

2.3 BACKGROUND SAMPLING FOR BASELINE DATA

Background soil samples were collected from test pits at three locations within the general vicinity of Gowen Field. Figure 2-2 shows the locations of the background sampling points.

The background sample locations are necessary to provide data on surface contaminant concentrations and a more complete background data set. The analytical data from these test pit samples were used for comparative purposes in the development of the baseline risk assessment.

Test pits were excavated using the methods and procedures outlined in Section 2.2.2. Parameters for laboratory analysis include VOCs, semivolatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs), dioxins, and total petroleum hydrocarbons (TPH). Table 2-4 summarizes the analytical parameters sampled for at the background points. Following completion of the test pit, all soils that were removed during the excavation were returned to the hole and compacted using the backhoe. All attempts were made to restore the sample location to its original condition.



3. SIGNIFICANCE OF RESULTS

The results of the 1992 field investigation conducted at Idaho Air National Guard (IANG), Gowen Field are discussed in this section. This field investigation was conducted to augment previous Site Inspection (SI) activities and consisted of laboratory sampling of soils, lithologic sampling of soil borings and test pits, sampling of soils for geotechnical analysis, and water level measurements of installed monitoring wells. Section 3.1 addresses the general geology and hydrogeology of the eastern portion of IANG, Gowen Field where the sites of concern are located. Section 3.2 summarizes the Quality Assurance/Quality Control (QA/QC) results for this field investigation. Section 3.3 presents the background sampling results. Sections 3.4 through 3.7 provide site-specific detailed information on the aforementioned sampling and testing.

3.1 BASE GEOLOGY AND HYDROGEOLOGY

Eleven test pits were excavated to 4 feet below land surface (BLS) and one soil boring was drilled to 160 feet BLS as part of this investigation. The lithology encountered during the excavations and drilling activities was the same as that identified during previous drilling activities. No information was found that would contradict or dispute the previous lithologic descriptions for the soils in the study site area. The only new information obtained during this investigation was the presence of a hardpan layer in background test pits BG-3 and BG-4. This layer was not identified in the study site area during this investigation or previous SI investigations. This hardpan layer is not considered to be consistent across the Base, nor does its presence have any bearing on current or previous interpretations or results.

Water elevations were taken from the 11 existing monitoring wells to confirm the groundwater flow direction determined during the 1990 investigation. No new or additional data were obtained that would alter the conclusions of the previous study. The water level elevation was consistently lower in each well (by an average of 3.35 feet). The lower water levels could be the result of seasonal fluctuations and/or regional drought conditions that were occurring during the time of the measurements. This consistent decrease in water level elevation did not

change the general groundwater flow direction in the vicinity of the sites of concern as determined during the previous studies.

The following two subsections summarize the geology and hydrogeology at IANG, Gowen Field based on the findings of the previous SI field investigations (SAIC 1987, 1990) in addition to the physical properties of the soils that were determined during the 1992 field investigation. The geology of the areas investigated is discussed in Section 3.1.1 rather than in the individual site subsections because the geology identified was consistent throughout the sites investigated. The general hydrogeology of the areas investigated is discussed in Section 3.1.2.

3.1.1 Base Geology

The geologic unit consistently encountered during the 1990 IANG, Gowen Field SI was the Older Terrace Gravel. This unit of unconsolidated silt, sand, and gravel of Pleistocene Age was believed to have been deposited by torrential floods of meltwater emanating from glaciated areas to the northeast (Savage 1958). At the sites of concern, this unit consisted of an upper 45- to 60-foot layer of an unconsolidated, well-sorted mixture of medium to coarse sand and pebble to cobble sized gravel. The samples taken from this area were generally dry, loose, and pale brown/yellow. The sand within these samples showed wide variations in both angularity and sphericity.

The upper zone (45 to 60 feet BLS) graded into unconsolidated, well-sorted, interbedded, fine to coarse sands, which extend to an unknown depth below the furthest point drilled during the 1990 SI (200 feet BLS). The samples taken from this area were generally dry (above the water table), loose, and pale brown to brownish yellow. The samples showed a wide variation in angularity and sphericity, and were generally well-sorted throughout the sampling depth. Several samples contained trace amounts of silt and/or clay in addition to minor clay lenses (0.5 to 1.0 foot thick) and weakly cemented, oxidized, banded sand beds. Oxidation was prominent in some sampling intervals above the water table where a fine sand exhibited a bright orange color. Representative soil boring logs from the 1990 SI field investigation and all test pit and soil boring logs from the current investigation that provide detailed lithologic descriptions are presented in Appendix A. The location and depiction of a cross section showing the general

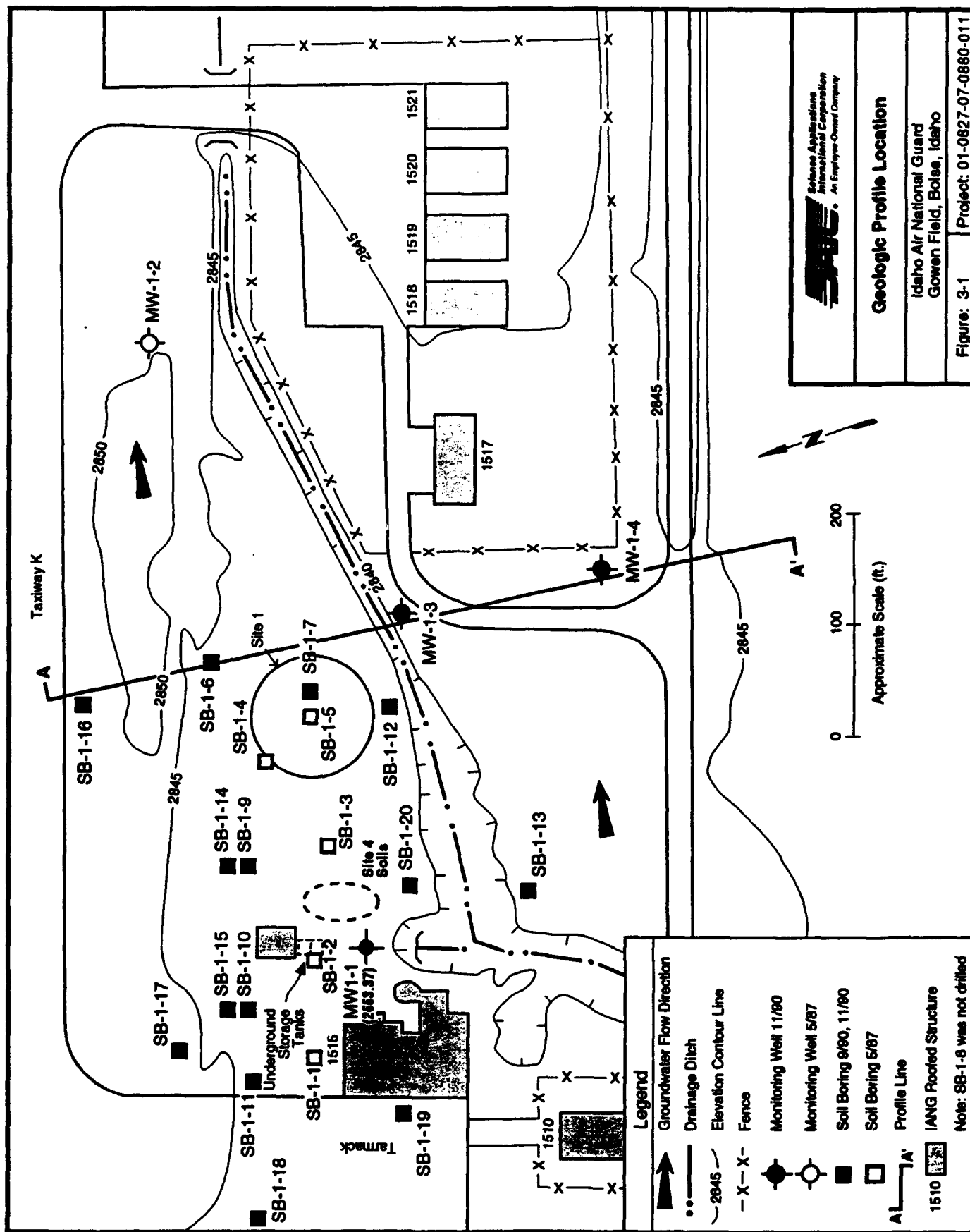
geology in the vicinity of Site 1 - Current Fire Training Area, which is representative of the entire area, are shown in Figures 3-1 and 3-2, respectively.

The subsurface soil samples collected from the deep boring (GT-1-1) drilled to 160.0 feet BLS at Site 1 - Current Fire Training Area were analyzed for grain size, moisture content, bulk density, and total organic carbon. These geotechnical analyses were conducted on six samples collected from 50 to 160 feet BLS. The results of these analyses provide the characteristic physical properties of the soils at Site 1 necessary to allow the contaminant transport model to effectively determine the potential migration of contaminants through these soils. The results of these analyses are summarized in Table 3-1; grain size distribution plots are provided in Appendix D. The soils underlying Site 1 range from poorly sorted fine to coarse sand, gravel, and cobbles to very fine sand and silt below a depth of 100 feet BLS. Moisture content ranges from 3.8 to 24.4 percent with a soil bulk density of 95.1 to 118.6 pounds per cubic foot. Total organic carbon in the subsurface soils is less than 1 percent.

3.1.2 General Hydrogeology

The major aquifer system in the Boise area is composed of the Older Terrace Gravel, basalts of the Smoke River Group, the Younger Terrace Gravel, and the Quaternary alluvium. A number of minor aquifers (up to 62), as well as perched water zones, also have been identified within these systems. Although each aquifer has individual hydraulic characteristics, the aquifers act as a single hydrologic unit (Dion 1972, Boise Water Corp. 1991). The shallow aquifer system that was the focus for the study at IANG, Gowen Field is located within the Older Terrace Gravel formation. The shallow aquifer is the system of concern, since it is most likely to be affected by past waste handling, storage, and disposal practices at the study area.

Determination of the groundwater flow direction in the immediate area of the IANG, Gowen Field sites was an objective of the SI field investigation activities conducted in 1990. The most complete report to date that addresses the hydrogeology of the area (Dion 1972) presents data indicating a northwestern trend for Boise and the surrounding area; however, this report also shows a groundwater mound in the study area south of Boise with the flow direction rotating 180 degrees. In the area of the Pressure Treated Timber Company and Boise Cascade



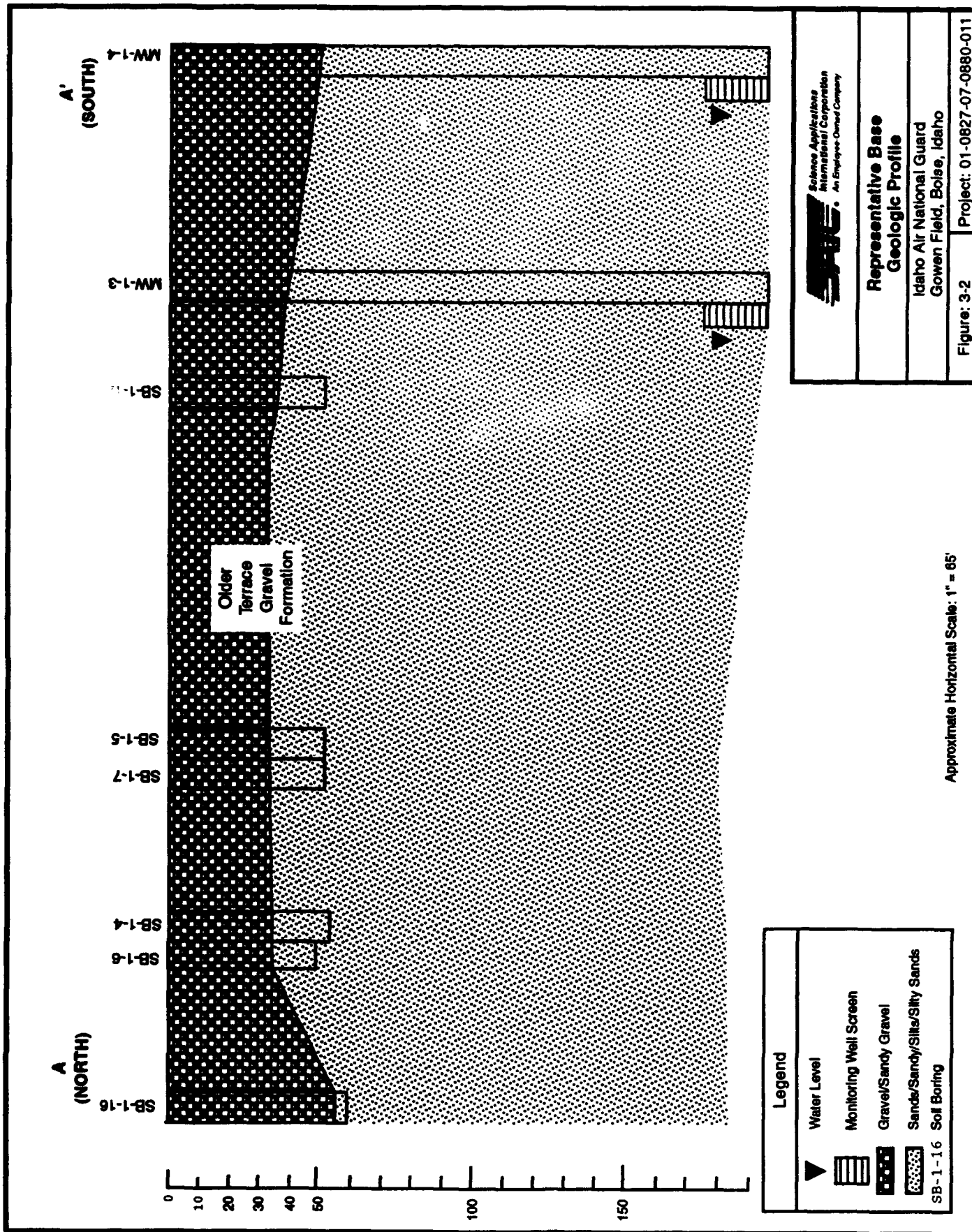


**Table 3-1. Physical Properties of Subsurface Soils, Site 1 - Current Fire Training Area
Idaho Air National Guard 124th Reconnaissance Group
Gowen Field, Boise, Idaho**

GRAIN SIZE DISTRIBUTION PERCENT PASSING	Sample Depth					
	50 Feet	80 Feet	100 Feet	120 Feet	140 Feet	160 Feet
3/8"	100	100				
No. 4	99	82	100		100	
No. 10	96	70	99		97	100
No. 20	82	52	97	100	96	94
No. 40	50	29	92	98	95	63
No. 80	15	17	61	88	92	25
No. 200	4	11	21	74	50	17
.034	4	11	21	22	32	14
.022	4	10	17	19	22	11
.013	3	7	13	17	17	8
.009	3	6	9	11	14	7
.0067	3	5	8	8	11	6
.0032	3	4	6	6	9	4.5
.0013	2.2	3.6	5.2	3.7	7.1	
Mean(mm)	.39	.62	.10	.05	.06	.10
Standard Deviation (mm)	.36	.12	.20	.27	.17	.23
Calculated K (cm/day)*	8886	36979	226	5	73	120
Natural Moisture Content (%)	3.8	5.6	8.6	24.4	16.6	13.4
Bulk Density (#/cuft)	102.3	118.3	99.1	95.1	98.7	101.2
Total Organic Carbon (%)	<.01	<.01	<.01	<.01	<.01	<.01

* Calculated using Monte Carlo estimates of Kozeny - Carmen equation.

Aviation located south of IANG, Gowen Field, monitoring data showed a southeast flow direction (Montgomery Engineers, Inc. 1988). However, communications with Montgomery Engineers, Inc. indicated that the integrity of the monitoring wells that were installed was unknown and one well would not pass a 5-foot bailer. Because of the vertical deviations in the well installations, water level measurements could not be accurately recorded and are deemed suspect.

The 1987 data collected during the initial SI activities conducted at IANG, Gowen Field showed a northeast groundwater flow direction. The varying opinions and uncertainties concerning the hydrogeology of the area are best summarized by Dion (1972), who stated that "the shape of the water table and direction of groundwater movement undoubtedly are more complex than indicated . . ." and ". . . cannot be resolved from the available data." A detailed hydrogeologic study was not within the scope of the SI given the complex hydrogeologic nature of the area. Best possible efforts and sound scientific judgments were made to determine the groundwater flow direction in the immediate area of the sites of concern.

The hydrologic characterization of the study area is based primarily on groundwater level elevations, aquifer rising head permeability tests, and subsurface geology determined from soil boring and monitoring well drilling. The discrepancies and incomplete and inconsistent data from previous studies made it important during the 1990 investigation to determine the groundwater flow direction in the area of each of the sites and then properly place the monitoring wells downgradient from the sites.

To ensure that the monitoring wells were ideally located, groundwater elevations were collected from existing monitoring wells at the initiation of the 1990 field program. The first monitoring well installed during the 1990 SI was surveyed and the information used to determine the groundwater flow direction by the method of triangulation. The first monitoring well was installed at Site 2 - Former Fire Training Area to provide a monitoring point that would definitively allow for triangulation with the existing monitoring wells at Site 1 - Current Fire Training Area (MW-1-1 and MW-1-2), Site 5 - Former Wood Preserving Operation (MW-5-1), and Site 6 - Tar Pit (MW-6-1) that were generally oriented in a north/south direction east of Site 2.

After the first well at Site 2 - Former Fire Training Area (MW-2-1) was installed, the flow direction was determined and the location of the next monitoring well to be installed was sited. Monitoring well MW-2-2 was then installed, surveyed, and water level measurements were recorded from all existing monitoring wells. The data obtained from these wells (MW-1-1, MW-1-2, MW-2-1, MW-2-2, MW-5-1, and MW-6-1) depicted a channel trending to the east (November 1990). This flow direction contradicted previous studies (Dion 1972, HMTc 1985), which reported the general groundwater flow in the area of IANG, Gowen Field to be in a south/southeasterly direction.

The location of the remaining monitoring wells (MW-1-3, MW-1-4, MW-2-3, MW-5-2, and MW-6-2) were based on the groundwater elevation data obtained in November 1990. All of these new monitoring well locations proved to be downgradient except for the location of monitoring well MW-1-4. Groundwater elevations collected following the completion of the field program (January 1992) indicated a flow trending more north-northeasterly, perpendicular to the flow of the Boise River, at Site 1 - Current Fire Training Area than was previously indicated by the November 1990 data.

The difference in the groundwater flow direction as determined during the SI activities at the Base, compared to the best available information, can most likely be attributed to the groundwater mound that appears to be centered on the New York Canal located northwest of IANG, Gowen Field. This groundwater mound is the high point of the shallow aquifer system for the Boise Valley and acts as a divide, directing groundwater flow in a radial pattern from the mound. The location of this mound at or near the New York Canal makes it subject to groundwater properties related to the canal. The lining of this canal has been ongoing for more than 30 years and the integrity of the lining is unknown. The potential for migration of the groundwater mound exists, due to the possibility of leakage from the New York Canal and the effects of seasonal fluctuations, which would make a north/northeasterly groundwater flow direction highly plausible for the Boise area (Idaho Department of Water Resources 1991). Changes in regional land use that could potentially increase demand on the groundwater supply (i.e., increased irrigation, increased population) also could account for changes in the general groundwater flow direction.

Rising head permeability tests were performed on all monitoring wells (i.e., MW-1-3, MW-1-4, MW-2-1, MW-2-2, MW-2-3, MW-5-2, and MW-6-2) installed during the 1990 field activities. These tests were conducted to obtain data to help calculate groundwater flow velocities and determine the possible extent of contaminant migration at the sites of concern if the groundwater proved to be contaminated. These tests recorded the recovery of groundwater in the wells, which was used to calculate the hydraulic conductivity (K) values at each site. These calculations were made using AQTESOLV™, a computer program designed by Geraghty & Miller, Inc., which uses statistical parameter estimation methods and graphical curve-matching techniques (Geraghty & Miller 1989). The methods used were based on equations developed by Bouwer and Rice (1976) for an unconfined aquifer. The average hydraulic conductivity value for the three general site areas, Site 1, Site 2, and Site 5/6, was calculated to be 1.1E-02 ft/min (5.8E-03 cm/sec). This value corresponds to the eastern edge of the Base where the sites are concentrated (SAIC 1992).

Hydraulic gradient (I) is the change in hydraulic head per unit horizontal distance measured along a groundwater flowline (i.e., the slope of the water table). A value of 0.015 ft/ft, or 79.2 ft/mile, was calculated as the hydraulic gradient for the eastern portion of the Base and is considered the average for the three general site areas (SAIC 1992). This value differs from previous studies, Dion (1972) (I = 0.0035) and SAIC (1988) (I = 0.008), possibly because the earlier recorded values were determined from an average for a larger study area where too few data points were available.

Groundwater flow rate (V) represents the macroscopic velocity of groundwater in the horizontal plane. Using the average hydraulic conductivity (K) and hydraulic gradient (I), values were calculated as part of the 1990 investigation for the eastern portion of the Base. The average horizontal groundwater flow rate was calculated for this area and ranged from 347 ft/year (n = 0.235) to 217 ft/yr (n = 0.40), as calculated by the Darcy Flow equation:

$$V = \frac{KI}{n}$$

where:

K = hydraulic conductivity

I = hydraulic gradient

n = porosity (values ranged from 0.25 to 0.4 to represent a sand media [Driscoll 1986]) (SAIC 1992).

The lithologic data collected during all phases of the SI indicate that the groundwater in this shallow formation occurs under water table conditions. Static groundwater elevations measured in September 1992 ranged from 2656.65 (MW-1-2) to 2693.80 (MW-2-2) feet above mean sea level (AMSL). Table 3-2 shows static groundwater levels measured during the 1992 field investigation. Table 3-3 shows the static groundwater levels during the 1987 SI field activities (August 1987), at the beginning of the 1990 SI field activities (September 1990), at the completion of the SI field work/monitoring well installation (December 1990), and during the SI groundwater sampling (January 1991).

Figures 3-3 and 3-4 show the groundwater elevation contours for the groundwater elevation data collected during the 1992 and 1990 SI field investigations, respectively. The eastern edge of LANG, Gowen Field is shown because this is where the sites of concern and associated data are concentrated. Comparison of these figures shows that the general trend of the groundwater flow direction has remained the same since the 1990 investigation. In the area of Site 2 - Former Fire Training Area, groundwater flow is in a southeasterly direction with monitoring wells MW-2-1 and MW-2-3 located in the general downgradient flow path and monitoring well MW-2-2 located upgradient of the site. Site 5 - Former Wood Preserving Operation and Site 6 - Tar Pit indicate a northeasterly flow direction, with monitoring wells MW-5-2 and MW-6-2 located in a general downgradient direction of their respective sites. Site 1 - Current Fire Training Area also depicts a groundwater flow direction trending to the northeast, with monitoring well MW-1-2 located downgradient from the fire training burn pit. Monitoring well MW-1-1 is located downgradient from the Site 1 USTs.

**Table 3-2. 1992 Water Level Data for Idaho Air
National Guard, 124th Reconnaissance Group
Gowen Field, Boise, Idaho**

Monitoring Well I.D.#	Date	Well Elevation (BTOC)	Water Level (BTOC)	Water Level (MSL)
MW-1-1	9/24/92	2841.43	182.69	2658.74
MW-1-2	9/24/92	2850.05	193.40	2656.65
MW-1-3	9/24/92	2840.18	181.85	2658.33
MW-1-4	9/24/92	2842.31	183.05	2659.26
MW-2-1	9/24/92	2836.49	156.21	2686.28
MW-2-2	9/24/92	2839.33	145.53	2693.80
MW-2-3	9/24/92	2837.19	147.32	2689.87
MW-5-1	9/24/92	2843.36	182.38	2660.98
MW-5-2	9/24/92	2844.96	185.01	2659.95
MW-6-1	9/24/92	2836.30	160.25	2676.05
MW-6-2	9/24/92	2842.42	181.54	2660.88

BTOC - below top of casing

MSL - mean sea level

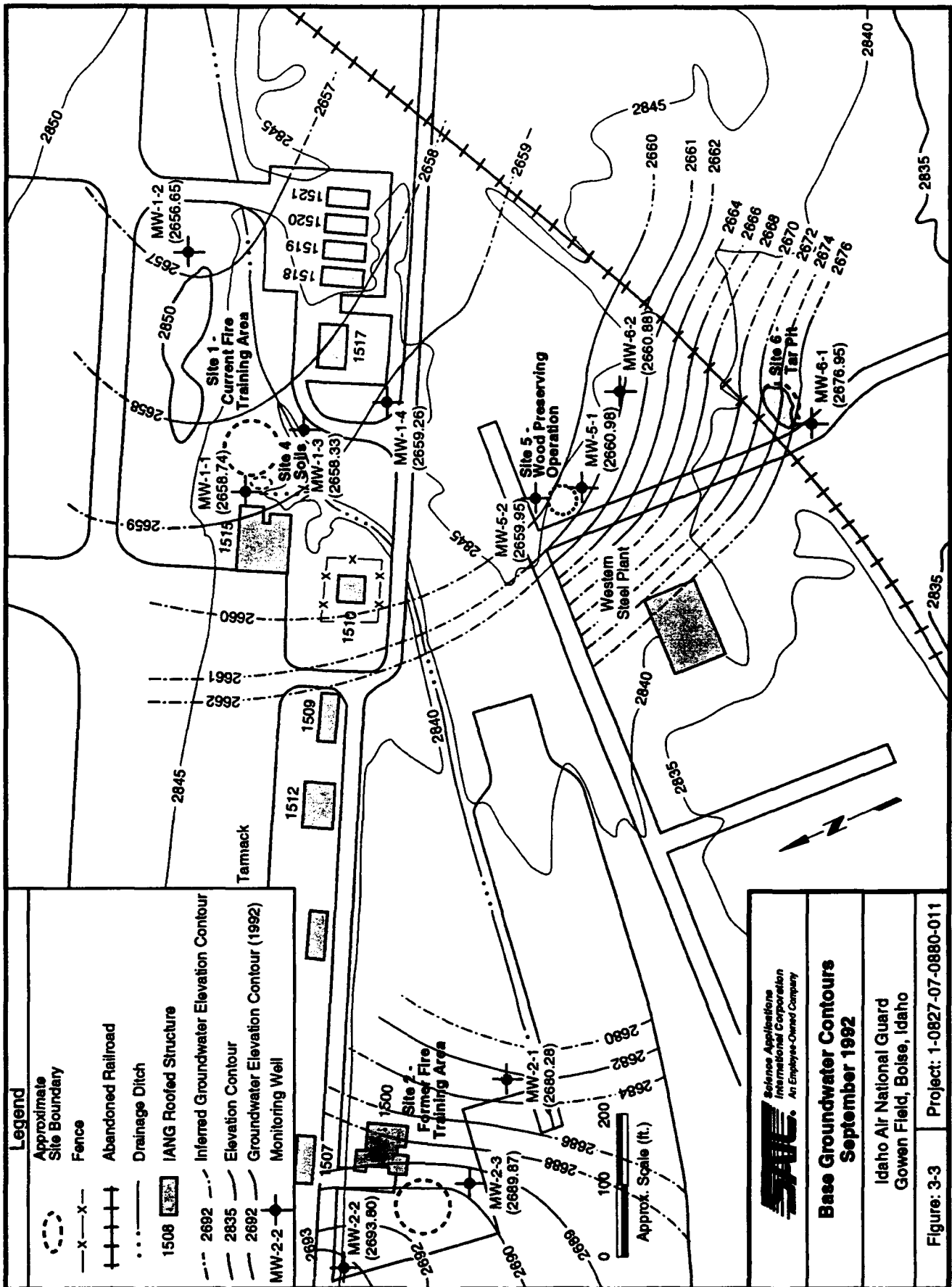
**Table 3-3. Water Level Data for Idaho Air National Guard,
124th Reconnaissance Group, Gowen Field, Boise, Idaho**

MONITORING		WATER LEVEL	
WELL I.D. #	DATE	BTOC	MSL
MW-1-1	8/15/87	171.60	2669.83
	9/6/90	177.20	2664.23
	1/16/91	178.06	2663.37
MW-1-2	8/15/87	181.90	2668.15
	9/6/90	188.53	2661.52
	1/15/91	188.80	2661.25
MW-1-3	8/15/87	NA	NA
	9/6/90	NA	NA
	1/15/91	177.30	2662.88
MW-1-4	8/15/87	NA	NA
	9/6/90	NA	NA
	1/15/91	178.70	2663.61
MW-2-1	8/15/87	NA	NA
	9/6/90	NA	NA
	1/15/91	153.83	2682.66
MW-2-2	8/15/87	NA	NA
	9/6/90	NA	NA
	1/15/91	144.70	2694.63
MW-2-3	8/15/87	NA	NA
	9/6/90	NA	NA
	1/15/91	146.50	2690.69
MW-5-1	8/15/87	170.60	2672.76
	9/6/90	177.54	2665.82
	1/15/91	177.80	2665.56
MW-5-2	8/15/87	NA	NA
	9/6/90	NA	NA
	1/15/91	180.42	2664.54
MW-6-1	8/15/87	157.20	2679.10
	9/6/90	159.88	2676.42
	1/15/91	158.88	2677.42
MW-6-2	8/15/87	NA	NA
	9/6/90	NA	NA
	1/15/91	177.44	2664.98

BTOC - below top of casing

MSL - mean sea level

NA - not applicable; monitoring well not installed at this time



3.2 DATA QUALITY ASSESSMENT

A standardized QA/QC program was followed during the collection of additional soil samples during the 1992 field investigation, which supplemented previous sampling conducted during the IANG, Gowen Field SI, to ensure that analytical results and the decisions based on these results are representative of the environmental condition at the installation. The objectives of the 1992 field investigation were to collect and analyze sufficient numbers of samples to support a baseline risk assessment and a computer contaminant transport model, and to determine the disposal fate of previous SI generated drill cuttings. All additional soil sampling activities at IANG, Gowen Field were conducted using Hazardous Waste Remedial Actions Program (HAZWRAP) Level C (i.e., EPA Level III) for soil and groundwater samples; quality control (QC) requirements described in *Requirements for Quality Control of Analytical Data* (DOE/HWP-65/R1, July 1990); and the guidelines and specifications described in the Quality Assurance Project Plans (QAPPs) submitted as part of the project work plans prepared by Science Applications International Corporation (SAIC). The numbers of soil samples collected during the additional sampling at IANG, Gowen Field, in addition to the number of field QC samples collected and selected laboratory QC (i.e., matrix spikes and duplicates) samples analyzed, are summarized in Appendix C. The data validation worksheets are referenced within the subsection describing the applicable analysis. The QC checks and results are summarized below.

3.2.1 Data Quality Objectives

The following sections summarize the data quality objectives (DQOs) for precision, accuracy, representativeness, comparability, and completeness (PARCC) obtained during the IANG, Gowen Field supplemental sampling.

3.2.1.1 Precision

Precision was defined as the reproducibility, or degree of agreement, among the replicate measurements of the same quantity. The closer the numerical values of the measurement are to each other, the more precise the measurement is. Analytical precision was expressed as the percentage of the difference between the results of duplicate samples for a given compound or

element. Relative percent difference (RPD) was calculated using the equation given in Appendix C.

Precision was determined using matrix spike/matrix spike duplicate (MS/MSD) and duplicate sample analyses conducted on samples collected for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), polychlorinated dibenzodioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and priority pollutant metals during the IANG, Gowen Field supplemental sampling. The laboratory selected 1 sample in 20 and split the sample into 2 additional aliquots. MS/MSD samples were prepared by routinely analyzing the first aliquot for the parameters of interest, while the remaining two aliquots were spiked with known quantities of the parameters of interest before analysis. The RPD between the spiked results was calculated and used as an indication of the analytical precision for the VOC, SVOC, pesticide/PCB, TPH, PCDD, and PCDF analyses performed. Duplicate samples (i.e., priority pollutant metals analyses) were prepared by subdividing 1 sample of every 20 samples received and analyzing both samples of the duplicate pair. The RPD between the two detected concentrations was calculated and used as an indication of the analytical precision for the analyses performed.

All RPD values calculated from the VOC MS/MSD analyses were within the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) advisory control limits for analytical precision. All RPD values calculated from the TPH, PCDD, and PCDF analyses were within the appropriate control limits for analytical precision. Twenty RPD values (of 22 total values) calculated from the SVOC MS/MSD analyses, and one RPD (of 12 total values) calculated from the pesticide/PCB MS/MSD analyses were outside the EPA CLP advisory control limits for analytical precision. Since each analysis was evaluated according to the required QC criteria described in Appendix C (Section C.3) and all of these criteria were met for environmental samples analyzed, these RPD values are considered to be a more representative reflection of the variability characteristic of the environmental condition at IANG Gowen Field, and as a result, the analytical DQO for VOC, SVOC, pesticide/PCB, TPH, and PCDD and PCDF precision is considered to have been met. Strict CLP validation guidelines

were applied to the priority pollutant metals duplicate sample results, even though no practical methods are defined by EPA to determine or relate the duplicate results in one environmental duplicate sample to those that might be calculated in another unrelated environmental sample. All RPD values calculated from the priority pollutant metals were within the appropriate control limits. Therefore, the analytical precision DQO for priority pollutant metals analyses is considered to have been met. The analytical QC criteria used to evaluate the analytical precision and all MS/MSD results are discussed in Appendix C (Section C.3).

Sample collection reproducibility and media variability were measured in the laboratory by the analysis of field replicates. Field replicates were collected using the same techniques as those used to collect the environmental samples. One sample in 10 similar matrices was collected, and sample collection reproducibility and media variability were evaluated based on the RPD values between duplicate samples. No corrective action was taken based on the RPD values.

All soil samples to be analyzed by the Weyerhaeuser Laboratory, located in Tacoma, Washington, were collected using decontaminated stainless steel sampling tools (i.e., for VOC, SVOC, pesticide/PCB, TPH, PCDD, PCDF, and priority pollutant metals analyses) and then transferred into the appropriate containers, labeled, and then shipped to the Weyerhaeuser Laboratory. Therefore, the replicate concentrations measured by the laboratory reflect the natural matrix variability inherent in the subsurface soils at LANG, Gowen Field and were not used to assess sample collection precision. Field RPD values were calculated only for compounds and elements detected in concentrations greater than the contract required detection limits (CRDLs) in both replicate pairs and only for those compounds and elements not considered to be common laboratory contaminants (e.g., methylene chloride). All VOC and SVOC RPDs met the acceptance criteria. All pesticide/PCB replicate RPD values met the acceptance criteria, except for 4,4'-DDT (106.7 percent) and heptachlor epoxide (113.7 percent) in one soil replicate pair (i.e., TP-1-1-0.5). All PCDD RPDs met the acceptance criteria, except for 1,2,3,4,7,8,9-heptachlorodibenzo-p-dioxin (108.7 percent) detected in one soil replicate pair (i.e., TP-1-1-4.0). All TPH RPD values met the evaluation criteria, except for TP-1-1-4.0RE (67.2 percent). All other pesticide/PCB, PCDD and TPH RPDs met the acceptance criteria.

All priority pollutant metals replicate RPD values met the acceptance criteria, except for lead (52.4 percent) in TP-1-1-4.0. Based on these RPD results and the acceptable laboratory QC results, the sample collection DQO for reproducibility is considered to have been met, except where noted. A comprehensive discussion of all replicate sample results is presented in Appendix C (Section C.2.4).

3.2.1.2 Accuracy

Accuracy was defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement approaches the true value, or actual concentration, the more accurate the measurement is. Analytical accuracy is expressed as the percent recovery of a compound or element that has been added to the environmental sample at a known concentration before analysis. The percent recovery values were calculated using the equation given in Appendix C.

Laboratory accuracy was qualitatively assessed by evaluating the following laboratory QC information: sample holding times, method blank, tuning and mass calibration (gas chromatography/mass spectrometry [GC/MS]) only, surrogate recovery (GC/MS only), internal standard (GC/MS only), laboratory control sample (LCS) and method blank spike recovery, and initial and continuing calibration results calculated from all analyses conducted on environmental samples.

Twenty-three (of 44 values), 2 (of 24 values), and 9 (of 24 values) percent recovery values were outside the applicable EPA CLP control limits. All supporting SVOC, pesticide/PCB, and priority pollutant metals QC information cited above also was qualitatively evaluated with respect to the analytical accuracy DQO. Selected data validation qualifiers were applied to the VOC environmental sample results due to method blank interference (i.e., acetone and 2-butanone) and inadequate internal standard performance. Selected data validation qualifiers were applied to the SVOC environmental sample results due to method blank interference (i.e., bis[2-ethylhexyl]phthalate), inadequate calibration standard performance (i.e., 2-nitroaniline, 4-nitrophenol, and 2,2-oxybis-[1-chloro-propane]), and poor surrogate recoveries. One hundred and eighty-six data points were rejected due to zero percent recoveries.

for selected SVOC surrogate recoveries. These rejected points are discussed in Appendix C on page C-11 (Table C-2) and page C-71. Of the qualified SVOC data points, these values have the greatest adverse impact on the environmental data quality, since these results prevent an evaluation of any aged petroleum fuel hydrocarbons that may have been detected in the samples. Data validation qualifiers were applied to 30 antimony and selenium concentrations to indicate that these values were rejected due to unacceptable (i.e., less than 30 percent) matrix spike recoveries. In addition, data validation qualifiers were applied to numerous other priority pollutant metals concentrations to indicate that the matrix spike recoveries were outside the applicable control limits. Despite these values, no systematic laboratory error was detected, since all of the LCS criteria for soil samples were met. As a result, all associated soil data were qualified for data validation purposes, as required by EPA validation guidelines; however, the results are considered to have little impact on the overall environmental data quality.

Sampling accuracy was maximized by adherence to the strict quality assurance (QA) program presented in the SI QAPP. All procedures (i.e., soil excavation, soil sample collection, equipment decontamination, and health monitoring equipment calibration and operation) used during the sampling at IANG, Gowen Field were documented as standard operating procedures (SOPs). Field QC blanks (i.e., trip blanks, field blanks, and equipment blanks) were prepared to ensure that all samples represent the particular site from which they were collected, assess any cross-contamination that may have occurred, and qualify the analytical data accordingly.

Data validation qualifiers were applied to the VOC (i.e., acetone) detected in five soil samples to indicate that acetone was considered not detected due to associated field QC blank interference. These samples were validated using the highest concentration of the applicable interferent detected in the associated field QC blank. Data validation qualifiers also were applied to selected priority pollutant metals (e.g., arsenic and zinc) detected in soil samples to indicate that these concentrations are considered not detected, since the concentrations detected in the soil samples do not exceed five times that detected in the associated field QC blank. Despite the data validation qualifiers applied to these VOC and metals samples, the compounds detected in the associated field blanks are nonvolatile. Therefore, the possibility of cross contamination between field QC blanks and their associated environmental samples is considered remote. In addition,

it is unlikely that the water used to prepare the field QC blanks was the source of the arsenic and zinc detected in the associated soil samples, since the sampling tools were effectively rinsed numerous times with the sample media during the sampling collection activities. Based on an evaluation of the compounds and elements detected in the field QC blanks, the overall field accuracy is acceptable, except where noted. A comprehensive discussion of the field QC results is presented in Appendix C (Section C.2).

3.2.1.3 Representativeness

Representativeness was defined as the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling location, a process condition, or an environmental condition. Sample representativeness was ensured during the IANG, Gowen Field supplemental sampling by collecting sufficient samples of a population medium, properly distributed with respect to location and time. Representativeness was assessed by reviewing the drilling techniques and equipment; well installation procedures and materials; and sample collection methods, equipment, and sample containers used during the IANG, Gowen Field supplemental sampling, in addition to evaluating the RPD values calculated from the duplicate samples and the concentrations of interferents detected in the field and laboratory QC samples. The reproducibility of a representative set of samples reflects the degree of heterogeneity of the sampled medium, as well as the effectiveness of the sample collection technique.

As required by the SI Statement of Work (SOW), test pits were excavated using a backhoe. All samples were collected using stainless steel tools. Four soil samples were collected according to the TCLP sampling procedures outlined in Section 2.2.3. All data are considered to be representative.

Based on the evaluation of the factors described above and summarized in Appendix C (Section C.3), the samples collected during the supplemental sampling are considered to be representative of the environmental conditions at IANG, Gowen Field.

3.2.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another and is limited to the other PARCC parameters, because only when precision and accuracy are known can one data set be compared to another. To optimize comparability, only the specific methods and protocols that were specified in the SI QAPP, as required by DOE/HWP-65/R1, were used to collect and analyze samples during the IANG, Gowen Field supplemental sampling. By using consistent sampling and analysis procedures, all data sets were comparable within the sites at IANG, Gowen Field, between sites at the installation, or among U.S. Air Force (USAF) facilities nationwide, to ensure that remedial action decisions and priorities were based on a consistent data base. Comparability also was ensured by the analysis of EPA reference materials, establishing that the analytical procedures used were generating valid data.

All samples collected for VOC, SVOC, pesticide/PCB, PCDD and PCDF, TPH, and priority pollutant metals analyses were analyzed using EPA methods. Based on the precision and accuracy assessment presented above, the data collected during the supplemental sampling are considered to be comparable with the data collected during previous investigations.

3.2.1.5 Completeness

Completeness was defined as the percentage of valid data obtained from a measurement system. For data to be considered valid, they must have met all acceptance criteria, including accuracy and precision, as well as any other criteria specified by the analytical methods used.

Furthermore, project completeness was defined as the percentage of data that will be used to prepare a preliminary risk evaluation and upon which recommendations for site remediation are based. For analytical data to be considered to be usable for preliminary risk evaluation and remediation recommendations, each data point must be satisfactorily validated. Rejected (e.g., due to poor surrogate recoveries and matrix spike recoveries) concentrations reported for all analyses were not used in the risk estimates or for remediation recommendations due to the increased potential of using the concentration of compounds and elements (i.e., false positives) or omitting compounds or elements (i.e., false negatives) that may have an adverse impact on

human health. As a result, 186 SVOC data points and 60 priority pollutant metals data points were not included in the baseline risk assessment of the supplemental sampling data. Based on the evaluation of the field and laboratory QC results presented in Appendix C (Sections C.2 and C.3), 100 percent of the sample data collected for VOC, pesticide/PCB, TPH, PCDD, and PCDF analyses; 90 percent of the sample data collected for SVOC analyses; and 82.76 percent of the data collected for priority pollutant metals analyses during the supplemental sampling were used as the basis for all recommendations presented in this Addendum Report. A complete list of these data points is presented in Appendix C.

3.3 BACKGROUND SOIL SAMPLING RESULTS

As part of the 1987 field investigation, background soil samples were collected at points located off of the Base in remote areas that showed no signs of past hazardous materials or development activities. The concentrations of the contaminants of concern in these samples were at levels that were consistently above the concentrations detected in the environmental samples collected from the sites of concern, thus biasing the comparison to background levels. These background samples were ultimately not deemed representative of background conditions. As part of the 1992 field investigation, three background test pits (i.e., BG-3, BG-4, and BG-5) at various locations on IANG, Gowen Field were sampled to collect information on the three background test pits (i.e., BG-3, BG-4, and BG-5) at various locations on IANG, Gowen Field were sampled to collect information on the concentrations of contaminants that are of concern at the investigated sites. These points were located in areas that had no history of being involved with the handling of hazardous materials and showed no visible signs of existing contamination (i.e., stressed vegetation or surface stains). Selecting sampling locations on the Base provided representative conditions that would be experienced at the sites of concern. The analytical results of the samples from these test pits were considered as background concentrations for the study areas. Figure 2-2 shows the locations of these sample points. Samples were collected at 0.5 feet BLS and 4 feet BLS in each test pit, including a duplicate sample (BG-3-0.5), and each sample was analyzed for TPH, VOCs, SVOCs, metals, pesticides/PCBs, and dioxin/furans. Table 3-4 summarizes the contaminants detected in these soil samples. Appendix B presents the results of all analyses conducted on these samples.

Table 3-4. Data Summary Table: Soil (1992) - Background Site, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho

SAT ID Number	BG-3-03	BG-3-03R	BG-3-70	BG-4-03	BG-4-70	BG-5-03	BG-5-70
Laboratory ID Number	96892	96893	96894	96895	96896	96897	96898
Collection Date	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/23/92	09/23/92
Collection Depth (ft)	0.5	0.5	4	0.5	4	0.5	0.5
Associated Field QC Sample	TB-1 EB-1,EB-2 PB-2 PB-1,EB-3	TB-1 EB-1,EB-2 PB-2 PB-1,EB-3	TB-1 EB-1,EB-2 PB-2 PB-1,EB-3	TB-1 EB-1,EB-2 PB-2 PB-1,EB-3	TB-1 EB-1,EB-2 PB-2 PB-1,EB-3	TB-2 EB-1,EB-2 PB-2 PB-1,EB-3	TB-2 EB-1,EB-2 PB-2 PB-1,EB-3
Units							
TOTAL PETROLEUM HYDROCARBONS (SW 3550B 418.1)							
Total Petroleum Hydrocarbons	<10	<10	<10	<10	<10	44	<10
ICP METALS (SW 3050/6010)							
Beryllium	1.00	0.96	0.86	0.50	0.58	0.35 B	0.30 B
Cadmium	0.23 U	0.23 U	0.21 U	0.17 U	0.24 U	0.17 U	0.26 B
Chromium	17.7	16.6	12.0	11.4	12.3	9.7	6.4
Copper	16.2 K(N)	14.9 K(N)	13.9 K(N)	13.8 K(N)	15.4 K(N)	9.0 K(N)	6.0 K(N)
Nickel	16.7	16.6	14.5	10.5	14.7	8.7	7.0 U(MB)
Silver	0.55 B	0.47 B	0.75 B	0.52 B	0.96 B	0.31 U	0.34 U
AA METALS							
Antimony (SW 3050/7041)	0.21 R(N)	0.24 R(N)	0.23 R(N)	0.25 R(N)	0.24 R(N)	0.3 R(N)	0.16 R(N)
Arsenic (SW 3050/7060)	3.8 U(PB)	3.7 U(PB)	5.1 U(PB)	3.3	7.1 U(PB,W)	5	2.7
Lead (SW 3050/7421)	14.2	13.6	11	16	9.3	15.9	9.4
Selenium (SW 3050/7740)	0.94 R(N)	0.09 R(N)	0.94 R(N)	0.78 R(N)	0.8 R(N)	0.82 R(N)	0.79 R(N)
Thallium (SW 3050/7641)	0.16 U(X,N,W)	0.16 U(X,N,W)	0.2 K(N)	0.14 U(X,N,W)	0.14 U(X,N,W)	0.14 U(X,N,W)	0.14 U(X,N,W)
VOLATILE ORGANICS (SOW 399)							
μg/g	ND	ND	ND	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS (SOW 390)							
μg/g	370 U	370 U	390 U	320 U	120 J	330 U	340 U
μg/g	6007 (5)	6740 (2)	6990 (4)	1257 (4)	1020 (4)	7432 (7)	6520 (3)
PESTICIDE ORGANICS (SW 3550/0000)							
μg/g	3.8 U	3.8 U	4 U	3.4 U	3.7 U	0.49 X(CV)	3.4 U
μg/g	3.8 U	3.8 U	4 U	3.4 U	3.7 U	1.1 X(CV)	3.4 U
μg/g	19 U	2.5 X(SR,ICV)	20 U	17 U	19 U	17 U	17 U
DIOXINS/FURANS (SW 8290)							
ng/g	0.73 X(NCC)	0.33 U	0.59 U	0.37 U	0.86 U	0.38 U	0.87 U
1234789-HxCDF	0.52 U	0.42 U	0.45 U	0.97 U	0.47 U	3.71 J	1.13 U
OCDD	3.39 X(NCC,LCC)	0.59 U	0.80 U	42.77 X(NCC,LCC)	0.60 U	55.08 X(NCC,LCC)	13.13 X(NCC,LCC)

Validation note: All descriptive qualifiers applied to the reported values by the laboratory are reported in parentheses.

Each data point has been assessed to determine whether the value is considered usable (i.e., no qualifier), usable but estimated (i.e., "J"), or not usable (i.e., "R"). All usability qualifiers are followed by the applicable laboratory or field QC qualifier, presented in parentheses and defined above. Usability qualifiers were not applied to values qualified by the laboratory, but were not considered to have been adversely impacted by the applicable laboratory QC result (e.g., duplicated and matrix spike analysis).

ND - not detected

TICs - tentatively identified compounds, total concentration is listed and the total number of tentatively identified compounds is inside the parentheses

Data Validation Qualifiers

J - associated numerical value is the approximate concentration

R - rejected value

U - compound/element was included in analysis, but was not detected

UJ - reported quantitation limit is approximate and may or may not represent the actual quantitation necessary to accurately and precisely measure the analyte

Explanatory Data Validation Qualifiers

FB - compound/element was also detected in the associated field blank

ICV - Initial Calibration Verification

LCC - continuing calibration is outside the control limits for labelled congeners

MB - compound/element was also detected in the associated laboratory method blank

NCC - continuing calibration is outside the control limits for unlabelled congeners

SR - surrogate recovery outside control limits

BPA - defined CLP SOW Laboratory

B(metal) - the reported value is estimated because it is greater than the Instrument Detection Limit (IDL), but less than the Contract Required Detection Limit (CRDL)

N - spiked sample recovery outside of control limits

W - post-digestion spike for Graphite Furnace Atomic Absorption (GFAA) analysis is out of control limits (85 - 115%), while sample absorbance is less than 50% of the spike absorbance

TPH was detected in one sample (BG-5-0.5) collected at 0.5 feet BLS in test pit BG-5 at a concentration of 44 mg/kg. VOCs were not detected in any of the background samples collected. SVOCs were detected in each background sample collected. Bis(2-ethylhexyl)-phthalate was the only identifiable SVOC detected and was found in sample BG-4-4.0 at a concentration of 120J $\mu\text{g/kg}$. SVOC tentatively identified compounds (TICs) were detected in all background samples at total concentrations ranging from 1,020 $\mu\text{g/kg}$ in sample BG-4-4.0 to 7,438 $\mu\text{g/kg}$ in BG-5-0.5.

Metals were detected in each background sample. Beryllium was detected at concentrations ranging from 0.3B $\mu\text{g/kg}$ in BG-5-4.0 to 1.00 $\mu\text{g/kg}$ in sample BG-3-0.5. Cadmium was detected in sample BG-5-4.0 at a concentration of 0.26 $\mu\text{g/kg}$. Chromium was detected in all samples at concentrations ranging from 6.4 $\mu\text{g/kg}$ in sample BG-5-4.0 to 17.7 $\mu\text{g/kg}$ in sample BG-3-0.5. Copper was detected in all samples at concentrations ranging from 6.0 $\mu\text{g/kg}$ in sample BG-5-4.0 to 16.2 $\mu\text{g/kg}$ in sample BG-3-0.5. Nickel was detected in five of the six background samples at concentrations ranging from 8.7 $\mu\text{g/kg}$ in sample BG-5-0.5 to 16.7 $\mu\text{g/kg}$ in sample BG-3-0.5. Silver was detected in four of the samples at concentrations ranging from 0.96 $\mu\text{g/kg}$ in sample BG-4-4.0 to 0.47 $\mu\text{g/kg}$ in sample BG-3-0.5R. Arsenic was detected in three samples at concentrations ranging from 2.7 $\mu\text{g/kg}$ in sample BG-5-4.0 to 5 $\mu\text{g/kg}$ in sample BG-5-0.5. Lead was detected in all background samples at concentrations ranging from 9.3 $\mu\text{g/kg}$ in BG-4-4.0 to 16 $\mu\text{g/kg}$ in BG-4-0.5. Thallium was detected in sample BG-3-4.0 at 0.2 $\mu\text{g/kg}$. The concentrations of antimony and selenium detected in all background samples are not considered to be representative values because the associated laboratory spiked sample was outside the control limits, rendering these data unusable.

Pesticides were detected in samples BG-3-0.5R and BG-5-0.5. Methoxychlor was detected in BG-3-0.5R at 2.5 $\mu\text{g/kg}$. Sample BG-5-0.5 contained 4,4'-DDE at a concentration of 0.49 $\mu\text{g/kg}$ and 4,4'-DDT at a concentration of 1.1 $\mu\text{g/kg}$.

Three dioxin congeners were identified in the background samples: 12368-HxCDF, 1234789-HpCDD, and OCDD. Sample BG-3-0.5 contained 12368-HxCDF at a concentration of 0.73 ng/kg and OCDD at a concentration of 3.39 ng/kg. Sample BG-5-0.5 contained

1234789-HpCDD and OCDD at concentrations of 3.71 ng/kg and 55.08 ng/kg, respectively. OCDD was detected in samples BG-4-0.5 and BG-5-4.0 at concentrations of 42.77 ng/kg and 13.13 ng/kg, respectively.

The concentrations of contaminants detected in these background samples will be used for qualitative comparisons with the contaminants detected at the study sites. These results are presented in the following site-specific subsections. Quantitative analysis using the results of these background samples were conducted in the baseline risk assessment that was completed for Site 1 - Current Fire Training Area, Site 3 - Central Drainage Ditch, the stockpiled Site 4 - Oil Patch in Drainage Field soils, and Site 6 - Tar Pit.

3.4 SITE 1 - CURRENT FIRE TRAINING AREA

This section provides details on the additional sampling activities conducted at Site 1 - Current Fire Training Area and the results of chemical laboratory analyses conducted on collected soil samples. Site 1 consists of the current fire training area and an underground storage tank (UST) area. The current fire training area is a circular site approximately 100 feet in diameter. Soil contamination in the fire training area is the result of training exercises, which inundate the site with waste fuels, oils, and solvents that are subsequently combusted. The UST site consists of an UST connected to the fire training area by an underground pipeline. Because the two areas within Site 1 are distinctive based on the activities that are conducted in each area, the data for each area are presented as the Fire Training Pit Area and the Underground Storage Tank (UST) Area.

Sixteen soil samples were collected from eight shallow test pits excavated within the perimeter of the current fire training pit area and in the vicinity of the UST and associated pipelines (Figure 2-1). Soil samples were obtained from 0.5- and 4.0-foot depths from each pit.

Laboratory chemical analysis of the test pit samples consisted of VOCs, SVOCs, pesticides/PCBs, dioxin/furans, TPH, and metals. Detected compounds for each sample are provided in summary table (Table 3-5) and complete data presentations are provided in Appendix B.

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

SAC ID Number Laboratory ID Number Collection Date Collection Depth (ft) Associated Field QC Sample	TP-1-1-0.5		TP-1-1-0.5RE		TP-1-1-0.5R		TP-1-1-4.0		TP-1-1-4.0RE	
	96870	09/22/92	96870RE	09/22/92	96890	09/22/92	96871	09/22/92	96871RE	09/22/92
	0.5		0.5		0.5		4		4	
	TB-1		TB-1		TB-1		TB-1		TB-1	
	EB-1,EB-2		EB-1,EB-2		EB-1,EB-2		EB-1,EB-2		EB-1,EB-2	
	FB-2		FB-2		FB-2		FB-2		FB-2	
	FB-1,FB-3		FB-1,FB-3		FB-1,FB-3		FB-1,FB-3		FB-1,FB-3	
Units										
SEMI-VOLATILE ORGANICS (SO W 3/90) (Continued)										
2-Chloronaphthalene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
2-Nitroaniline	µg/kg	19000 U	NA	NA	20000 U	8100 U	18000 U	7500 U	NA	NA
Dimethyl phthalate	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Acenaphthylene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
2,6-Dinitrotoluene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
3-Nitroaniline	µg/kg	19000 U	NA	NA	20000 U	8100 U	18000 U	7500 U	NA	NA
Acenaphthene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
2,4-Dinitrophenol	µg/kg	19000 U	NA	NA	20000 U	8100 U	18000 U	7500 U	NA	NA
4-Nitrophenol	µg/kg	19000 U	NA	NA	20000 U	8100 U	18000 U	7500 U	NA	NA
Dibenzofuran	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
2,4-Dinitrotoluene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Diethylphthalate	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
4-Chlorophenyl-phenyl ether	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Fluorene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
4-Nitroaniline	µg/kg	19000 U	NA	NA	20000 U	8100 U	18000 U	7500 U	NA	NA
4,6-Dinitro-2-methylphenol	µg/kg	19000 U	NA	NA	20000 U	8100 U	18000 U	7500 U	NA	NA
N-Nitrosodiphenylamine (1)	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
4-Bromophenyl phenyl ether	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Hexachlorobenzene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Pentachlorophenol	µg/kg	19000 U	NA	NA	20000 U	8100 U	18000 U	7500 U	NA	NA
Phenanthrene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Anthracene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Carbazole	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
di-N-Butyl phthalate	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Fluoranthene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Pyrene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Butylbenzylphthalate	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
3,3'-Dichlorobenzidine	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Benzo(a)anthracene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Chrysene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
bis(2-Ethylhexyl)phthalate	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
di-N-Octyl phthalate	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Benzo(b)fluoranthene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Benzo(k)fluoranthene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Benzo(a)pyrene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Indeno(1,2,3-c,d)pyrene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Dibenzo(a,b)anthracene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
Benzo(g,h,i)perylene	µg/kg	7700 U	NA	NA	8100 U	20000 U	7500 U	18000 U	NA	NA
TIC	µg/kg	474100 (20)	NA	NA	467000 (20)	386600 (21)	NA	NA	NA	NA
PESTICIDE ORGANICS (SW 355/0000)										
Heptachlor epoxide	µg/kg	12 UJ(SR,ICV,FD)	NA	NA	3.3 J(SR,ICV,FD)	5.3 J(ICV)	NA	NA	NA	NA
Endosulfan I	µg/kg	21 UJ(SR)	NA	NA	2.1 U	21 U	NA	NA	NA	NA
Dieldrin	µg/kg	41 UJ(SR)	NA	NA	2.8 J(SR,ICV)	41 U	NA	NA	NA	NA
Endosulfan II	µg/kg	49 J(SR,BRK)	NA	NA	4.1 U	41 U	NA	NA	NA	NA
4,4'-DDD	µg/kg	41 UJ(SR)	NA	NA	4.1 U	41 U	NA	NA	NA	NA
4,4'-DDT	µg/kg	41 UJ(SR)	NA	NA	4.1 U	41 U	NA	NA	NA	NA
Methoxychlor	µg/kg	24 UJ(SR,ICV,FD)	NA	NA	7.3 J(SR,ICV,FD)	12 J(ICV)	NA	NA	NA	NA
Endrin aldehyde	µg/kg	210 UJ(SR)	NA	NA	21 U	210 U	NA	NA	NA	NA
	µg/kg	41 UJ(SR)	NA	NA	5.5 (P)	41 U	NA	NA	NA	NA
DIOXINS/FURANS (SW 8290)										
1234678-HpCDF	ng/kg	7.04 U	NA	NA	2.28 U	1.06 U	NA	NA	NA	NA
1234789-HpCDD	ng/kg	11.44 U	NA	NA	15.43 J	4.36 J(FD)	NA	NA	NA	NA
OCDD	ng/kg	233.48 J(AR)	NA	NA	178.25 J(AR)	51.70	NA	NA	NA	NA
OCDF	ng/kg	4.62 U	NA	NA	2.42 U	0.93 U	NA	NA	NA	NA

	TP-1-1-4.0R	TP-1-1-4.0RE	TP-1-2-0.5	TP-1-2-0.5RE	TP-1-2-0.5DL
SAIC ID Number					
Laboratory ID Number	96872	96872RE	96873	96873RE	96873DL
Collection Date	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92
Collection Depth (ft)	4	4	0.5	0.5	0.5
Associated Field QC Sample					
	TB-1	TB-1	TB-1	TB-1	TB-1
	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2
	FB-2	FB-2	FB-2	FB-2	FB-2
	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3
Units					

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Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

SAC ID Number Laboratory ID Number Collection Date Collection Depth (ft) Associated Field QC Sample	TP-1-1-4OR	TP-1-1-4ORRE	TP-1-2-05	TP-1-2-05RE	TP-1-2-05DL
94672	94672	94672	94673	94673	94673DL
09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92
4	4	4	0.5	0.5	0.5
TB-1	TB-1	TB-1	TB-1	TB-1	TB-1
EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2
FB-2	FB-2	FB-2	FB-2	FB-2	FB-2
FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3
Units					
SEMIVOLATILE ORGANICS (SW 3/90) (Continued)					
2-Chloronaphthalene	7800 R(SR)	NA	7700 U	NA	NA
2-Nitroaniline	19000 R(SR)	NA	19000 U	NA	NA
Dimethyl phthalate	7800 R(SR)	NA	7700 U	NA	NA
Acenaphthylene	7800 R(SR)	NA	7700 U	NA	NA
2,6-Dinitrotoluene	7800 R(SR)	NA	7700 U	NA	NA
3-Nitroaniline	19000 R(SR)	NA	19000 U	NA	NA
Acenaphthene	7800 R(SR)	NA	7700 U	NA	NA
2,4-Dinitrophenol	19000 U	NA	19000 U	NA	NA
4-Nitrophenol	19000 U	NA	19000 U	NA	NA
Dibenzofuran	7800 R(SR)	NA	7700 U	NA	NA
2,4-Dinitrotoluene	1400 X(SR)	NA	7700 U	NA	NA
Diethylphthalate	7800 R(SR)	NA	7700 U	NA	NA
4-Chlorophenyl - phenyl ether	7800 R(SR)	NA	7700 U	NA	NA
Fluorene	1100 X(SR)	NA	7700 U	NA	NA
4-Nitroaniline	19000 R(SR)	NA	19000 U	NA	NA
4,6-Dinitro-2-methylphenol	19000 U	NA	19000 U	NA	NA
N-Nitrosodiphenylamine (I)	7800 R(SR)	NA	7700 U	NA	NA
4-Bromophenyl phenyl ether	7800 R(SR)	NA	7700 U	NA	NA
Hexachlorobenzene	7800 R(SR)	NA	7700 U	NA	NA
Pentachlorophenol	19000 U	NA	19000 U	NA	NA
Phenanthrene	3500 X(SR)	NA	7700 U	NA	NA
Anthracene	3700 X(SR)	NA	7700 U	NA	NA
Carbazole	7800 R(SR)	NA	7700 U	NA	NA
di-N-Butyl phthalate	7800 R(SR)	NA	7700 U	NA	NA
Fluoranthene	7800 R(SR)	NA	7700 U	NA	NA
Pyrene	7800 R(SR)	NA	810 J	NA	NA
Butylbenzylphthalate	3700 R(SR)	NA	7700 U	NA	NA
3,3'-Dichlorobenzidine	7800 R(SR)	NA	7700 U	NA	NA
Benzo(a)anthracene	7800 R(SR)	NA	7700 U	NA	NA
Chrysene	7800 R(SR)	NA	7700 U	NA	NA
bio(2-Ethylhexyl)phthalate	1500 R(SR)	NA	7700 U	NA	NA
di-N-Octyl phthalate	7800 R(SR)	NA	7700 U	NA	NA
Benzo(b)fluoranthene	7800 R(SR)	NA	7700 U	NA	NA
Benzo(k)fluoranthene	7800 R(SR)	NA	7700 U	NA	NA
Benzo(a)pyrene	7800 R(SR)	NA	7700 U	NA	NA
Indeno(1,2,3-c,d)pyrene	7800 R(SR)	NA	7700 U	NA	NA
Dibenzo(a,h)anthracene	7800 R(SR)	NA	7700 U	NA	NA
Benzo(g,h,i)perylene	7800 R(SR)	NA	7700 U	NA	NA
TICs	1660000 (20)	NA	151000 (20)	NA	NA
PESTICIDE ORGANICS (SW 3/5/06060)					
Heptachlor epoxide	7.9 J(ICV)	NA	5.2 J(ICV)	NA	NA
Endosulfan I	21 U	NA	19 U	NA	NA
Dielsin	41 U	NA	39 U	NA	NA
Endosulfan II	41 U	NA	29 J(BRK)	NA	NA
4,4'-DDD	41 U	NA	39 U	NA	NA
4,4'-DDT	16 J(ICV)	NA	11 J(ICV)	NA	NA
Methoxychlor	210 U	NA	190 U	NA	NA
Endrin aldehyde	41 U	NA	39 U	NA	NA
DIOXINS/SPURANS (SW 8/90)					
1234678-HpCDF	1.13 U	NA	13.19 J	NA	NA
1234789-HpCDD	14.74 J(FD)	NA	40.18	NA	NA
OCDD	81.86	NA	438.18 J(IAR)	NA	NA
OCDF	1.84 U	NA	13.66 J(NCC)	NA	NA

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

SAC ID Number Laboratory ID Number Collection Date Collection Depth (ft) Associated Field QC Sample	Units	TP-1-2-4.0			TP-1-2-4.0RE			TP-1-2-4.0DL			TP-1-3-03			TP-1-3-03RE
		96874	96874	09/22/92	96874RE	09/22/92	4	96874DL	09/22/92	4	96875	09/22/92	0.5	96875RE
		TB-1	TB-1		TB-1		4	TB-1		4	TB-1		0.5	TB-1
		EB-1, EB-2	EB-1, EB-2		EB-1, EB-2		4	EB-1, EB-2		4	EB-1, EB-2		0.5	EB-1, EB-2
		FB-2	FB-2		FB-2		4	FB-2		4	FB-2		0.5	FB-2
		FB-1, FB-3	FB-1, FB-3		FB-1, FB-3		4	FB-1, FB-3		4	FB-1, FB-3		0.5	FB-1, FB-3
TOTAL PETROLEUM HYDROCARBONS (SW 3550B 418.1)														
Total Petroleum Hydrocarbons	mg/kg	13600 NU			12000			NA			27900 NU			29800
ICP METALS (SW 3050/6010)														
Beryllium	mg/kg	0.48			NA			NA			0.51			NA
Cadmium	mg/kg	0.31 B			NA			NA			0.22 U			NA
Chromium	mg/kg	13.9 X(N)			NA			NA			9.7 X(N)			NA
Copper	mg/kg	26.6 X(N)			NA			NA			22.3 X(N)			NA
Nickel	mg/kg	9.9			NA			NA			12.4			NA
Silver	mg/kg	1.2 U(MB)			NA			NA			0.83 U(MB)			NA
AA METALS														
Antimony (SW 3050/7041)	mg/kg	0.47 R(N)			NA			NA			0.24 R(N)			NA
Arsenic (SW 3050/7060)	mg/kg	5.1 U(FB)			NA			NA			5 U(FB)			NA
Lead (SW 3050/7421)	mg/kg	75.3			NA			NA			51			NA
Selenium (SW 3050/7740)	mg/kg	0.13 R(N)			NA			NA			0.13 R(N)			NA
Thallium (SW 3050/7841)	mg/kg	1.3 U(X)			NA			NA			0.13 U(X, W)			NA
VOLATILE ORGANICS (SOW 3/90)														
Acetone	µg/kg	1100 (B, E)			NA			1400 U			1400 U			NA
1,2-Dichloroethene (total)	µg/kg	1300 (E, X)			NA			640 X(D, X)			270 X(X)			NA
2-Butanone	µg/kg	610 (E)			NA			1900 U(MB)			1500 U(MB)			NA
Trichloroethene	µg/kg	87			NA			1400 U			1400 U			NA
Benzene	µg/kg	65			NA			1400 U			810 J			NA
4-Methyl-2-pentanone	µg/kg	700 (E)			NA			1400 U			1400 U			NA
2-Hexanone	µg/kg	600 (E)			NA			1400 U			1400 U			NA
Toluene	µg/kg	2400 (E)			NA			2300 (D)			13000			NA
Chlorobenzene	µg/kg	11 U(IS)			NA			1400 U			1400 U			NA
Ethylbenzene	µg/kg	1600 (E)			NA			3100 (D)			1500			NA
Xylene (total)	µg/kg	9300 (E, X)			NA			22000 (D, X)			26000 (X)			NA
TICs	µg/kg	3889 (12)			NA			115000 (12)			234000 (11)			NA
Semi-VOLATILE ORGANICS (SOW 3/90)														
Phenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
bis(2-Chloroethyl) ether	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
2-Chlorophenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
1,3-Dichlorobenzene	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
1,4-Dichlorobenzene	µg/kg	840 J			NA			NA			7600 R(SR)			NA
1,2-Dichlorobenzene	µg/kg	4700 J			NA			NA			7600 R(SR)			NA
2-Methylphenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
2,2-oxobis(1-Chloropropane)	µg/kg	7500 U(CCV)			NA			NA			7600 R(SR)			NA
4-Methylphenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
N-Nitroso-di-N-propylamine	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
Hexachloroethane	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
Nitrobenzene	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
Isochlorane	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
2-Nitrophenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
2,4-Dimethylphenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
bis(2-Chloroethoxy)methane	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
2,4-Dichlorophenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
1,2,4-Trichlorobenzene	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
Naphthalene	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
4-Chloroaniline	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
Hexachlorobutadiene	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
4-Chloro-3-methylphenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
2-Methylnaphthalene	µg/kg	1300 J			NA			NA			10000 X(SR)			NA
Hexachlorocyclopentadiene	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
2,4,6-Trichlorophenol	µg/kg	7500 U			NA			NA			7600 R(SR)			NA
2,4,5-Trichlorophenol	µg/kg	18000 U			NA			NA			19000 R(SR)			NA

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

SAC ID Number Laboratory ID Number Collection Date Collection Depth (ft) Associated Field QC Sample	TP-1-2-40			TP-1-2-40RE			TP-1-2-40DL			TP-1-2-63			TP-1-2-63RE		
	96874	96874RE	09/22/92	4	4	4	96874DL	96874RE	09/22/92	0.5	0.5	0.5	96874RE	96874RE	09/22/92
Units	TP-1-2-40	TP-1-2-40RE	TP-1-2-40DL	TP-1-2-63	TP-1-2-63RE	TP-1-2-63DL	TP-1-2-63	TP-1-2-63RE	TP-1-2-63DL	TP-1-2-63	TP-1-2-63RE	TP-1-2-63DL	TP-1-2-63	TP-1-2-63RE	TP-1-2-63DL
SEMI-VOLATILE ORGANICS (SOW 3190) (Continued)															
2-Chloronaphthalene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
2-Nitroaniline	19000 U	NA	NA	19000 U	NA	NA	19000 U	NA	NA	19000 U	NA	NA	19000 U	NA	NA
Dimethyl phthalate	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Acenaphthylene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
2,6-Dinitrotoluene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
3-Nitroaniline	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA
Acenaphthene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
2,4-Dinitrophenol	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA
4-Nitrophenol	18000 U (CCV)	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA
Dibenzofuran	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
2,4-Dinitrotoluene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Dichlorophthalate	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
4-Chlorophenyl-phenyl ether	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Fluorene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
4-Nitroaniline	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA
4,6-Dinitro-2-methylphenol	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
N-Nitrosodiphenylamine (1)	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA
4-Bromophenyl phenyl ether	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Hexachlorobenzene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Pentachlorophenol	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA	18000 U	NA	NA
Phenanthrene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Anthracene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Carbazole	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
di-N-Butyl phthalate	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Fluoranthene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Pyrene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Butylbenzylphthalate	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
3,3'-Dichlorobenzidine	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Benzoxanthracene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Chrysene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
bis(2-Ethylhexyl)phthalate	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
di-N-Octyl phthalate	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Benzofluoranthene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Benzofluoranthene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Benzofluoranthene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Benzofluoranthene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Indeno(1,2,3-cd)pyrene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Dibenz(a,h)anthracene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
Benzofluoranthene	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA	7500 U	NA	NA
TIC ₃	711700 (20)	NA	NA	711700 (20)	NA	NA	711700 (20)	NA	NA	711700 (20)	NA	NA	711700 (20)	NA	NA
PESTICIDE ORGANICS (SW 3550/0060)															
Heptachlor epoxide	14 X(CV)	NA	NA	14 X(CV)	NA	NA	14 X(CV)	NA	NA	14 X(CV)	NA	NA	14 X(CV)	NA	NA
Endosulfan I	16 X(CV)	NA	NA	16 X(CV)	NA	NA	16 X(CV)	NA	NA	16 X(CV)	NA	NA	16 X(CV)	NA	NA
Dieldrin	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA
Endrin	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA
Endosulfan II	18 X(CV)	NA	NA	18 X(CV)	NA	NA	18 X(CV)	NA	NA	18 X(CV)	NA	NA	18 X(CV)	NA	NA
4,4'-DDD	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA
4,4'-DDT	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA
Methoxychlor	190 U	NA	NA	190 U	NA	NA	190 U	NA	NA	190 U	NA	NA	190 U	NA	NA
Endrin aldehyde	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA	37 U	NA	NA
DIOXINS/FURANS (SW 8290)															
1234678-HpCDF	7.06	NA	NA	7.06	NA	NA	7.06	NA	NA	7.06	NA	NA	7.06	NA	NA
1234789-HpCDD	28.56 J	NA	NA	28.56 J	NA	NA	28.56 J	NA	NA	28.56 J	NA	NA	28.56 J	NA	NA
OCDD	415.88 X(AR)	NA	NA	415.88 X(AR)	NA	NA	415.88 X(AR)	NA	NA	415.88 X(AR)	NA	NA	415.88 X(AR)	NA	NA
OCDF	24.77 X(NCC)	NA	NA	24.77 X(NCC)	NA	NA	24.77 X(NCC)	NA	NA	24.77 X(NCC)	NA	NA	24.77 X(NCC)	NA	NA

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

SAC ID Number Laboratory ID Number Collection Date Collection Depth (ft) Associated Field QC Sample	TP-1-1-3-10		TP-1-1-4-03		TP-1-1-4-05RE		TP-1-1-4-06		TP-1-1-5-03	
	96876	96877	96878	96879	96877RE	96878	96879	96880	96881	96882
	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92
	4	4	0.5	0.5	0.5	4	4	4	0.5	0.5
	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1
	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2
	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2
	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3
Unit										
TOTAL PETROLEUM HYDROCARBONS (SW 3550/B 418.1)										
Total Petroleum Hydrocarbons	mg/kg	560	21700 NU	20500	95	1020				
ICP METALS (SW 3650/B 6010)										
Beryllium	mg/kg	0.49	0.30 B	NA	NA	0.55	0.35 B			
Cadmium	mg/kg	0.18 B	0.21 U	NA	NA	0.20 U	0.19 U			
Chromium	mg/kg	10.9 X(N)	10.8 X(N)	NA	NA	10.5 X(N)	7.9 X(N)			
Copper	mg/kg	13.3 X(N)	11.8 X(N)	NA	NA	14.0 X(N)	5.8 X(N)			
Nickel	mg/kg	9.6	5.0	NA	NA	10.2	5.6			
Silver	mg/kg	0.68 U(MB)	0.38 U(MB)	NA	NA	0.41 U(MB)	0.35 U			
AA METALS										
Antimony (SW 3050/7041)	mg/kg	0.29 R(N)	0.19 R(N)	NA	NA	0.24 R(N)	0.11 R(N)			
Arsenic (SW 3050/7040)	mg/kg	2 U(FB)	3.3 U(FB)	NA	NA	2 U(FB)	3 U(FB)			
Lead (SW 3050/7421)	mg/kg	13	155	NA	NA	10.1	8.5			
Selenium (SW 3050/7740)	mg/kg	0.17 R(N)	0.14 R(N)	NA	NA	0.14 R(N)	0.13 R(N)			
Thallium (SW 3050/7841)	mg/kg	0.17 U(X,N,W)	0.14 U(X,N,W)	NA	NA	0.17 X(N)	0.2 X(N)			
VOLATILES ORGANICS (SW 3390)										
Acetone	µg/kg	180 (B,FB)	5100 U	NA	NA	910	10 U			
1,2-Dichloroethene (total)	µg/kg	220 (X)	5100 U	NA	NA	18 X(X)	10 U			
2-Butanone	µg/kg	77	5100 U(MB)	NA	NA	360	10 U			
Trichloroethene	µg/kg	12 U	5100 U	NA	NA	62 U	10 U			
Benzene	µg/kg	51	900 J	NA	NA	11 J	10 U			
4-Methyl-2-pentanone	µg/kg	12 U	10000	NA	NA	62 U	10 U			
2-Hexanone	µg/kg	58	5100 U	NA	NA	77	10 U			
Toluene	µg/kg	190	26000	NA	NA	230	10 U			
Chlorobenzene	µg/kg	12 U	5100 U	NA	NA	14 J	10 U			
Ethylbenzene	µg/kg	130	8400	NA	NA	130	10 U			
Xylene (total)	µg/kg	670 (X)	72000 (X)	NA	NA	1300 (E,X)	10 U			
TICs	µg/kg	4626 (12)	575000 (11)	NA	NA	6060 (12)	0 (0)			
SEMI-VOLATILES ORGANICS (SW 3390)										
Phenol	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
bis(2-Chloroethyl)ether	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2-Chlorophenol	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
1,3-Dichlorobenzene	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
1,4-Dichlorobenzene	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
1,2-Dichlorobenzene	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2-Methylphenol	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2,2-dimethyl-1-chloropropane	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
4-Methylphenol	µg/kg	95 J	2400 (SR)	NA	NA	410 U	330 U			
N-Nitroso-di-N-propylamine	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
Hexachlorobenzene	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
Nitrobenzene	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
Isophorone	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2-Nitrophenol	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2,4-Dimethylphenol	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
bis(2-Chloroethyl)ether	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2,4-Dichlorophenol	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
1,2,4-Trichlorobenzene	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
Naphthalene	µg/kg	270 J	5500 (SR)	NA	NA	410 U	330 U			
4-Chloroaniline	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
Hexachlorobutadiene	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
4-Chloro-3-methylphenol	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2-Methylnaphthalene	µg/kg	510	12000 (SR)	NA	NA	410 U	330 U			
Hexachlorocyclopentadiene	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2,4,6-Trichlorophenol	µg/kg	390 U	6900 R(SR)	NA	NA	410 U	330 U			
2,4,5-Trichlorophenol	µg/kg	950 U	17000 R(SR)	NA	NA	980 U	610 U			

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

SAIC ID Number Laboratory ID Number Collection Date Collection Depth (ft) Associated Field QC Sample	TP-1-1-3-4.0		TP-1-1-4-0.5		TP-1-1-4-0.5RE		TP-1-1-4-4.0		TP-1-1-5-4.5	
	94876	94877	94877	94877	94877RE	94877	94878	94878	94885	94885
	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92
	4	0.5	0.5	0.5	0.5	0.5	4	4	0.5	0.5
	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1	TB-1
	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2
	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2	FB-2
	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3
Units										
SEMI-VOLATILE ORGANICS (SOW 3/90) (Continued)										
2-Chloronaphthalene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
2-Nitroanthracene	µg/g	950 U	17000 R(SR)	NA	NA	NA	980 U	980 U	810 U	810 U
Diethyl phthalate	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Acenaphthylene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
2,6-Dinitrofluorene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
3-Nitroanthracene	µg/g	950 U	17000 R(SR)	NA	NA	NA	980 U	980 U	810 U	810 U
Acenaphthene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
2,4-Dinitrophenol	µg/g	950 U	17000 R(SR)	NA	NA	NA	980 U	980 U	810 U	810 U
4-Nitrophenol	µg/g	950 U	17000 R(SR)	NA	NA	NA	980 U	980 U	810 U	810 U
Dibenzofuran	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
2,4-Dinitrofluorene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Diethyl phthalate	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
4-Chlorophenyl-phenyl ether	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Fluorene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
4-Nitroanthracene	µg/g	950 U	17000 R(SR)	NA	NA	NA	980 U	980 U	810 U	810 U
4,6-Dinitro-2-methylphenol	µg/g	950 U	17000 R(SR)	NA	NA	NA	980 U	980 U	810 U	810 U
N-Nitrosodiphenylamine (1)	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
4-Bromophenyl phenyl ether	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Hexachlorobenzene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Pentachlorobenzene	µg/g	950 U	17000 R(SR)	NA	NA	NA	980 U	980 U	810 U	810 U
Phenanthrene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Anthracene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Carbazole	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
di-N-Butyl phthalate	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Fluoranthene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Pyrene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Butylbenzylphthalate	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
3,3'-Dichlorobenzidine	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Benzoxanthracene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Chrysene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
2,2'-Bis(4-ethylphenyl)phthalate	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
di-N-Octyl phthalate	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Benzoxanthracene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Benzoxanthracene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Indeno(1,2,3-c,d)pyrene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Dibenz(a,h)anthracene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
Benz(a,g,h)perylene	µg/g	390 U	6900 R(SR)	NA	NA	NA	410 U	410 U	330 U	330 U
TiCs	µg/g	46480 (21)	1396000 (20)	NA	NA	NA	35440 (21)	35440 (21)	16680 (21)	16680 (21)
PESTICIDE ORGANICS (SW 355/8000)										
Heptachlor epoxide	µg/g	20 U	2.8 J(CV)	NA	NA	NA	21 U	21 U	NA	NA
Endosulfan I	µg/g	20 U	18 U	NA	NA	NA	21 U	21 U	NA	NA
Dieldrin	µg/g	40 U	36 U	NA	NA	NA	41 U	41 U	NA	NA
Endosulfan II	µg/g	40 U	36 U	NA	NA	NA	41 U	41 U	NA	NA
4,4'-DDD	µg/g	40 U	36 U	NA	NA	NA	41 U	41 U	NA	NA
4,4'-DDT	µg/g	40 U	36 U	NA	NA	NA	41 U	41 U	NA	NA
Methoxychlor	µg/g	200 U	180 U	NA	NA	NA	210 U	210 U	NA	NA
Endrin aldehyde	µg/g	40 U	36 U	NA	NA	NA	41 U	41 U	NA	NA
DIOXINS/FURANS (SW 8290)										
1234678-HpCDF	ng/g	0.67 U	4.11 U	NA	NA	NA	0.87 U	0.87 U	NA	NA
1234789-HpCDD	ng/g	0.98 U	6.95 U	NA	NA	NA	1.23 U	1.23 U	NA	NA
OCDD	ng/g	12.54 J	105.84 J	NA	NA	NA	1.33 U	1.33 U	NA	NA
OCDF	ng/g	0.90 U	10.18 U	NA	NA	NA	1.27 U	1.27 U	NA	NA

Table 3-5. Data Summary Table: Soil (1972) -- Site 1 -- Current Fire Training Area, Idaho Air National Guard 124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

SATC ID Number	Laboratory ID Number	Collection Date	Collection Depth (ft)	Associated Field OC Sample	Units	TP-1-6-83	TP-1-6-83RE	TP-1-6-40RE
						94883	94883RE	94884RE
						09/22/92	09/22/92	09/22/92
						0.5	0.5	4
						TB-1	TB-1	TB-1
						EB-1,EB-2	EB-1,EB-2	EB-1,EB-2
						PB-2	PB-2	PB-2
						PB-1,PB-3	PB-1,PB-3	PB-1,PB-3
TOTAL PETROLEUM HYDROCARBONS (SW 3550/B 418.1)								
Total Petroleum Hydrocarbons					mg/kg	7810 NU	15300	710
ICP METALS (SW 3050/6010)								
Beryllium					mg/kg			
Cadmium					mg/kg	0.27 B	NA	0.27 B
Chromium					mg/kg	0.20 U	NA	0.19 U
Copper					mg/kg	11.7 X(N)	NA	7.7 X(N)
Nickel					mg/kg	23.6 X(N)	NA	7.9 X(N)
Silver					mg/kg	8.2	NA	6.4
						0.36 U	NA	0.35 U
AA METALS								
Antimony (SW 3050/7041)					mg/kg		NA	0.16 R(N)
Arsenic (SW 3050/7060)					mg/kg	1.7 U(X,W)	NA	5.1 U(FB)
Lead (SW 3050/7421)					mg/kg	143	NA	12
Selenium (SW 3050/7740)					mg/kg	0.14 R(N)	NA	0.13 R(N)
Thallium (SW 3050/7841)					mg/kg	0.24 X(N)	NA	0.13 X(N,W)
VOLATILE ORGANICS (SOW 3/90)								
Acetone					µg/kg	12 U	NA	1300 U
1,2-Dichloroethane (total)					µg/kg	12 U	NA	1300 U
2-Butanone					µg/kg	12 U	NA	1300 U(FB)
Trichloroethene					µg/kg	12 U	NA	1300 U
Benzene					µg/kg	12 U	NA	330 J
4-Methyl-2-pentanone					µg/kg	12 U	NA	1300 U
2-Hexanone					µg/kg	12 U	NA	1300 U
Toluene					µg/kg	12 U	NA	1300 U
Chlorobenzene					µg/kg	12 U	NA	1300 U
Ethylbenzene					µg/kg	12 U	NA	1300 U
Xylene (total)					µg/kg	12 U	NA	200 J
TICS					µg/kg	3500 (X)	NA	3600 (X)
						189500 (11)	NA	49400 (11)
SEMI-VOLATILE ORGANICS (SOW 3/90)								
Phenyl					µg/kg	390 U	NA	1100 U
2-Chloroethyl ether					µg/kg	390 U	NA	1100 U
2-Chlorophenol					µg/kg	390 U	NA	1200 U
1,3-Dichlorobenzene					µg/kg	390 U	NA	1200 U
1,4-Dichlorobenzene					µg/kg	390 U	NA	1200 U
1,2-Dichlorobenzene					µg/kg	390 U	NA	1200 U
2-Methylphenol					µg/kg	390 U	NA	1200 U
2,2-dimethyl-1-chloropropane					µg/kg	390 U(CCV)	NA	1200 U
4-Methylphenol					µg/kg	390 U	NA	1200 U(CCV)
N-Nitroso-di-N-propylamine					µg/kg	390 U	NA	1200 U
Hexachlorobenzene					µg/kg	390 U	NA	1200 U
Nitrobenzene					µg/kg	390 U	NA	1200 U
Isophorone					µg/kg	390 U	NA	1200 U
2-Nitrophenol					µg/kg	390 U	NA	1200 U
2,4-Dimethylphenol					µg/kg	390 U	NA	1200 U
2,4-Dichlorophenol					µg/kg	390 U	NA	1200 U
1,2,4-Trichlorobenzene					µg/kg	390 U	NA	1200 U
Naphthalene					µg/kg	86 J	NA	1200 U
4-Chloroaniline					µg/kg	390 U	NA	1200 U
Hexachlorobutadiene					µg/kg	390 U	NA	1200 U
4-Chloro-3-methylphenol					µg/kg	390 U	NA	1200 U
2-Methylnaphthalene					µg/kg	180 J	NA	1200 U
Hexachlorocyclopentadiene					µg/kg	390 U	NA	1200 U
2,4,6-Trichlorophenol					µg/kg	390 U	NA	1200 U
2,4,5-Trichlorophenol					µg/kg	950 U	NA	2600 U

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowca Field, Boise, Idaho (Continued)

SAC ID Number	TP-1-5-4.0	TP-1-6-0.5	TP-1-6-0.5RE	TP-1-6-4.0	TP-1-6-4.0RE
Laboratory ID Number	96866	96883	9683RE	96804	9684RE
Collection Date	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92
Collection Depth (ft)	4	0.5	0.5	4	4
Associated Field QC Sample	TB-1 EB-1,EB-2 FB-2 FB-1,FB-3	TB-1 EB-1,EB-2 FB-2 FB-1,FB-3	TB-1 EB-1,EB-2 FB-2 FB-1,FB-3	TB-1 EB-1,EB-2 FB-2 FB-1,FB-3	TB-1 EB-1,EB-2 FB-2 FB-1,FB-3
Units	Units	Units	Units	Units	Units
SEMIVOLATILE ORGANICS (SO W 3/90) (Continued)					
2-Chloronaphthalene	390 U	1400 R(SR)	NA	1100 U	1200 U
2-Nitroaniline	950 U	3500 R(SR)	NA	2600 U	2800 U
Dimethyl phthalate	390 U	1400 R(SR)	NA	1100 U	1200 U
Acenaphthylene	390 U	1400 R(SR)	NA	1100 U	1200 U
2,6-Dinitrotoluene	390 U	1400 R(SR)	NA	1100 U	1200 U
3-Nitroaniline	950 U	3500 R(SR)	NA	2600 U	2800 U
Acenaphthene	390 U	1400 R(SR)	NA	1100 U	1200 U
2,4-Dinitrophenol	950 U	3500 U	NA	2600 U(XCCV)	2800 U
4-Nitrophenol	950 U	3500 U	NA	1100 U	1200 U
Dibenzofuran	390 U	1400 R(SR)	NA	1100 U	1200 U
2,4-Dinitrotoluene	390 U	1400 R(SR)	NA	1100 U	1200 U
Diethyl phthalate	390 U	1400 R(SR)	NA	1100 U	1200 U
4-Chlorophenyl-phenyl ether	390 U	1400 R(SR)	NA	1100 U	1200 U
Fluorene	390 U	1400 R(SR)	NA	1100 U	1200 U
4-Nitroaniline	950 U	3500 R(SR)	NA	2600 U	2800 U
4,6-Dinitro-2-methylphenol	950 U	3500 U	NA	2600 U	2800 U
N-Nitrosodiphenylamine (1)	390 U	1400 R(SR)	NA	1100 U	1200 U
4-Bromophenyl phenyl ether	390 U	1400 R(SR)	NA	1100 U	1200 U
Hexachlorobenzene	390 U	1400 R(SR)	NA	1100 U	1200 U
Pentachlorophenol	950 U	3500 U	NA	2600 U	2800 U
Phenanthrene	390 U	1400 R(SR)	NA	1100 U	1200 U
Anthracene	390 U	1400 R(SR)	NA	1100 U	1200 U
Carbazole	390 U	1400 R(SR)	NA	1100 U	1200 U
di-N-Butyl phthalate	390 U	1400 R(SR)	NA	1100 U	1200 U
Fluoranthene	390 U	1400 R(SR)	NA	1100 U	1200 U
Pyrene	390 U	1400 R(SR)	NA	1100 U(XIS)	1200 U
Buylbenzylphthalate	390 U	1400 R(SR)	NA	1100 U(XIS)	1200 U
3,3'-Dichlorobenzidine	390 U	1400 R(SR)	NA	1100 U(XIS)	1200 U
Benz(a)anthracene	390 U	1400 R(SR)	NA	1100 U(XIS)	1200 U
Chrysene	390 U	1400 R(SR)	NA	1100 U(XIS)	1200 U
bis(2-Ethylbenzyl)phthalate	390 U	1400 R(SR)	NA	1100 U(XIS)	150 (B)
di-N-Octyl phthalate	390 U	1400 R(SR)	NA	1100 U	1200 U
Benz(b)fluoranthene	390 U	1400 R(SR)	NA	1100 U	1200 U
Benz(a)fluoranthene	390 U	1400 R(SR)	NA	1100 U	1200 U
Benz(a)pyrene	390 U	1400 R(SR)	NA	1100 U	1200 U
Indeno(1,2,3-c,d)pyrene	390 U	1400 R(SR)	NA	1100 U	1200 U
Dibenz(a,h)anthracene	390 U	1400 R(SR)	NA	1100 U	1200 U
Benz(a,h)perylene	390 U	1400 R(SR)	NA	1100 U	1200 U
TICs	61940 (21)	218500 (20)	NA	43270 (21)	43870 (21)
PESTICIDE ORGANICS (SW 3/50/6000)					
Heptachlor epoxide	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA
4,4'-DDD	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA
DIOXINS/FURANS (SW 82/90)					
1234678-HpCDF	NA	NA	NA	NA	NA
1234789-HpCDD	NA	NA	NA	NA	NA
OCDD	NA	NA	NA	NA	NA
OCDF	NA	NA	NA	NA	NA

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard 124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

SLC ID Number	TP-1-7-03	TP-1-7-05	TP-1-7-06	TP-1-8-03	TP-1-8-05	TP-1-8-06
Laboratory ID Number	94881	94882	94882	94879	94879	94879
Collection Date	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92
Collection Depth (ft)	0.5	4	4	0.5	0.5	0.5
Associated Field QC Sample	TB-1 EB-1,EB-2 FB-2 FB-1,EB-3	TB-1 EB-1,EB-2 FB-2 FB-1,EB-3	TB-1 EB-1,EB-2 FB-2 FB-1,EB-3	TB-1 EB-1,EB-2 FB-2 FB-1,EB-3	TB-1 EB-1,EB-2 FB-2 FB-1,EB-3	TB-1 EB-1,EB-2 FB-2 FB-1,EB-3
Units	Units	Units	Units	Units	Units	Units
SEMIVOLATILE ORGANICS (SO W 3/90) (Continued)						
2-Chloronaphthalene	350 U	370 U	370 U	340 U	340 U	340 U
2-Nitroaniline	840 U	910 U	910 U	820 U	820 U	820 U
Dimethyl phthalate	350 U	370 U	370 U	340 U	340 U	340 U
Acenaphthylene	350 U	370 U	370 U	340 U	340 U	340 U
2,6-Dinitrotoluene	350 U	370 U	370 U	340 U	340 U	340 U
3-Nitroaniline	840 U	910 U	910 U	820 U	820 U	820 U
Acenaphthene	350 U	370 U	370 U	340 U	340 U	340 U
2,4-Dinitrophenol	840 U	910 U	910 U	820 U	820 U	820 U
4-Nitrophenol	840 U	910 U	910 U	820 U	820 U	820 U
Dibenzofuran	350 U	370 U	370 U	340 U	340 U	340 U
2,4-Dinitrotoluene	350 U	370 U	370 U	340 U	340 U	340 U
Diethylphthalate	350 U	370 U	370 U	340 U	340 U	340 U
4-Chlorophenyl - phenyl ether	350 U	370 U	370 U	340 U	340 U	340 U
Fluorene	350 U	370 U	370 U	340 U	340 U	340 U
4-Nitroaniline	840 U	910 U	910 U	820 U	820 U	820 U
4,6-Dinitro-2-acetylphenol	350 U	370 U	370 U	340 U	340 U	340 U
N-Nitrosodiphenylamine (1)	350 U	370 U	370 U	340 U	340 U	340 U
4-Bromophenyl phenyl ether	350 U	370 U	370 U	340 U	340 U	340 U
Hexachlorobenzene	840 U	910 U	910 U	820 U	820 U	820 U
Pentachlorophenol	350 U	370 U	370 U	340 U	340 U	340 U
Phenanthrene	350 U	370 U	370 U	340 U	340 U	340 U
Anthracene	350 U	370 U	370 U	340 U	340 U	340 U
Carbazole	350 U	370 U	370 U	340 U	340 U	340 U
di-N-Butyl phthalate	350 U	370 U	370 U	340 U	340 U	340 U
Fluoranthene	350 U	370 U	370 U	340 U	340 U	340 U
Pyrene	350 U	370 U	370 U	340 U	340 U	340 U
Butylbenzylphthalate	350 U	370 U	370 U	340 U	340 U	340 U
3,3'-Dichlorobenzidine	350 U	370 U	370 U	340 U	340 U	340 U
Benzo(a)anthracene	350 U	370 U	370 U	340 U	340 U	340 U
Chrysene	350 U	370 U	370 U	340 U	340 U	340 U
bi(2-Ethylhexyl)phthalate	350 U	370 U	370 U	340 U	340 U	340 U
di-N-Octyl phthalate	350 U	370 U	370 U	340 U	340 U	340 U
Benzo(b)fluoranthene	350 U	370 U	370 U	340 U	340 U	340 U
Benzo(k)fluoranthene	350 U	370 U	370 U	340 U	340 U	340 U
Benzo(a)pyrene	350 U	370 U	370 U	340 U	340 U	340 U
Indeno(1,2,3-c-d)pyrene	350 U	370 U	370 U	340 U	340 U	340 U
Dibenz(a,h)anthracene	350 U	370 U	370 U	340 U	340 U	340 U
Benzo(g,h,i)perylene	350 U	370 U	370 U	340 U	340 U	340 U
TICs	11430 (20)	19440 (21)	14950 (20)	46150 (20)	46150 (20)	35120 (20)
PESTICIDE ORGANICS (SW 355/06060)						
Hepachlor epoxide	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA
Dielsdorf	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA
4,4'-DDD	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA
DIOXINS/FURANS (SW 0290)						
1234678-HpCDF	ng/kg	NA	NA	NA	NA	NA
1234789-HpCDD	ng/kg	NA	NA	NA	NA	NA
OCDD	ng/kg	NA	NA	NA	NA	NA
OCDF	ng/kg	NA	NA	NA	NA	NA

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area
Idaho Air National Guard, 12th Tactical Reconnaissance Group
Gowen Field, Boise, Idaho (Continued)

SAIC ID Number	TP-18-70
Laboratory ID Number	96580
Collection Date	09/22/92
Collection Depth (ft)	4
Associated Field QC Sample	TB-1 EB-1, EB-2 FB-2 FB-1, FB-3

Unit	mg/kg	mg/kg
TOTAL PETROLEUM HYDROCARBONS (SW 355@/E 418.1)		1340
Total Petroleum Hydrocarbons		
ICP METALS (SW 305@/6010)		
Beryllium	mg/kg	0.52
Cadmium	mg/kg	0.19 U
Chromium	mg/kg	9.5 X(N)
Copper	mg/kg	12.1 X(N)
Nickel	mg/kg	10.1
Silver	mg/kg	0.61 U(MB)
AA METALS		
Antimony (SW 3050/7041)	mg/kg	0.13 R(N)
Arsenic (SW 3050/7040)	mg/kg	3.7 U(FB)
Lead (SW 3050/7421)	mg/kg	12.6
Selenium (SW 3050/7740)	mg/kg	0.13 R(N)
Thallium (SW 3050/7841)	mg/kg	0.16 X(N)
VOLATILE ORGANICS (SW 3/90)		
Acetone	µg/kg	1400 U
1,2-Dichloroethene (total)	µg/kg	1400 U
2-Butanone	µg/kg	1400 U(MB)
Trichloroethene	µg/kg	1400 U
Benzene	µg/kg	770 J
4-Methyl-2-pentanone	µg/kg	1400 U
2-Hexanone	µg/kg	1400 U
Toluene	µg/kg	11000
Chlorobenzene	µg/kg	1400 U
Ethylbenzene	µg/kg	2400
Xylene (total)	µg/kg	36000 (X)
TICs	µg/kg	144900 (11)
SEMI-VOLATILE ORGANICS (SW 3/90)		
Phenol	µg/kg	770 U
bis(2-Chloroethyl)ether	µg/kg	770 U
2-Chlorophenol	µg/kg	770 U
1,3-Dichlorobenzene	µg/kg	770 U
1,4-Dichlorobenzene	µg/kg	770 U
1,2-Dichlorobenzene	µg/kg	770 U
2-Methylphenol	µg/kg	770 U
2,2-dimethyl-1-chloropropane	µg/kg	770 U(CCV)
4-Methylphenol	µg/kg	770 U
N-Nitroso-di-N-propylamine	µg/kg	770 U
Hexachloroethane	µg/kg	770 U
Nitrobenzene	µg/kg	770 U
Isophorone	µg/kg	770 U
2-Nitrophenol	µg/kg	770 U
2,4-Dimethylphenol	µg/kg	770 U
bis(2-Chloroethoxy)methane	µg/kg	770 U
2,4-Dichlorophenol	µg/kg	770 U
1,2,4-Trichlorobenzene	µg/kg	770 U
Naphthalene	µg/kg	770 U
4-Chloroaniline	µg/kg	770 U
Hexachlorobutadiene	µg/kg	770 U
4-Chloro-3-methylphenol	µg/kg	190 J
2-Methylnaphthalene	µg/kg	770 U
Hexachlorocyclopentadiene	µg/kg	770 U
2,4,6-Trichlorophenol	µg/kg	770 U
2,4,5-Trichlorophenol	µg/kg	1900 U

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area
Idaho Air National Guard, 124th Tactical Reconnaissance Group
Gowen Field, Boise, Idaho (Continued)

SAIC ID Number		TP-1-8-70
Laboratory ID Number	56880	
Collection Date	09/22/92	
Collection Depth (ft)	4	
Associated Field QC Sample	TB-1	
	EB-1, EB-2	
	FB-2	
	FB-1, FB-3	
Units		
SEMIVOLATILE ORGANICS (SW 3/90) (Continued)		
2-Chloronaphthalene	µg/kg	770 U
2-Nitroaniline	µg/kg	1900 U
Dimethyl phthalate	µg/kg	770 U
Acenaphthylene	µg/kg	770 U
2,6-Dinitrotoluene	µg/kg	770 U
3-Nitroaniline	µg/kg	1900 U
Acenaphthene	µg/kg	770 U
2,4-Dinitrophenol	µg/kg	1900 U
4-Nitrophenol	µg/kg	1900 U (CCV)
Dibenzofuran	µg/kg	770 U
2,4-Dinitrotoluene	µg/kg	770 U
Diethylphthalate	µg/kg	770 U
4-Chlorophenyl-phenyl ether	µg/kg	770 U
Fluorene	µg/kg	92 J
4-Nitroaniline	µg/kg	1900 U
4,6-Dinitro-2-methylphenol	µg/kg	1900 U
N-Nitrosodiphenylamine (1)	µg/kg	770 U
4-Bromophenyl phenyl ether	µg/kg	770 U
Hexachlorobenzene	µg/kg	770 U
Pentachlorophenol	µg/kg	1900 U
Phenanthrene	µg/kg	110 J
Anthracene	µg/kg	770 U
Carbazole	µg/kg	770 U
di-N-Butyl phthalate	µg/kg	770 U
Fluoranthene	µg/kg	770 U
Pyrene	µg/kg	770 U
Butylbenzylphthalate	µg/kg	770 U
3,3'-Dichlorobenzidine	µg/kg	770 U
Benzo(a)anthracene	µg/kg	770 U
Chrysene	µg/kg	770 U
bis(2-Ethylhexyl)phthalate	µg/kg	770 U
di-N-Octyl phthalate	µg/kg	770 U
Benzo(b)fluoranthene	µg/kg	770 U
Benzo(k)fluoranthene	µg/kg	770 U
Benzo(e)pyrene	µg/kg	770 U
Indeno(1,2,3-c,d)pyrene	µg/kg	770 U
Dibenzo(a,b)anthracene	µg/kg	770 U
Benzo(g,h,i)perylene	µg/kg	770 U
TICs	µg/kg	172400 (21)
PESTICIDES ORGANICS (SW 3/90/0000)		
Heptachlor epoxide	µg/kg	NA
Endosulfan I	µg/kg	NA
Dieldrin	µg/kg	NA
endrin	µg/kg	NA
Endosulfan II	µg/kg	NA
4,4'-DDD	µg/kg	NA
4,4'-DDT	µg/kg	NA
Methoxychlor	µg/kg	NA
Endrin aldehyde	µg/kg	NA
DIOXINS/FURANS (SW 8290)		
1234678-HpCDF	ng/kg	NA
1234789-HpCDD	ng/kg	NA
OCDD	ng/kg	NA
OCDF	ng/kg	NA

Table 3-5. Data Summary Table: Soil (1992) - Site 1 - Current Fire Training Area, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho (Continued)

Validation note: All descriptive qualifiers applied to the reported values by the laboratory are reported in parentheses. Each data point has been assessed to determine whether the value is considered usable (i.e., no qualifier), usable but estimated (i.e., "J", or not usable (i.e., "R"). All usability qualifiers are followed by the applicable laboratory or field QC qualifier, presented in parentheses and defined above. Usability qualifiers were not applied to values qualified by the laboratory, but were not considered to have been adversely impacted by the applicable laboratory QC result (e.g., duplicated and matrix spike analysis).

DL - dilution

NA - not analyzed

RE - reanalysis

TICs - tentatively identified compounds, total concentration is listed and the total number of tentatively identified compounds is inside the parentheses

Data Validation Qualifiers

J - associated numerical value is the approximate concentration

R - rejected value

U - compound/element was included in analysis, but was not detected

UJ - reported quantitation limit is approximate and may or may not represent the actual quantitation necessary to accurately and precisely measure the analyte

Explanatory Data Validation Qualifiers

BRK - end/in/DDT breakdown

CCV - continuing calibration verification

D - the identified compound was analyzed at a secondary dilution factor after exceeding the calibration range of the instrument on the first analysis

FB - compound/element was also detected in the associated field blank

FD - field duplicate relative percent differences (RPDs) outside control limits

IAR - ion abundance ratio outside the specified control limits

ICV - Initial Calibration Verification

IS - internal standard outside control limits

MB - compound/element was also detected in the associated laboratory method blank

NCC - Continuing calibration is outside the control limits for unlabelled congeners

NU - not useable - these samples were rerun because initial dilution factors were suspect. The value reported as a rerun is more representative of the sample

SR - surrogate recovery outside control limits

BPA-defined CLP SO₂ Laboratory Qualifiers

B(metals) - the reported value is estimated because it is greater than the Instrument Detection Limit (IDL), but less than the Contract Required Detection Limit (CRDL)

B(organoics) - compound was also detected in the associated laboratory method blank

E(organoics) - concentration exceeds the calibration range of the instrument; the sample must be diluted and reanalyzed

N - spiked sample recovery outside of control limits

P - there is greater than 25% difference for detected concentrations between the two GC columns. The lower of the two values is reported

W - post-digestion spike for Graphite Furnace Atomic Absorption (GFAA) analysis is out of control limits (85-115%), while sample absorbance is less than 50% of the spike absorbance

X - compound is present, but does not meet CLP criteria

3.4.1 Fire Training Pit Area Soil Sampling Results

Inorganic and organic contaminants were detected in soil samples at the current fire training area to a depth of 4.0 feet BLS (Table 3-5; pages 3-23 to 3-37). Metals concentrations consisted of arsenic (4.8 mg/kg), beryllium (0.3 to 0.64 mg/kg), cadmium (0.18 to 0.79 mg/kg), chromium (9.7 to 14.7 mg/kg), copper (11.8 to 45.7 mg/kg), nickel (5.0 to 14.0 mg/kg), lead (13.0 to 155.0 mg/kg), and thallium (0.15 to 0.18 mg/kg). Concentrations of arsenic, beryllium, chromium, nickel, and thallium were comparable to the values detected in background samples for IANG, Gowen Field. Cadmium, copper, and lead concentrations exceeded the ranges observed in the background samples. The metals concentrations generally decreased with sample depth.

TPH concentrations were detected in all of the collected soil samples at the Fire Training Pit Area and ranged between 95 and 29,800 mg/kg. The concentrations generally exceeded the range of values detected in the background samples (< 10 to 44 mg/kg) and showed a decrease in concentration with sample depth. VOCs detected in the soil samples included 1,2-dichloroethene (18 to 1300 $\mu\text{g/kg}$), 2-butanone (77 to 610 $\mu\text{g/kg}$), trichloroethene (26 to 87 $\mu\text{g/kg}$), benzene (11 to 810 $\mu\text{g/kg}$), 4-methyl-2-pentanone (140 to 700 $\mu\text{g/kg}$), 2-hexanone (58 to 600 $\mu\text{g/kg}$), toluene (46 to 13,000 $\mu\text{g/kg}$), chlorobenzene (14 to 17 $\mu\text{g/kg}$), ethylbenzene (39 to 1,300 $\mu\text{g/kg}$), and xylenes (330 to 26,000 $\mu\text{g/kg}$). VOCs were not detected in the background samples.

SVOC detected in the Fire Training Pit Area soil samples included 4-methylphenol (95 to 2,400 $\mu\text{g/kg}$), bis-2-ethylhexyl phthalate (1,200 to 2,200 $\mu\text{g/kg}$), 1,2-dichlorobenzene (8 to 18,000 $\mu\text{g/kg}$), 1,3-dichlorobenzene (30 to 610 $\mu\text{g/kg}$), 1,4 dichlorobenzene (860 to 4,700 $\mu\text{g/kg}$), 2-methyl-naphthalene (510 to 12,000 $\mu\text{g/kg}$), 4-chloroaniline (1,300 $\mu\text{g/kg}$), naphthalene (270 to 5,500 $\mu\text{g/kg}$), and 2,4-dinitrotoluene (1,400 $\mu\text{g/kg}$). SVOCs were not detected in the background samples, with the exception of 120 $\mu\text{g/kg}$ of bis-2-ethylhexylphthalate in BG-4-4.0. SVOC concentrations in the soil are irregularly distributed, but generally show decreasing concentrations with sample depth. Samples 1-1-4.0 and 1-2-4.0 showed higher concentrations in the deeper samples, indicating that the maximum extent of SVOC contamination was not attained at these locations.

Pesticide compounds were detected primarily in surface samples at the Fire Training Pit Area and included heptachlor epoxide (2.8 to 12 $\mu\text{g/kg}$), endrin (12 to 30 $\mu\text{g/kg}$), endrin aldehyde (5.5 $\mu\text{g/kg}$), dieldrin (2.8 $\mu\text{g/kg}$), 4,4'-DDT (3.6 to 26 $\mu\text{g/kg}$), 4'-DDD (17 $\mu\text{g/kg}$), Endosulfan I (7.8 to 16 $\mu\text{g/kg}$), and Endosulfan II (18 $\mu\text{g/kg}$). Pesticide concentrations were detected in the deeper samples at locations TP-1-1 and TP-1-2. Detected pesticide concentrations exceeded the levels observed in the background samples. Polycyclic aromatic hydrocarbon (PAH) compounds were similarly detected primarily in the surface samples at the Fire Training Pit Area with concentrations ranging from 750 to 3,500 $\mu\text{g/kg}$. Individual PAH compounds detected in the samples included pyrene (750 to 810 $\mu\text{g/kg}$), fluorene (1,100 $\mu\text{g/kg}$), phenanthrene (1,400 to 3,500 $\mu\text{g/kg}$), fluoranthene (1,100 $\mu\text{g/kg}$), and anthracene (3,700 $\mu\text{g/kg}$). Elevated PAH concentrations were detected in the deeper samples at location TP-1-1. PAH compounds were not detected in the background samples.

Dioxin compounds, including HpCDF (7.05 to 13.19 ng/kg), HpCDD (14.74 to 40.18 ng/kg), OCDD (12.54 to 438.18 ng/kg), and OCDF (13.66 to 24.77 ng/kg), were detected in the Fire Training Pit Area soils in concentrations generally exceeding background levels. The dioxin concentrations showed lower concentrations in the deeper samples.

3.4.2 UST Area Soil Sampling Results

Metals concentrations in the soils at the UST Area (Table 3-5; pages 3-23 to 3-37) ranged between 0.13 mg/kg and 29.9 mg/kg. These values are comparable to the concentrations detected in the background samples. Detected individual metals included beryllium, cadmium, chromium, copper, nickel, silver, lead, and thallium.

TPH concentrations were detected in all of the collected soil samples at the UST Area and ranged between 270 and 15,300 mg/kg. The TPH concentrations generally exceeded the range of values detected in the background samples (<10 to 44 mg/kg) and showed a decrease in concentration with sample depth with the exception of sample locations TP-1-7 and TP-1-8, which showed higher concentrations in the deeper samples. VOCs were detected in the soil samples at locations TP-1-6 and TP-1-8 and included benzene (330 to 770 $\mu\text{g/kg}$), toluene (11,000 $\mu\text{g/kg}$), ethylbenzene (200 to 2,600 $\mu\text{g/kg}$), and xylenes (3,500 to 36,000 $\mu\text{g/kg}$). The

detection of benzene, toluene, ethylbenzene, and xylene (BTEX) compounds at the UST Area is consistent with the spillage or leakage of fuels. VOCs were not detected in the background samples.

SVOCs were detected in soil samples 1-5-4.0, 1-6-4.0, 1-8-0.5, and 1-8-4.0 and included 4-chloro-3-methylphenol (49 to 62 $\mu\text{g/kg}$), penta-chlorophenol (60 $\mu\text{g/kg}$), bis-2-ethylhexylphthalate (71 $\mu\text{g/kg}$), 2-methylnaphthalene (180 to 190 $\mu\text{g/kg}$), and naphthalene (86 $\mu\text{g/kg}$). SVOCs were not detected in the background samples, with the exception of 120 $\mu\text{g/kg}$ of bis-2-ethylhexylphthalate in BG-4-4.0. SVOC concentrations in the soil at the UST Area are irregularly distributed and indicate concentrations elevated above background levels at the 4.0-foot sample depth.

PAH compounds were detected at location TP-1-8 with concentrations ranging from 91 to 190 $\mu\text{g/kg}$. Individual PAH compounds detected in the samples included pyrene (91 $\mu\text{g/kg}$), fluorene (92 $\mu\text{g/kg}$), phenanthrene (110 $\mu\text{g/kg}$), and benzo(g,h,i)perylene (140 $\mu\text{g/kg}$). PAH compounds were not detected in the background samples. Pesticide/PCB and dioxin/furan analyses were not conducted at the UST Area.

3.4.3 Site 1 - Toxicity Characteristic Leaching Procedure (TCLP) Results

Two composite soil samples (TCLP-1 and TCLP-1A) were collected from the bermed soils at Site 1 to determine the disposal fate of these soils. Sample TCLP-1 was collected from the stockpiled drill cuttings generated from monitoring wells MW-1-3 and MW-1-4 and the drummed drill cuttings from soil boring SB-1-20. Sample TCLP-1A was collected from the drill cuttings from soil boring SB-1-15, the bermed soil boring cuttings from previous investigations that are stockpiled on the fire training pit berm, and the drill cuttings that were generated by the drilling of GT-1-1. Both samples were collected at random depths throughout the stockpiled or drummed soils. Samples were collected according to procedures outlined in Section 2.2.3. The results of this analysis are presented in Table 3-6.

The only parameters detected in either TCLP sample collected at Site 1 were barium (0.7 mg/L), and methoxychlor (0.0003 mg/L) both detected in sample TCLP-1A. The

**Table 3-6. Toxicity Characteristic Leaching Procedure Results for Soil Cuttings
Idaho Air National Guard, 124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho**

Parameter	Regulatory Level (mg/L)	TCLP-1 (mg/L)	TCLP-1A (mg/L)	TCLP-2 (mg/L)	TCLP-4 (mg/L)	TCLP-6 (mg/L)
Arsenic	5.0	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	100.0	<0.5	0.7	0.7	1.2	0.8
Benzene	0.5	<0.003	<0.003	<0.003	<0.003	<0.003
Cadmium	1.0	<0.01	<0.01	<0.01	<0.01	<0.01
Carbon Tetrachloride	0.5	<0.006	<0.006	<0.006	<0.006	<0.006
alpha-Chlordane	0.03	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
gamma-Chlordane	0.03	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chlorobenzene	100.0	<0.004	<0.004	<0.004	<0.004	<0.004
Chloroform	6.0	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	5.0	<0.01	<0.01	<0.01	<0.01	<0.01
o-Cresol (a)	200.0	<0.100	<0.100	<0.100	<0.100	<0.100
m-Cresol (a)	200.0	<0.100	<0.100	<0.100	<0.100	<0.100
p-Cresol (a)	200.0	<0.100	<0.100	<0.100	<0.100	<0.100
2,4-D	10.0	<0.010	<0.010	<0.010	<0.010	<0.010
1,4-Dichlorobenzene	7.5	<0.010	<0.010	<0.010	<0.010	<0.010
1,2-Dichloroethane	0.5	<0.010	<0.010	<0.010	<0.010	<0.010
1,1-Dichloroethylene	0.7	<0.010	<0.010	<0.010	<0.010	<0.010
2,4-Dinitrotoluene	0.13	<0.100	<0.100	<0.100	<0.100	<0.100
Endrin	0.02	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Heptachlor	0.008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Heptachlor Epoxide	0.008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Hexachlorobenzene	0.13	<0.100	<0.100	<0.100	<0.100	<0.100
Hexachlorobutadiene	0.5	<0.100	<0.100	<0.100	<0.100	<0.100
Hexachloroethane	3.0	<0.100	<0.100	<0.100	<0.100	<0.100
Lead	5.0	<0.05	<0.05	<0.05	<0.05	<0.05
Lindane	0.4	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Mercury	0.2	<0.001	<0.001	<0.001	<0.001	<0.001
Methoxychlor	10.0	<0.0005	0.0003	<0.0005	<0.0005	<0.0005
Methyl ethyl ketone	200.0	<0.030	<0.030	<0.030	<0.030	<0.030
Nitrobenzene	2.0	<0.100	<0.100	<0.100	<0.100	<0.100
Pentachlorophenol	100.0	<0.250	<0.250	<0.250	<0.250	<0.250
Pyridine	5.0	<0.100	<0.100	<0.100	<0.100	<0.100
Selenium	1.0	<0.2	<0.2	<0.2	<0.2	<0.2
Silver	5.0	<0.01	<0.01	<0.01	<0.01	<0.01
Tetrachloroethylene	0.7	<0.006	<0.006	<0.006	<0.006	<0.006
Toxaphene	0.5	<0.005	<0.005	<0.005	<0.005	<0.005
Trichloroethylene	0.5	<0.006	<0.006	<0.006	<0.006	<0.006
2,4,5-Trichlorophenol	400.0	<0.250	<0.250	<0.250	<0.250	<0.250
2,4,6-Trichlorophenol	2.0	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (Silvex)	1.0	<0.002	<0.002	<0.002	<0.002	<0.002
Vinyl chloride	0.2	<0.008	<0.008	<0.008	<0.008	<0.008

(a) Cresol isomers, o-, m-, and p-cresol, are reported as 2-, 3-, and 4-methylphenol, respectively.

concentrations of barium and methoxychlor were below the regulatory level of 100.0 mg/L and 10.0 mg/L, respectively. In addition barium is considered a laboratory contaminant, since it is inherent to the sample filters used during analysis.

3.5 SITE 2 - FORMER FIRE TRAINING AREA

3.5.1 TCLP Results

A composite soil sample (TCLP-2) was collected from the stockpiled monitoring well drill cuttings at Site 2 - Former Fire Training Area. Sample TCLP-2 was collected at random depths throughout the berm using stainless steel tools. The sample was collected according to the procedures outlined in Section 2.2.3. This analysis was conducted to determine the disposal fate of these soils. The results of this analysis are presented in Table 3-6.

The only parameter detected in sample TCLP-2 was barium (0.7 mg/L). The concentration of barium was below the regulatory level of 100.0 mg/L and is considered a laboratory contaminant, since it is inherent to the sample filters used during analysis.

3.6 SITE 4 - OIL PATCH IN DRAINAGE FIELD (Stockpiled Site 4 Soils)

Site 4 - Oil Patch in Drainage Field was an area of visibly stained soil located at the end of an abandoned underground drain pipe in a dry depression of a drainage field, located midway between Ingalls and Farmer Streets. In 1985, the contaminated soils at this site were excavated and stockpiled adjacent to the fire training pit at Site 1 - Current Fire Training Area. Soil samples were collected from these stockpiled soils and analyzed to determine the contaminant characteristics of this soil, in addition to TCLP characteristics. The current location of these soils is presented in Figure 2-1.

The analytical results for the samples collected from the Site 4 - Oil Patch in Drainage Field soils stockpiled at Site 1 - Current Fire Training Area indicate that the soils are contaminated. Concentrations of fuel-related compounds, metals, and pesticides/PCBs were detected in the samples collected at the site.

3.6.1 Soil Sampling Results

Four composite samples (TP-4-1 through TP-4-4) were collected from undisturbed soils at random depths within the stockpiled Site 4 soils located at Site 1 - Current Fire Training Area. All samples submitted to the laboratory were analyzed for VOCs, SVOCs, TPH, metals, and pesticides/PCBs. Table 3-7 presents the results of contaminants detected. Appendix B presents all laboratory analytical results for the samples collected from the stockpiled soils.

No VOCs were detected in any of the soil samples collected from the stockpiled soils. No identifiable SVOCs were detected, with the exception of 21 SVOC TICs that were found in each of the four samples. Individual SVOC TIC concentrations ranged from 53 (TP-4-2) to 6,000 $\mu\text{g/kg}$ (TP-4-4). The total concentrations of the SVOC TICs for samples TP-4-1 through TP-4-4 were 19,060 (21) $\mu\text{g/kg}$; 7,559 (21) $\mu\text{g/kg}$; 13,660 (21) $\mu\text{g/kg}$; and 12,290 (21) $\mu\text{g/kg}$, respectively. Background sample results indicated elevated levels of individual SVOC TICs ranging from approximately 59 (BG-5-0.5) to 6,600 $\mu\text{g/kg}$ (BG-5-0.5). However, 4-hydroxy-4-methyl-2-pentanone and benzaldehyde are considered common laboratory artifacts/contaminants and account for approximately 6,000 $\mu\text{g/kg}$ of the total TIC concentration for the stockpiled Site 4 soils and background samples. Total TIC concentrations of SVOC TICs for background samples BG-3-0.5, BG-3-0.5R, BG-3-4.0, BG-4-0.5, BG-4-4.0, BG-5-0.5, and BG-5-4.0 are 807 $\mu\text{g/kg}$, 140 $\mu\text{g/kg}$, 300 $\mu\text{g/kg}$, 1,257 $\mu\text{g/kg}$, 810 $\mu\text{g/kg}$, 428 $\mu\text{g/kg}$, and 420 $\mu\text{g/kg}$, respectively. Background sample results are presented in Table 3-4. The results indicate that the stockpiled soil sample concentrations are an order of magnitude higher than background, and therefore can-not be considered indigenous to the site. The detection of the SVOC TICs in these soils suggests that either fuel-related contaminants from the previously identified waste spill still exist or the soils may be affected by the jet-engine hydrocarbon emissions released from the nearby runway.

TPH were detected in all samples collected from the stockpiled Site 4 soils. TPH were detected at a concentration of 1,500 mg/kg in TP-4-1, 210 mg/kg in TP-4-2, 1,860 mg/kg in TP-4-3, and 490 mg/kg in TP-4-4. Background sample results indicated an elevated concentration of TPH in sample BG-5-0.5 at 44 mg/kg . Because the detected concentration in the background sample was significantly lower than the detected concentrations in the stockpiled

Table 3-7. Data Summary Table: Soil (1992) - Site 4 - Stockpiled Oil Patch and Drainage Field, Idaho Air National Guard
124th Tactical Reconnaissance Group, Gowen Field, Boise, Idaho

SATC ID Number	TP-4-1	TP-4-2	TP-4-3	TP-4-3RE	TP-4-4
Laboratory ID Number	96887	96888	96889	96890RE	96891
Collection Date	09/22/92	09/22/92	09/22/92	09/22/92	09/22/92
Collection Depth (ft)	Composite	Composite	Composite	Composite	Composite
Associated Field QC Sample	TB-1	TB-1	TB-1	TB-1	TB-1
	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2	EB-1,EB-2
	FB-2	FB-2	FB-2	FB-2	FB-2
	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3	FB-1,FB-3
Units					
TOTAL PETROLEUM HYDROCARBONS (SW 3550/E 418.1)	1550 NU	210	2130 NU	1860	490
Total Petroleum Hydrocarbons	mg/kg				
ICP METALS (SW 3050/6010)					
Beryllium	0.46	0.59	0.58	NA	0.49
Chromium	9.2 X(N)	9.5 X(N)	10.1 X(N)	NA	11.8
Copper	9.9 X(N)	8.4	8.3	NA	11.6 X(N)
Nickel	8.7			NA	10.6
AA METALS					
Antimony (SW 3050/7041)	0.19 R(N)	0.18 R(N)	0.12 R(N)	NA	0.39 R(N)
Lead (SW 3050/7421)	43	17	15.7	NA	50.4
Selenium (SW 3050/7740)	0.13 R(N)	0.12 R(N)	0.14 R(N)	NA	0.84 R(N)
Thallium (SW 3050/7641)	0.24 X(N)	0.13 U(X)	0.17 X(N)	NA	0.15 U(X,N,W)
VOLATILE ORGANICS (SOW 3490)					
2-Butanone	10 J	11 U	11 U	NA	10 U
4-Methyl-2-pentanone	5 J	11 U	11 U	NA	10 U
TICs	0 (0)	0 (0)	0 (0)	NA	0 (0)
SEMI-VOLATILE ORGANICS (SOW 3490)					
Hex(2-Ethylhexyl)phthalate	350 U	340 U	420 (B)	NA	340 U
TICs	19060 (21)	7349 (20)	13520 (20)	NA	12290 (21)
PESTICIDE ORGANICS (SW 3550/6000)					
gamma-BHC (Lindane)	1.8 U	1.8 U	1.7 U	NA	0.38 XSR,ICV)
Dieldrin	3.6 U	3.6 U	3.5 U	NA	0.85 XSR,ICV)
4,4'-DDE	0.18 X(ICV)	3.6 U	3.5 U	NA	3.5 U(SR,ICV,BRK)
endrin	3.6 U	3.6 U	3.5 U	NA	1.4 J
4,4'-DDD	1.5 J	3.6 U	3.5 U	NA	3.5 U
4,4'-DDT	2 X(ICV)	0.24 X(ICV)	3.5 U	NA	2.6 XSR,ICV)
Methoxychlor	1.7 X(ICV)	18 U	17 U	NA	17 U
DIOXINS/FURANS (SW 2290)					
	NA	NA	NA	NA	NA

Validation note: All descriptive qualifiers applied to the reported values by the laboratory are reported in parentheses.

Each data point has been assessed to determine whether the value is considered usable (i.e., no qualifier), usable but estimated (i.e., "J"), or not usable (i.e., "R"). All usability qualifiers are followed by the applicable laboratory or field QC qualifier, presented in parentheses and defined above. Usability qualifiers were not applied to values qualified by the laboratory, but were not considered to have been adversely impacted by the applicable laboratory QC result (e.g., duplicated and matrix spike analysis).

NA - not analyzed

RE - reanalysis

TICs - tentatively identified compounds, total concentration is listed and the total number of tentatively identified compounds is inside the parentheses

Data Validation Qualifiers

J - associated numerical value is the approximate concentration

R - rejected value

U - compound determination was included in analysis, but was not detected

UJ - reported quantitation limit is approximate and may or may not represent the actual quantitation necessary to accurately and precisely measure the analyte

Explanatory Data Validation Qualifiers

BRK - endrin/DDT breakdown

ICV - Initial Calibration Verification

NU - not usable - these samples were rerun because initial dilution factors were suspect. the value reported as a rerun is more representative of the sample

SR - surrogate recovery outside control limits

BPA - defined CLP SOW Laboratory Qualifiers

B(organic) - compound was also detected in the associated laboratory method blank

N - spiked sample recovery outside of control limits

W - post-digestion spike for Graphite Furnace Atomic Absorption (GFAA) analysis is out of control limits (85 - 115%), while sample absorbance is less than 50% of the spike absorbance

soil sample, it is believed that TPH is not inherent to the soils of this site. The detection of TPH in the stockpiled soils suggests that either fuel-related contaminants from the previously identified waste spill still exist in these soils, or the soils may be affected by their close proximity to the runway, the jet-engine test area, and the jet run-up stand, and the hydrocarbon emissions associated with these activities.

Metals present in the stockpiled soils include beryllium, chromium, copper, and nickel. Beryllium concentrations ranged from 0.46 (TP-4-1) to 0.59 mg/kg (TP-4-2); this range generally agrees with the background concentrations (0.30 to 1.00 mg/kg) found at background test pit borings (BG-3, BG-4, and BG-5). Chromium concentrations ranged from 9.2 (TP-4-1) to 11.8 mg/kg (TP-4-4). Background concentrations of chromium ranged from 6.4 to 17.7 mg/kg. Copper concentrations ranged from 8.7 (TP-4-3) to 11.6 mg/kg (TP-4-4), and nickel concentrations ranged from 8.3 (TP-4-3) to 10.6 mg/kg (TP-4-4). These concentrations also are representative of the background soil samples, which were detected in the range of 6.0 to 16.2 mg/kg for copper and 8.7 to 16.7 mg/kg for nickel. The concentration of the metals identified in the site samples are within the same order of magnitude as the concentrations detected in background samples and can be considered indigenous to the site.

Pesticides (i.e., 4,4-DDE, 4,4-DDD, 4,4-DDT, dieldrin, and methoxychlor) were detected in samples TP-4-1, TP-4-2, and TP-4-4 from the stockpiled soils. These compounds, with the exception of dieldrin and 4,4-DDD, also were detected in the background soil samples BG-3-0.5R and BG-5-0.5 (see Table 3-4). Dieldrin was detected in sample TP-4-4 at a concentration of 0.85 $\mu\text{g/kg}$, and 4,4-DDD was detected in sample TP-4-1 at a concentration of 1.5 $\mu\text{g/kg}$. Since 4,4-DDD is a breakdown product of 4,4-DDT, which was observed in the background samples, this contaminant is considered inherent to the soils at the site. In addition, both detectable contaminants were below the contract required quantitation limit (CRQL) of 3.3 $\mu\text{g/kg}$, and therefore, are not likely due to site-related activities.

3.6.2 TCLP Results

A composite soil sample (TCLP-4) was collected from the Site 4 - Oil Patch in Drainage Field stockpiled soils at Site 1 - Current Fire Training Area. Sample TCLP-4 was collected at

random depths throughout the berm using stainless steel tools. This composite sample was collected according to the procedures outlined in Section 2.2.3. This analysis was conducted to determine the disposal fate of these soils. The results of this analysis are presented in Table 3-6.

The only parameter detected in sample TCLP-4 was barium (1.2 mg/L). The concentration of barium is below the regulatory level of 100.0 mg/L. In addition, barium is considered a laboratory contaminant, since it is inherent to the sample filters used during analysis.

3.7 SITE 6 - TAR PIT

3.7.1 TCLP Results

A composite soil sample (TCLP-6) was collected from the stockpiled monitoring well drill cuttings at Site 6 - Tar Pit. Sample TCLP-6 was collected at random depths throughout the berm using stainless steel tools. The sample was collected according to the procedures outlined in Section 2.2.3. This analysis was conducted to determine the disposal fate of these soils. The results of this analysis are presented in Table 3-6.

The only parameter detected in sample TCLP-6 was barium (0.8 mg/L). The concentration of barium was below the regulatory level of 100.0 mg/L and is considered a laboratory contaminant, since it is inherent to the sample filters used during analysis.

4. BASELINE HUMAN HEALTH RISK ASSESSMENT

4.1 INTRODUCTION

A baseline human health risk assessment was conducted evaluating exposure to chemicals present at, or released from the waste sites at Idaho Air National Guard (IANG), Gowen Field. This assessment is an expansion of the preliminary human health risk evaluation presented in the Site Inspection Addendum dated June 1992. Several changes have been incorporated into the baseline risk assessment since the earlier document, including:

- The addition of surface soil samples for Site 1 - Current Fire Training Area
- The use of a soil vadose zone contaminant transport model to further evaluate the potential for site-related groundwater contamination
- An expanded land use analysis of the potential for future residential or agricultural land use of IANG, Gowen Field
- Removal of Site 5 from the assessment
- Sampling of the stockpiled Site 4 soils located at Site 1
- Subdivision of Site 1 into three distinct contaminant areas
- An expanded evaluation of the relation of site contaminants to background concentrations
- Risk characterization of lead exposures by modelling intake of lead into blood.

The purpose of the baseline risk assessment of these sites is to evaluate potential risks to human health, and to support the determination of the need for site remediation. The baseline risk assessment focuses on potential noncancer and cancer health effects from long-term low-level exposures to site-related contaminants. The risk assessment also compares site-specific environmental data with applicable or relevant and appropriate Federal and state requirements (ARARs). The baseline risk assessment is part of the site inspection (SI) at IANG, Gowen Field, and is based upon results of samples collected in 1987, 1990, and 1992. The baseline risk assessment is focused on the following areas of concern:

- Site 1 - Current Fire Training Area: divided into 3 areas
 - Fire Training Pit Area

- Underground Storage Tank Area
- Stockpiled Site 4 Soils
- Site 2 - Former Fire Training Area
- Site 3 - Central Drainage Ditch
- Site 6 - Tar Pit.

The baseline risk assessment is a tool in selecting appropriate remedial alternatives, and one of the components that may be required to reach a remedial decision. Although the baseline risk assessment is comprehensive and consistent with the requirements of a remedial investigation, risks to ecological (i.e., nonhuman) receptors were not evaluated because of the lack of endangered species and critical habitats at the sites under investigation (ANG 1991).

The baseline risk assessment is organized according to the U.S. Environmental Protection Agency's (EPA's) Risk Assessment Guidance for Superfund (RAGS) which specifies four steps (EPA 1989a; 1991a,b; 1992d):

- 1) Data Collection and Evaluation (Section 4.2)
 - Gather and analyze relevant site data
 - Identify potential chemicals of concern
- 2) Exposure Assessment (Section 4.3)
 - Analyze contaminant releases
 - Identify exposed populations
 - Identify potential exposure pathways
 - Estimate exposure concentrations for pathways
 - Estimate contaminant intakes for pathways
- 3) Toxicity Assessment (Section 4.4)
 - Collect qualitative and quantitative toxicity information
 - Determine appropriate toxicity values

4) Risk Characterization (Section 4.5)

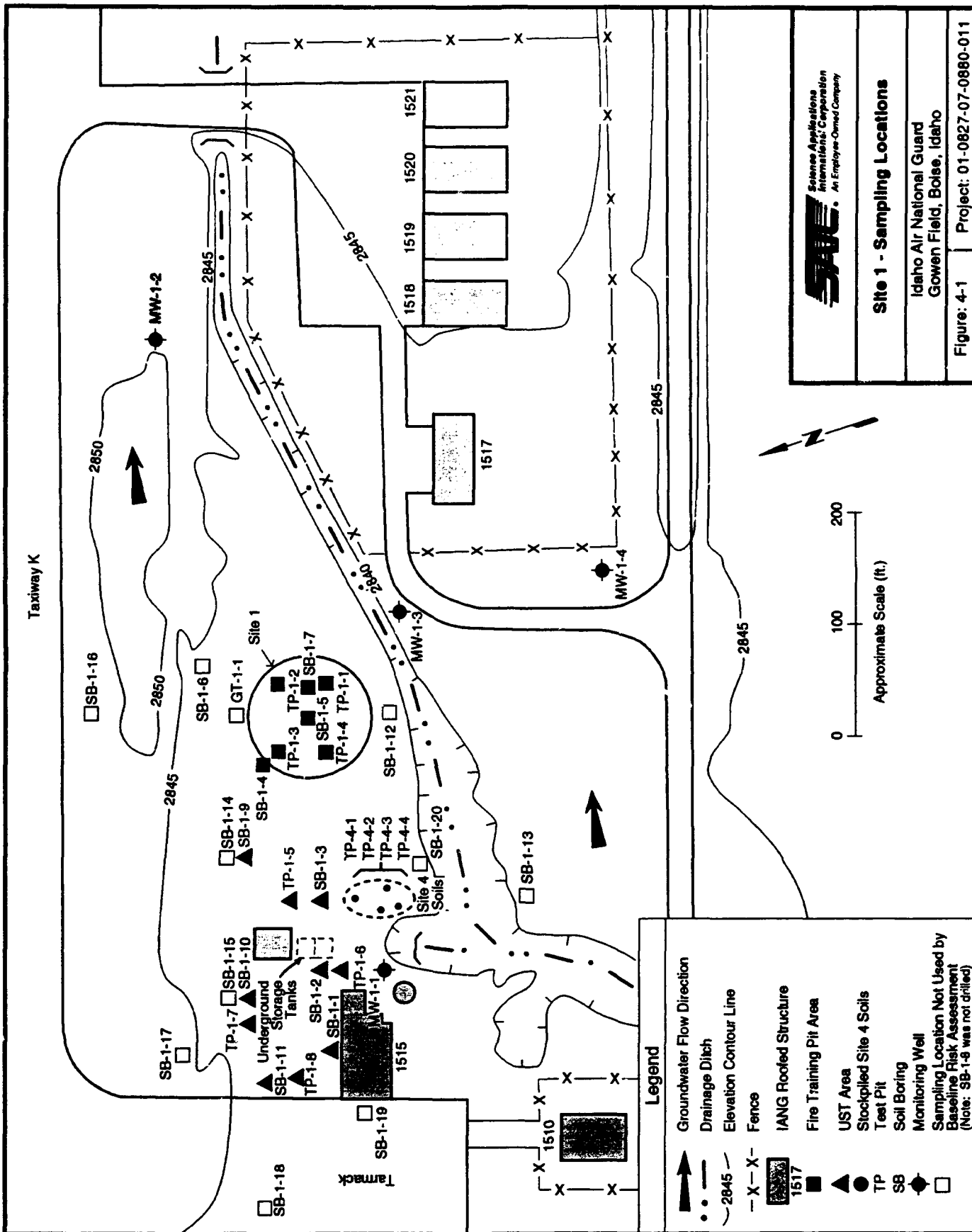
- Characterize potential for adverse health effects to occur
 - Estimate cancer risks
 - Estimate noncancer hazard quotients
- Evaluate uncertainty
- Summarize risk information.

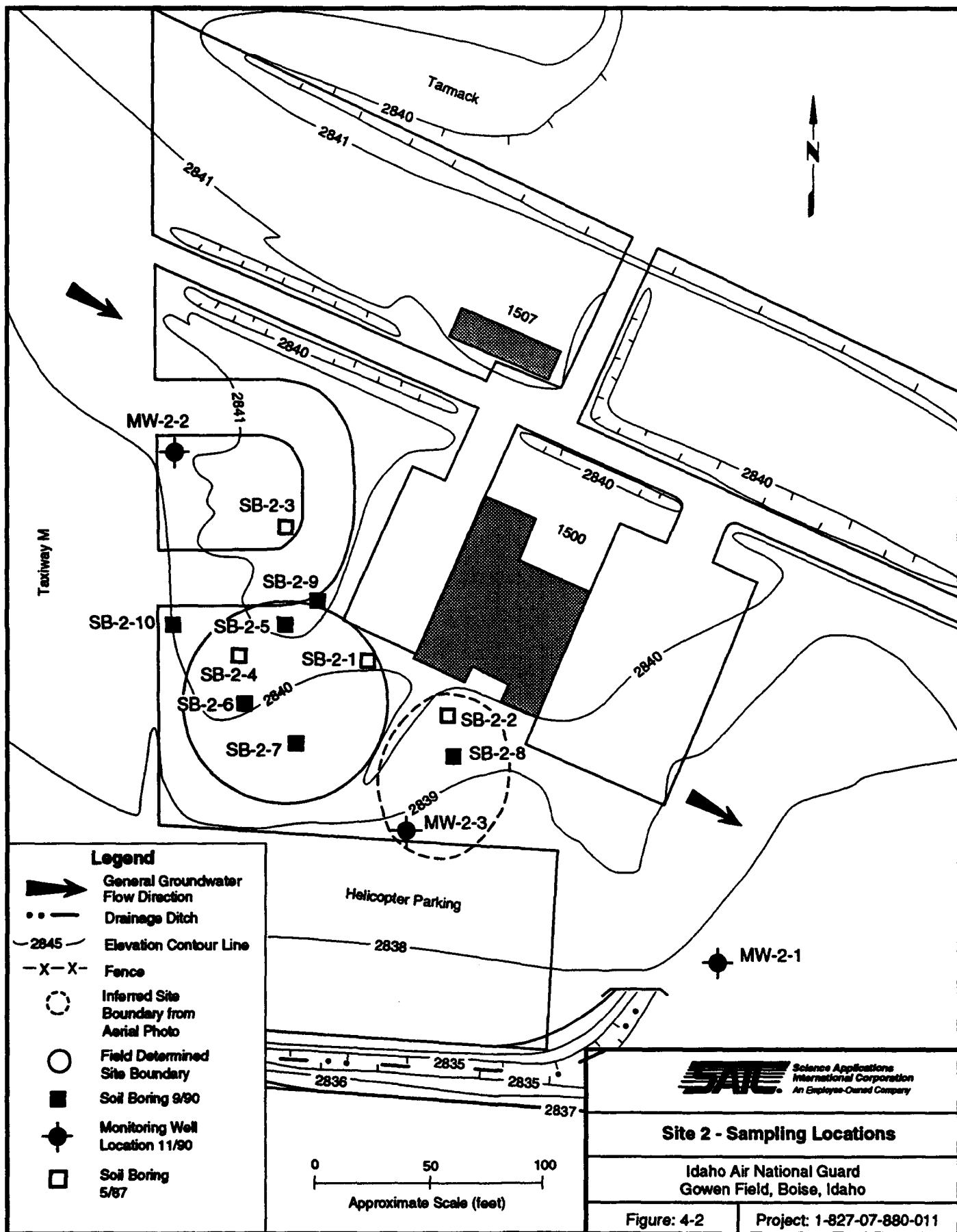
4.2 DATA COLLECTION AND EVALUATION

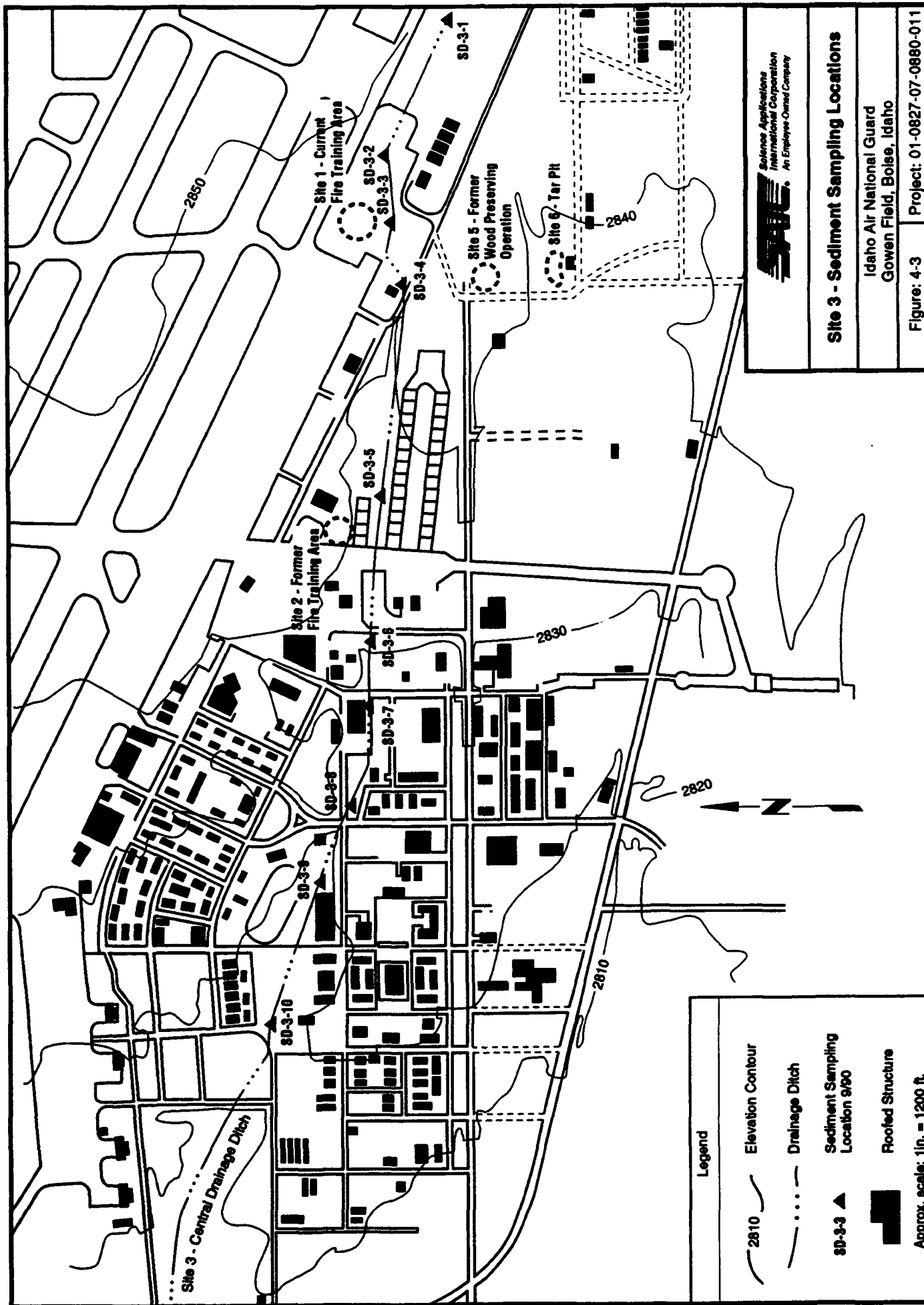
The purpose of this section is to evaluate the results of sampling and analysis of environmental media at Sites 1 (with three subareas), 2, 3, and 6 for use in the baseline risk assessment. Analytical data collected at IANG, Gowen Field have undergone quality assurance/quality control (QA/QC) evaluation using Hazardous Waste Remedial Actions Program (HAZWRAP) Level C (i.e., EPA Level III) for soil and groundwater samples; quality control (QC) requirements described in *Requirements for Quality Control of Analytical Data* (DOE/HWP-65/R1, July 1988); and the guidelines and specifications described in the Quality Assurance Projects Plans (QAPPs) submitted as part of the project work plans prepared by Science Applications International Corporation (SAIC). Results of these analyses are presented in the previous SI documents: Site Inspection (1987), and Site Inspection Addendum (1992); and Section 3 of this Addendum - 2. Summary statistics have been prepared in the baseline risk assessment using the validated data of all data sets.

The summary statistics calculated for the baseline risk assessment (Appendix H) were based upon the combined 1987, 1990, and 1992 sampling sets, and include frequency of detection, minimum, maximum, and the arithmetic mean concentrations of chemicals in environmental media at each site, and the background concentrations. The mean concentrations have been expressed as the arithmetic mean and the upper confidence limit on the arithmetic mean of the untransformed sample data for every site evaluated (EPA 1992d).

Figures 4-1 through 4-4 present the sampling locations at each site. Figure 4-5 identifies the background sampling locations and the overall proximity of each site. Site 1 - Current Fire Training Area was subdivided into three data sets for the risk assessment to distinguish the







different contaminant sources. The Fire Training Pit Area includes sample locations TP-1-1, TP-1-2, TP-1-3, TP-1-4, SB-1-4, SB-1-5, and SB-1-7. The UST Area, including the underground storage tank area and associated piping, includes sample locations TP-1-5, TP-1-6, TP-1-7, TP-1-8, SB-1-1, SB-1-2, SB-1-3, SB-1-9, SB-1-10, and SB-1-11. The Stockpiled Site 4 Soils includes samples TP-4-1, TP-4-2, TP-4-3, and TP-4-4 (Figure 4-1). Soils data collected from Site 2 (borings SB-2-1 through SB-2-10, except for SB-2-5), Site 3 (SD-3-1 through SD-3-10), and Site 6 (SB-6-1 and SB-6-2) during previous investigations were included in this risk assessment evaluation. Figures 4-2 through 4-4 show the sampling locations at these sites, respectively. Background soil samples were taken from sampling locations BG-3-4, BG-4-4, and BG-5-4 (Figure 4-5). Background soil samples BG-1 and BG-2 that were collected in 1987 were excluded from the background data set because they contained elevated inorganic levels and were thus determined to be unrepresentative of background soil for the Base.

The most recent sample data (1992) were collected at Site 1 and background locations, and provide additional soil data for the surface (0.5 feet inches below land surface [BLS]). The majority of the previously collected samples for Sites 1, 2, 3 and 6, were collected from depths of at least 4 feet BLS. The lack of near surface soil samples made the evaluation of risk more difficult since exposures are likely to occur at the surface. This was of particular concern for Site 1 because this area exhibited visual surface contamination. Using the 1992 surface soil data, two summary statistics data sets were prepared for samples collected from 1) surface soils, and 2) deeper soils (greater than 0.5 feet to approximately 15 feet BLS) at the Fire Training Pit and UST Areas.

For the purpose of risk assessment, the surface soils represent depths from 0 to 0.5 feet BLS, and the deeper soils represent depths greater than 0.5 feet to 15 feet BLS. Compiling separate shallow and deeper soil depth data sets allows increased resolution regarding the extent of the observed contamination, and is intended to provide a rational basis for focusing cleanup efforts, if so required. The Site 2, 3, and 6 sample data sets used for the baseline risk assessment are based on 1987 and 1990 sampling results. The data for Sites 2, 3, and 6 represent a single soil interval extending from the surface to 15 feet BLS. Surface soils were

not collected at these sites because of the lack of identified and/or visible contamination. A representative surface data set was not available for these sites.

4.2.1 Chemicals in Soils and Sediments

The results of sampling and analysis of soils and sediments at Sites 1, 2, 3, and 6 have been presented and discussed previously in the reports titled Site Inspection (1987), Site Inspection Addendum (1992), and in Section 3 of this Addendum - 2 Report. These following sections characterize the nature and extent of contamination and compare site chemical concentrations to background concentrations. Additional comparison to background levels is provided in the baseline risk assessment in Section 4.5.1.4.

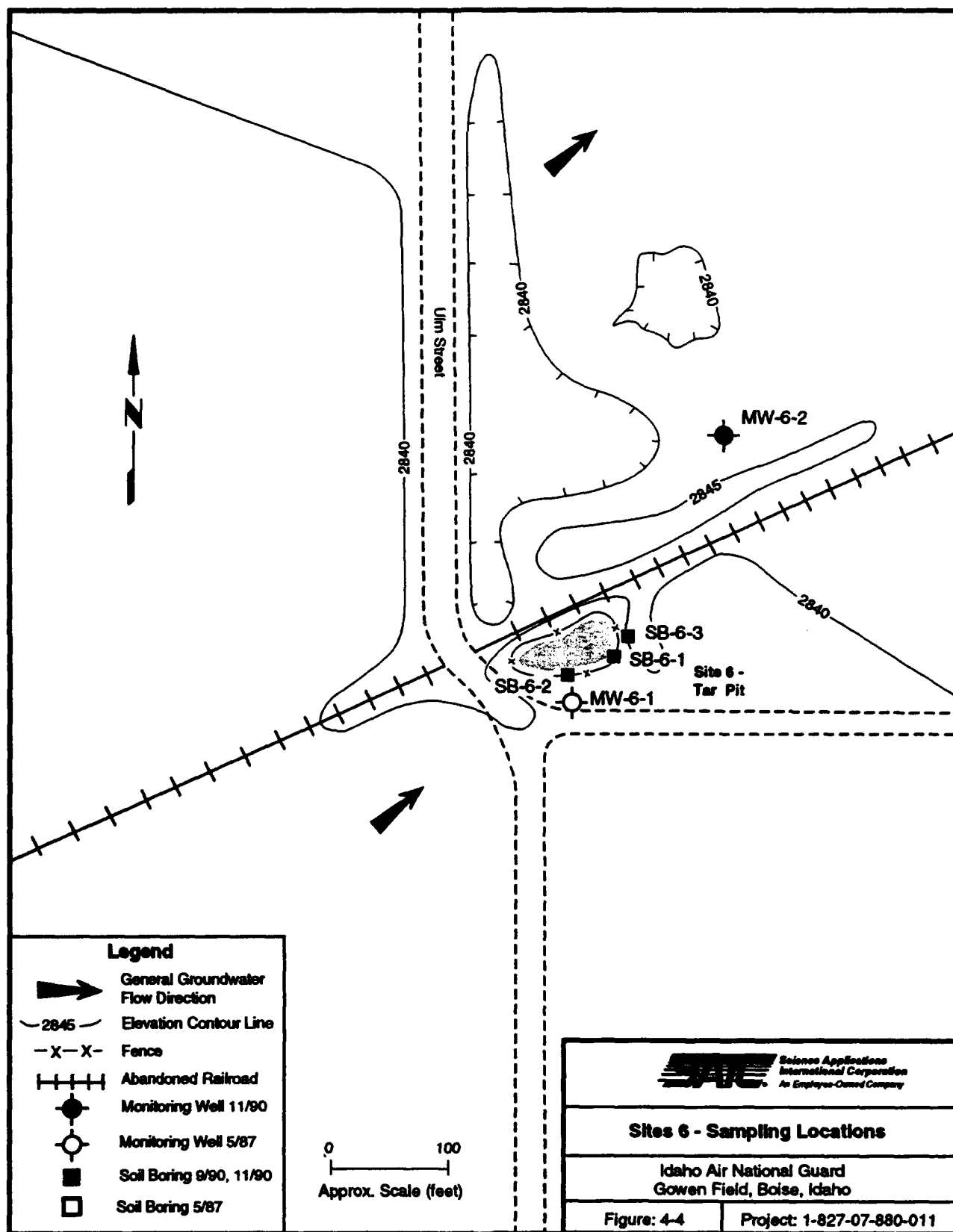
Background sampling locations were selected as site-specific points of comparison, and represent conditions that may be expected to exist at each site in the absence of site-related disposal activities. Inorganic chemicals are often naturally occurring, and although organics may also be naturally occurring, they are generally assumed to originate from human activity.

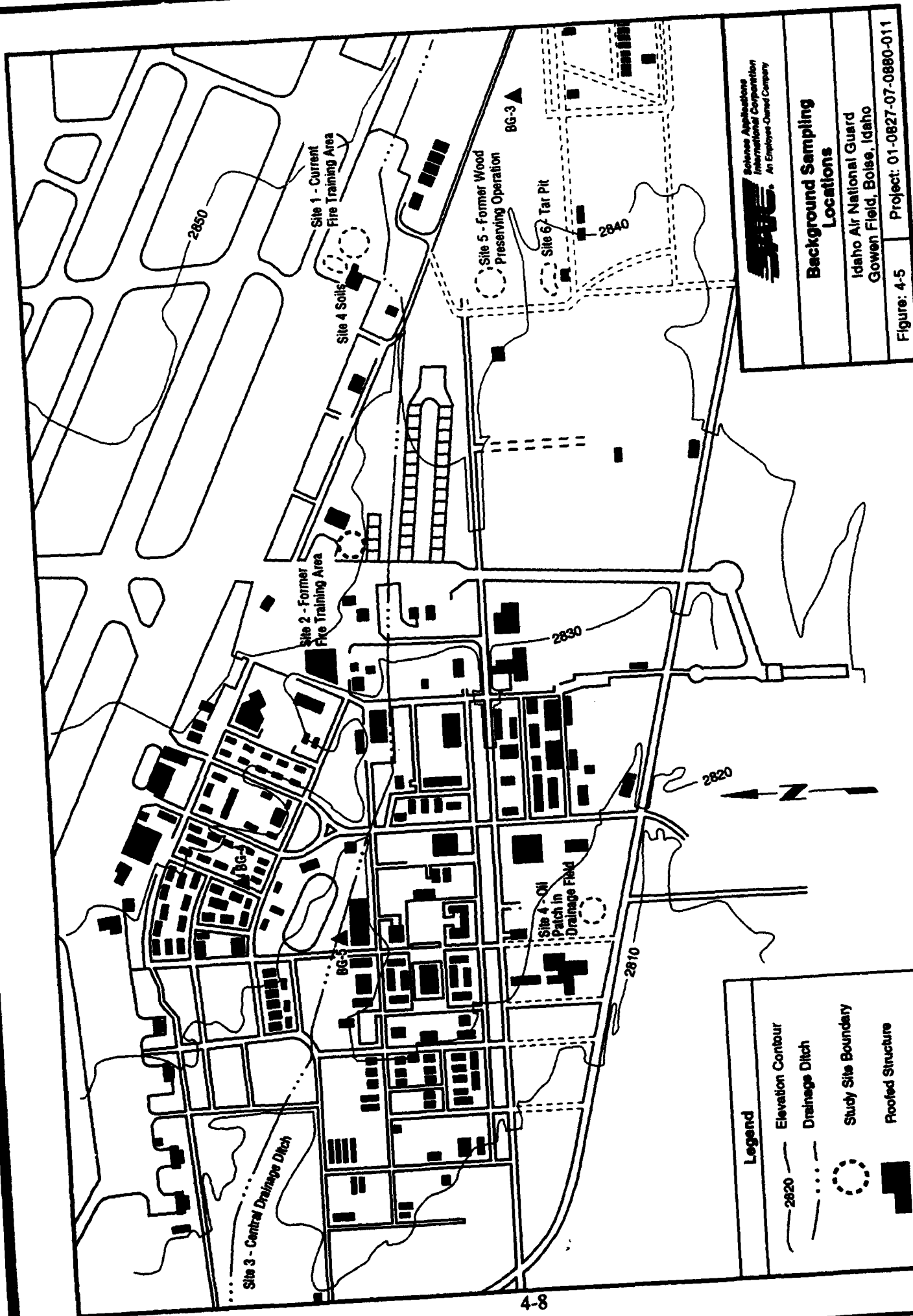
All chemicals positively identified in the appropriate soil and sediment samples of the past validated data sets are incorporated into the baseline risk assessment. Although EPA notes that a reduction of the number of analytes considered may be desirable when time and resources prohibit the evaluation of complex data sets (EPA 1989a), the process does not improve the risk characterization. Furthermore, EPA does not recommend eliminating chemicals from the risk assessment based upon their presence in background samples (EPA 1989a).

Formally promulgated Federal and state ARARs for soils and sediments are not currently available. No ARARs comparison for soils and sediments has been included in the baseline assessment of the IANG, Gowen Field investigated sites.

4.2.2 Chemicals in Groundwater

There are two primary water bearing units found beneath IANG, Gowen Field. A shallow aquifer is located in the Older Terrace Gravel formation at a depth of approximately 145 to 180 feet BLS. A deeper aquifer is found at 500 to 700 feet BLS. The Boise Water





Corporation draws from this deeper unit and provides potable supplies of drinking water to the Base and the surrounding community. Groundwater from the shallow aquifer is not used as a source of drinking water by Base personnel.

The deeper aquifer is a confined unit overlain by impermeable deposits of silt and clay (HMTC 1985). No hydrogeologic connection has been identified to exist between these aquifers in the vicinity of the Idaho National Guard Base. The major recharge zone for the deeper unit is the foothills of the mountainous region north of Boise where the Glens Ferry Formation is exposed at the earth's surface (HMTC 1985). No portion of this recharge zone is present at the Idaho National Guard Base.

It is important to recognize the hydrogeological complexity of the subsurface environment in the vicinity of IANG Gowen Field. There are numerous minor aquifers (up to 62), as well as local perched water zones found at varying depths between the land surface and the Older Terrace Gravel formation aquifer. A hydraulic link has not been established between these near surface aquifers and the deeper Older Terrace Gravel formation. The community surrounding the Idaho National Guard Base is served by the Boise Water Corporation with drinking water provided from the deep aquifer 500 feet BLS. None of the private wells reported to be located within the land-use section that includes IANG, Gowen Field (domestic or irrigation), are installed in the shallow aquifer. The maximum static water level reported for these wells is 11 feet BLS; the total depth of the deepest well is 58 feet BLS (Idaho Department of Water Resources, March 1991).

Based on the information provided above, a quantitative characterization of risks of hypothetical exposure to groundwater will not be presented in the baseline risk assessment. There is no current or foreseeable exposure to site-related chemicals by Base personnel or the surrounding community served by this aquifer via the groundwater pathway. The significance of chemicals in groundwater is evaluated by means of comparison with ARARs.

Tables 4-1 through 4-6 contain listings of ARARs for all chemicals positively detected in groundwater samples obtained at Sites 1, 2, and 6. These tables include:

- Maximum contaminant levels (MCLs)
- Maximum contaminant level goals (MCLGs)
- Proposed maximum contaminant levels (PMCLs)
- Proposed maximum contaminant level goals (PMCLGs)
- State water quality standards.

The results of groundwater sampling (1987 and 1990 to 1991 data) are compared with these guidelines. In all but two instances, the observed concentrations of chemicals in groundwater at the sites under investigation are in compliance with Federal and state ARARs. The mean and maximum concentrations of selenium in groundwater at Site 1 (for both the 1990 to 1991 and 1987 sampling sets) exceeded the Federal primary drinking water standard that existed for this element when the respective studies were conducted. The concentrations of selenium identified are now at levels below the current ARAR (EPA 1992e). The results of SI field investigations soil sampling indicate low levels of selenium in the first 10 feet BLS, however, selenium was not detected at greater depths. The source of the selenium in the groundwater was not determined to be the soil column beneath Site 1. The mean and maximum concentrations of lead in groundwater at Sites 1, 2, and 6 exceed the current nonenforceable MCLG. The concentrations of lead detected in the groundwater at these sites in 1987 and 1990 were below the Federal MCLs that existed when the SI investigations were conducted. Currently, no Federal MCL exists for lead in groundwater. A Federal action level exists, however, that initiates further investigation (Table 4-1).

4.2.3 Vadose Zone Modeling

This section analyzes the potential for contaminant migration through the vadose zone to the groundwater table. This was accomplished using the Pesticide Root Zone Model-2 (PRZM-2/VADOFT). PRZM-2 (USEPA 1992) is a compartmental model designed to simulate vadose flow and transport of chemical contaminants through variably saturated soils. The model provides an indication of whether significant concentrations of contaminants from the source area

TABLE 4-1. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR
GROUNDWATER: IDAHO AIR NATIONAL GUARD,
124th TACTICAL RECONNAISSANCE GROUP, GOWEN FIELD, BOISE, IDAHO

PARAMETER	MCLG(a)	MCL(a)	PMCLG(a)	PMCL(a)	Idaho Water Quality Standards (b)
INORGANICS					
Antimony	6	6			
Arsenic		50*			50
Beryllium	4	4			
Cadmium	5	5			
Chromium	100	100			50
Copper (c)	1300	1300			
Lead (c)	0	15			50
Nickel	100	100			
Selenium	50	50			10
Zinc					
ORGANICS					
Acetone					
Toluene	1000	1000			

All units are $\mu\text{g/L}$ for aqueous samples unless noted.

MCL - Maximum Contaminant Level

MCLG - Maximum Contaminant Level Goal

PMCL - Proposed Maximum Contaminant Level

PMCLG - Proposed Maximum Contaminant Level Goal

* - The MCL for arsenic is currently under review

(a) MCLs, MCLGs, proposed MCLs, and proposed MCLGs are taken from *Drinking Water Regulations and Health Advisories*, USEPA Office of Drinking Water, December 1992.

(b) *Rules Governing Public Drinking Water, Rules and Regulations of the Department of Health and Welfare*, Chapter 16, IDAPA 16.01.8900.

(c) 56 FR 26460 (June 7, 1991). This "action level," when measured in the 90th percentile at the consumer's tap, triggers initiation of corrosion control studies and treatment requirements.

TABLE 4-2. COMPARISON OF GROUNDWATER MEAN AND MAXIMUM CONCENTRATIONS WITH ARARs
AT SITE 1 - CURRENT FIRE TRAINING AREA (1990-91), IDAHO AIR NATIONAL GUARD,
124th TACTICAL RECONNAISSANCE GROUP, GOWEN FIELD, BOISE, IDAHO

Parameter	FREQUENCY OF DETECTION	MEAN CONCENTRATION IN GROUNDWATER (µg/L)		CONCENTRATION IN GROUNDWATER (µg/L)	MAXIMUM CONCENTRATION IN GROUNDWATER (µg/L)	COMPARISON: MEAN CONCENTRATION vs. ARAR		COMPARISON: MAXIMUM CONCENTRATION vs. ARAR	
INORGANICS									
Arsenic	3/4		7.19		15.80	--		--	
Beryllium	1/4		1.00		1.50	--		--	
Chromium	2/4		11.53		23.65	--		--	
Copper	2/4		15.54		26.25	--		--	
Lead	2/4		2.14		3.90	--		--	
Nickel	3/4		9.03		16.50	> MCLG		> MCLG	
Selenium	4/4		23.38		39.35	--		--	
Zinc	2/4		16.13		36.75	> IMCL		> IMCL	
ORGANICS									
	0/4		ND		ND	--		--	

-- ARARs not exceeded

> MCLG = Exceeds Maximum Contaminant Level Goal.

> IMCL = Exceeds Idaho Maximum Contaminant Level

TABLE 4-3. COMPARISON OF GROUNDWATER MEAN AND MAXIMUM CONCENTRATIONS WITH ARARs
AT SITE 1 - CURRENT FIRE TRAINING AREA (1987), IDAHO AIR NATIONAL GUARD,
124th TACTICAL RECONNAISSANCE GROUP, GOWEN FIELD, BOISE, IDAHO

Parameter	FREQUENCY OF DETECTION	MEAN CONCENTRATION IN GROUNDWATER ($\mu\text{g/L}$)	MAXIMUM CONCENTRATION IN GROUNDWATER ($\mu\text{g/L}$)	COMPARISON: MEAN CONCENTRATION vs. ARAR	COMPARISON: MAXIMUM CONCENTRATION vs. ARAR
INORGANICS					
Chromium	2/2	19	22	--	--
Copper	1/2	10	40	--	--
Lead	2/2	16	29	> action level (a); > MCLG	> MCL _L ; > MCLG
Nickel	2/2	46	79	--	--
Selenium	2/2	33	50	--	= MCL _L ; = IMCL
Zinc	2/2	486	980	--	--
ORGANICS					
Acetone	1/2	7	12	--	--
Toluene	1/2	7	20	--	--

-- ARARs not exceeded

> MCL = Exceeds Maximum Contaminant Level

> MCLG = Exceeds Maximum Contaminant Level Goal

> IMCL = Idaho Maximum Contaminant Level

(a) 56 FR 26460 (June 7, 1991). This "action level" when measured in the 90th percentile at the consumer's tap, triggers initiation of corrosion control studies and treatment requirements.

TABLE 4-4. COMPARISON OF GROUNDWATER MEAN AND MAXIMUM CONCENTRATIONS WITH ARARs AT
SITE 2 - FORMER FIRE TRAINING AREA (1990-91), IDAHO AIR NATIONAL GUARD,
124th TACTICAL RECONNAISSANCE GROUP, GOWEN FIELD, BOISE, IDAHO

Parameter	FREQUENCY OF DETECTION	MEAN CONCENTRATION IN GROUNDWATER ($\mu\text{g/L}$)	MAXIMUM CONCENTRATION IN GROUNDWATER ($\mu\text{g/L}$)	COMPARISON: MEAN CONCENTRATION vs. ARARs	COMPARISON: MAXIMUM CONCENTRATION vs. ARARs
INORGANICS					
Arsenic	2/2	5.73	9.95	--	--
Chromium	2/2	14.81	15.88	--	--
Copper	2/2	20.75	21.50	--	--
Lead	2/2	4.71	4.73	> MCLG	> MCLG
Nickel	2/2	4.31	4.63	--	--
Selenium	2/2	2.75	3.70	--	--
Zinc	2/2	26.50	32.25	--	--
ORGANICS					
	0/2	ND	ND	--	--

-- ARARs not exceeded

> MCLG = Exceeds Maximum Contaminant Level Goal

TABLE 4-5. COMPARISON OF GROUNDWATER MEAN AND MAXIMUM CONCENTRATIONS WITH ARARs AT
SITE 6 - TAR PIT (1990-91), IDAHO AIR NATIONAL GUARD,
124th TACTICAL RECONNAISSANCE GROUP, GOWEN FIELD, BOISE, IDAHO

Parameter	FREQUENCY OF DETECTION	MEAN CONCENTRATION IN GROUNDWATER (µg/L)		MAXIMUM CONCENTRATION IN GROUNDWATER (µg/L)		COMPARISON: MEAN CONCENTRATION vs. ARARs		COMPARISON: MAXIMUM CONCENTRATION vs. ARARs	
INORGANICS									
Antimony	1/2	1.38		2.25		--		--	
Arsenic	2/2	4.43		5.65		--		--	
Cadmium	1/2	1.40		1.80		--		--	
Chromium	1/2	7.00		7.50		--		--	
Copper	1/2	5.08		5.15		--		--	
Lead	1/2	3.58		6.65		> MCLG		> MCLG	
Nickel	1/2	6.50		7.00		--		--	
Selenium	1/2	4.55		7.60		--		--	
ORGANICS									
	0/2	ND		ND		--		--	

-- ARARs not exceeded

> MCLG = Exceeds Maximum Contaminant Level Goal

**TABLE 4-6. COMPARISON OF GROUNDWATER CONCENTRATIONS
WITH ARARs AT SITE 6 - TAR PIT (1987), IDAHO AIR NATIONAL GUARD,
124th TACTICAL RECONNAISSANCE GROUP, GOWEN FIELD, BOISE, IDAHO**

Parameter	CONCENTRATION ($\mu\text{g/L}$)	COMPARISON: CONCENTRATION vs. ARARs
INORGANICS		
Chromium	12	--
Lead	13	> MCLG
Nickel	24	--
Zinc	350	--
ORGANICS		
Acetone	260	--
Toluene	74	--

-- ARARs not exceeded

> MCLG = Exceeds Maximum Contaminant Level Goal

Note: MW-6-1 was the only Site 6 well installed in 1987

could be expected to migrate to groundwater. For the purpose of this analysis, the term significant refers to contaminants approaching or exceeding detectable levels in soil or groundwater. A detailed discussion of the methods used and the results obtained from the model runs is provided in Appendix G. The Fire Training Pit Area was chosen as the area to be modeled because of the elevated concentrations of contaminants detected in the site soils and because assessment of this site provides the most conservative projection for groundwater contamination as compared to the remaining sites.

Site specific properties including grain size distribution, natural moisture content, bulk density, and total organic carbon data were obtained from borehole GT-1-1 at the Fire Training Pit Area and were input to the model. Additional parameters (field capacity, wilting point, adsorption) required by the model were estimated using methods in the model documentation. Detailed discussion of the PRZM-2 model, its theory, applications, and verification can be found in Carsel et al, 1984 and Mullins et al, 1992.

Assumptions inherent in the PRZM-2/VADOFT computer program include one-dimensional, isothermal darcy flow with a homogeneous and slightly compressible fluid. Advection and dispersion are assumed to be one-dimensional and fluid properties are independent of contaminant concentrations. Diffusive and dispersive transport is governed by Fick's law. Adsorption and decay of the solute are described by a linear equilibrium isotherm and a lumped first order decay constant. The program simulates only single-phase flow and does not include sorption nonlinearity or kinetic sorption effects. The PRZM-2 model is advantageous in that it allows the initial soil concentration (mg/kg) as an input parameter as opposed to initializing to an estimated dissolved soil water concentration. This allows the use of site specific soil data to simulate leaching in the soil column by infiltrating soil water. A practical limitation on the application of the coupled model to the simulation of deep vadose zone flow and transport at sites such as those at IANG, Gowen Field, where the water table is at approximately 180 feet BLS, is related to the dimensionality of the PRZM-2 module (centimeter length unit).

The unsaturated zone underlying the Fire Training Pit Area is comprised of interlayered fine to coarse-grained sand, gravel, and cobbles with varying quantities of silt and clay. The

unsaturated zone is represented at the site by a poorly sorted sand, cobble, and boulder layer which extends to a depth of approximately 40 feet. The boulder/cobble layer is underlain to a depth of 120 feet BLS by poorly sorted, fine to coarse grained sand and fine gravel with occasional silt interlayers and seams. The grain size decreases between 120 and 172.5 feet BLS ranging from fine sand to sandy silt. Fine to medium sand occurs between 172.5 to a minimum of 181.5 feet BLS and comprises the upper saturated zone underlying the site. Laboratory data on the physical characteristics of the soils underlying the Fire Training Pit Area were obtained for representative samples from borehole GT-1-1. Bulk samples for analysis of grain size, natural moisture content, bulk density, and total organic carbon were obtained at 50, 80, 100, 120, 140, and 160 foot depths. Groundwater is estimated to occur at approximately 180 feet BLS beneath the site based on the results of previous investigations. Physical properties in the upper sand/cobble/boulder layer were not quantified because of difficulties obtaining representative samples of the soil while using the air rotary drilling method. Approximate information based on Soil Conservation Service (1980) data was used for this layer in formulating the model.

4.2.3.1 Conceptual Hydrologic Model

A one-dimensional model for the unsaturated zone underlying the Current Fire Training Area was developed using the observed stratigraphic information from boring SB-1-15. This boring was selected because it penetrated the full thickness of unsaturated sediments in the site area and was sampled by split spoon over most of the borehole depth. Because of the dimensionality inherent in PRZM-2, the present model was established using five PRZM-2 horizons overlying a single VADOFT horizon at the base of the soil column. The model includes an upper sand, cobble, boulder layer to a depth of 40 feet BLS, underlain by three sandy units to a depth of 120 feet BLS. The hydrologic properties of the sandy layers were estimated using the grain size data obtained from 50 to 100 feet BLS. The combined data from the samples obtained between 120 to 160 feet BLS were used to estimate the hydrologic properties of the sandy silt materials occurring between 120 to 172.5 feet BLS. The lower sand layer was given the hydrologic properties obtained from slug tests conducted in wells MW-1-3 and MW-1-4 at the Fire Training Pit Area during the SI. Input data files for the model runs are provided in Appendix G.

Transient, water flux boundary conditions in the model were established by PRZM-2 using actual precipitation, temperature and pan evaporation data from Boise, Idaho for a 30 year period (USEPA 1992). Meteorological data from the Boise area were obtained from the EPA Environmental Research Laboratory in Athens, Georgia. Net infiltration of precipitation (rainfall or snowmelt) to the underlying soil horizons occurs after accounting for interception storage by plant canopy (minimal), surface runoff, and evapotranspiration. A constant potential head boundary condition was established at the water table.

4.2.3.2 Contaminant Selection and Distribution

Selection of contaminants to be modeled was based on examination of compounds detected by analyses of Fire Training Pit Area soils during the SI investigations conducted between 1988 and 1993. Compounds such as Heptachlor epoxide, 4,4'-DDT, inorganic metals, polynuclear aromatic hydrocarbon (PAH) compounds, and dioxin compounds, which occurred relatively frequently but which have high soil/water partition coefficients (K_d) and low vapor/water partition coefficients (K_b), were not modeled. Because of their elevated partitioning coefficients, these compounds tend to adsorb to the soil matrix and do not migrate or volatilize appreciably from their source location in the soil column. Additionally, the detected maximum concentrations for many of these compounds were relatively low and many of the compounds were detected only sporadically. Xylene, benzene, and toluene occurred relatively frequently and were modeled in the fate and transport calculations based on their frequent occurrence and the elevated concentrations observed. Similarly, 1,2-dichloroethene (1,2-DCE) was selected to represent the volatile organic compound (VOC) fraction. These compounds should sufficiently represent the potential for migration from the fire training area to groundwater based on concentration and relative mobility.

Initial soil concentrations were determined based on the analytical data and were input directly into the soil column at the appropriate depths. The advective flux through the soil column effectively leaches the chemical constituents in accordance with the physical and chemical parameters established in the model for a specific chemical. Changes to the soil concentrations were modeled using advection, volatilization, and adsorption fate and transport

processes. Chemical decay also was considered in subsequent model runs, based on chemical half-life data reported in the literature.

Initial contaminant concentrations were based on the maximum observed concentrations in the upper 5 feet of the soil column using 5 compartments. The initial concentrations for xylene were varied based on the Fire Training Pit Area data to include the maximum value observed between 0 to 0.5 feet (72.0 mg/kg), 0.5 to 4.0 feet (1.3 mg/kg), and 4.0 to 5.0 feet (92.0 mg/kg). 1,2-DCE concentrations at the Fire Training Pit Area were generally of the same order of magnitude throughout the upper five feet of soil column, therefore, the maximum concentration of 0.53 mg/kg was initialized in each soil compartment in the five foot source zone. Benzene concentrations ranged from 0.900 mg/kg in the surficial sample to 0.10 mg/kg at a depth of 5 feet. Toluene concentrations were logarithmically interpolated between 0.5 feet and 3 feet (26 mg/kg to 3.3 mg/kg) and maximum values were used at 4 feet (1.2 mg/kg) and 5 feet (16 mg/kg).

4.2.3.3 Model Results

Leached contaminant distributions for xylene, toluene, benzene, and 1,2-DCE were calculated on an annual basis over a 30 year period subject to the physical and chemical conditions established in the model. The tabulated concentration profiles of the simulations for years 1, 5, 10, 20, and 30 are provided in Appendix G. The chemical profiles reflect the concentration distribution resulting from the downward movement of infiltrating water with chemical transport controlled predominantly by volatilization, diffuse transport, and low soil/water partitioning. The low estimates for soil/water partitioning is a direct manifestation of the organic carbon values measured for the site soils between 50 to 160 feet BLS (less than 1 percent).

The calculated concentrations indicate that benzene and 1,2-DCE concentrations are reduced to below detectable levels (1×10^{-2} mg/kg) at between 1 and 5 years respectively and would not be transported to the water table. Detectable xylene and toluene concentrations were calculated to a depth of approximately 90 feet BLS after 30 years. Because contaminant concentrations were not detected in site samples collected at 50 feet and the fire training area

is approximately 20 years old, the model overpredicts the migration depth (83 feet) for these compounds over a 20 year period. This conservative prediction is a result of the low calculated partition coefficients (K_d) for the site soils based on the measured total organic carbon data. The impact of the low K_d values in the model is to reduce the retardation of the migrating chemicals by the site soils. This may be highly conservative for shallow soils in the burn pit area.

Since the model predicts considerable migration of xylene and toluene (but not benzene or 1,2-DCE), the impact of degradation on xylene and toluene was further evaluated using conservative half lives for these compounds in groundwater (Howard et al, 1991). Half-life values of 360 days for xylene and 28 days for toluene were included in the model and chemical concentrations were recalculated for the same physical model. Based on model runs, which included the effect of the chemical degradation, calculated toluene concentrations were reduced to nondetectable levels within one year and xylene concentrations were reduced to nondetectable levels within 9 years. Detectable xylene concentrations were observed to a maximum depth of 48 feet over this period.

The calculated results also are sensitive to the diffusion coefficient for a particular chemical in air (cm^2/day). This parameter is used in the model to calculate the molecular diffusivity of the chemical in the air-filled pore spaces of the unsaturated zone. Diffusion coefficients for benzene, toluene, and xylene (Dragun 1988) ranged from 0.071 to $0.088 \text{ cm}^2/\text{sec}$ (6134 to $7603 \text{ cm}^2/\text{day}$). A diffusion coefficient of $5868 \text{ cm}^2/\text{day}$ for 1,2-DCE was calculated based on its molecular weight. Model runs for xylene and 1,2-DCE in which lower diffusion coefficients were used indicated substantially lower subsurface penetration (10 to 20 feet) for these chemicals.

Computer simulations using the PRZM-2 unsaturated flow and transport model indicate that representative organic chemicals in the Fire Training Pit Area soils would not be expected to migrate to the water table. Inorganic and organic compounds with greater soil/water partition coefficients than those used in the model would not be expected to migrate beyond the calculated penetration depths. The model calculations indicate detectable soil concentrations of 1,2-DCE to a depth of 22 feet after one year with a reduction to nondetectable levels after 5 years.

Calculated benzene concentrations were below detection after one year. Detectable (>10 mg/kg) xylene and toluene migration to depths of 80 feet BLS occurred over a 30-year simulation period. The model results are sensitive to chemical diffusion and soil/water partition coefficients with lower values reducing the subsurface penetration depth to 10 to 20 feet.

The PRZM-2 model results reflect the partitioning data available for the site and are conservative. This is because the mixture of contaminants in the fire training area is highly complex, and soil partitioning of chemicals in the upper four feet of the burn pit is underpredicted. The model, therefore, overpredicts the migration depth of the chemicals of concern. Based on the results of the PRZM-2 model and the measured subsurface sample results, the observed chemical contaminants in surface soil are not projected to migrate to the shallow aquifer at 180 feet BLS. Therefore, the deeper aquifer and drinking water supply do not appear to be, and are unlikely to be at risk of contamination. Based on the available information, private wells off base are not likely to be at risk of contamination by the chemical sources under investigation.

4.3 EXPOSURE ASSESSMENT

4.3.1 Overview and Objectives

This section evaluates the potential for human exposure to contaminants at the sites under investigation. The exposure assessment, in conjunction with the subsequent toxicity assessment, supports the characterization of potential risks to human health.

The exposure assessment consists of the following principal components:

- Evaluation of contaminant transport
- Identification and characterization of exposure pathways
- Identification of populations at risk of exposure
- Discussion of all assumptions used in deriving estimates of intake or dose.

In order to quantify exposure (and subsequent dose), exposure scenarios have been developed along with quantitative exposure parameter estimates. These exposure parameters

include, for example, exposure frequency (i.e., how often one may visit the site) and contact rate (i.e., how much soil may be ingested on a day of exposure). Although uncertainty in the results of the risk assessment may be tied to the exposure assumptions, the methods used in this section follow the most current EPA guidance on exposure and risk assessment (EPA 1989a,b and 1992d).

4.3.2 Land Use Restrictions

Both current and future land use must be considered in the baseline risk assessment (EPA 1989a). Possible shifts in land use over time were investigated as part of additional land use analysis in the baseline risk assessment. The following land use analysis is based upon Federal Aviation Administration (FAA) requirements enforced by the Boise Airport Authority.

No future residential land use or other development of the property is considered in the baseline risk assessment since land use is unlikely to change. IANG, Gowen Field is a tenant organization located within the boundaries of Boise Air Terminal and is designated in public records as within Airport Influence Zone C1. This land use zone is restrictive because of its proximity to Boise Air Terminal (Boise Airport Authority 1993).

The C1 zone encompasses all of IANG, Gowen Field and the surrounding area, and no residential or other public use of the land is permitted. This precludes current or future public activities associated with commercial, hunting, or agricultural land use. Under the C1 zoning designation land use must remain open, and any transactions are subject to Federal acquisition regulations. Even if IANG, Gowen Field does not remain under IANG management, land use would be largely determined by the Boise Airport Authority (Boise Airport Authority 1993).

The land use analysis confirms the validity of the assumption that current and future land use will remain unchanged over the period of time for long-term human health risk assessment. Land use at the sites is managed, although not governed by the IANG. IANG, Gowen Field is managed as a controlled facility and the general public does not have free access to this property. IANG representatives note that there are no plans to return the land to general public use and that the use of the property will remain under control of the National Guard (IANGL, March 1991).

Base closures cannot be ruled out of future land use considerations, even when this appears to be unlikely. IANG, Gowen Field, however, is both a military base with no plans for closure, and is located in the proximity of the Boise Air Terminal. Under these restrictions, the chain of events that would be required to successfully develop IANG, Gowen Field for unrestricted land use are particularly remote. Given these factors, significant access and land use restrictions will remain in effect.

4.3.3 Characterization of the Exposure Setting: Conceptual Site Models

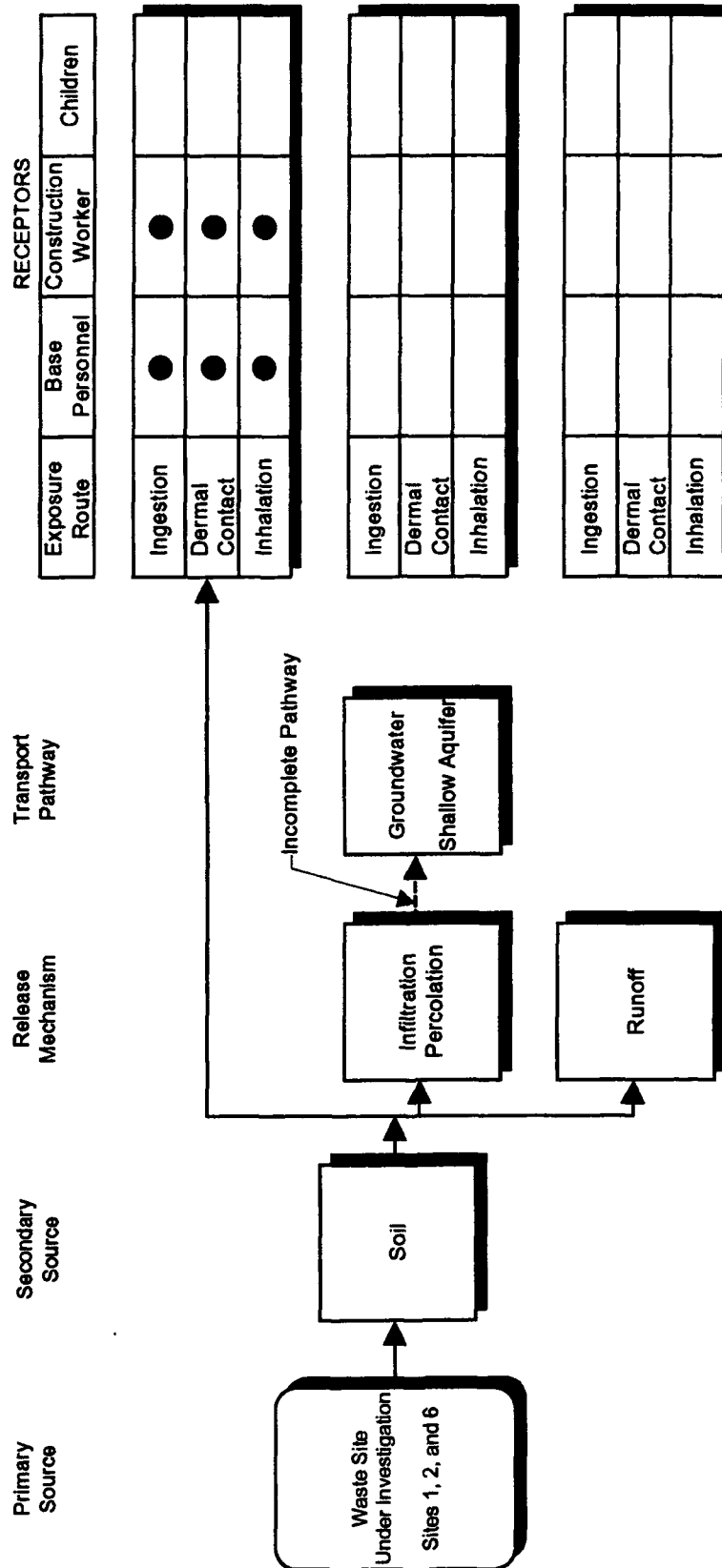
The exposure assessment may be qualitatively summarized as a conceptual site model for each site, as presented in Figures 4-6 and 4-7. Conceptual models of the sites under investigation at IANG, Gowen Field have been prepared to characterize the transport of a chemical from the source of release to receptors at potential risk of exposure. Following EPA guidance, the conceptual site models identify the sources and types of environmental release and links these with receptor locations and activity patterns to determine the important pathways of human exposure (EPA 1989a).

A conceptual site model has been prepared for Sites 1, 2, and 6. A separate model has been prepared for Site 3. Based on the available site-specific data and discussions with IANG personnel, the transport and exposure pathways for Sites 1, 2, and 6 are similar and may be represented by a single model. For Site 3, the sources of release, transport pathways, and receptors groups warrant the development of a different conceptual model.

4.3.3.1 Conceptual Models for Sites 1, 2, and 6

The general model for Sites 1, 2, and 6 depict chemical transport and potential routes of human exposure. As shown in Figure 4-6, the waste site (i.e., Site 1, 2, or 6) may act as potential sources of chemicals migrating into soils beneath the site. Once in soils, further chemical transport may occur via runoff, infiltration or percolation, or via entrainment of particulates or volatile emissions into the atmosphere.

Conceptual Site Model : Sites 1, 2, and 6



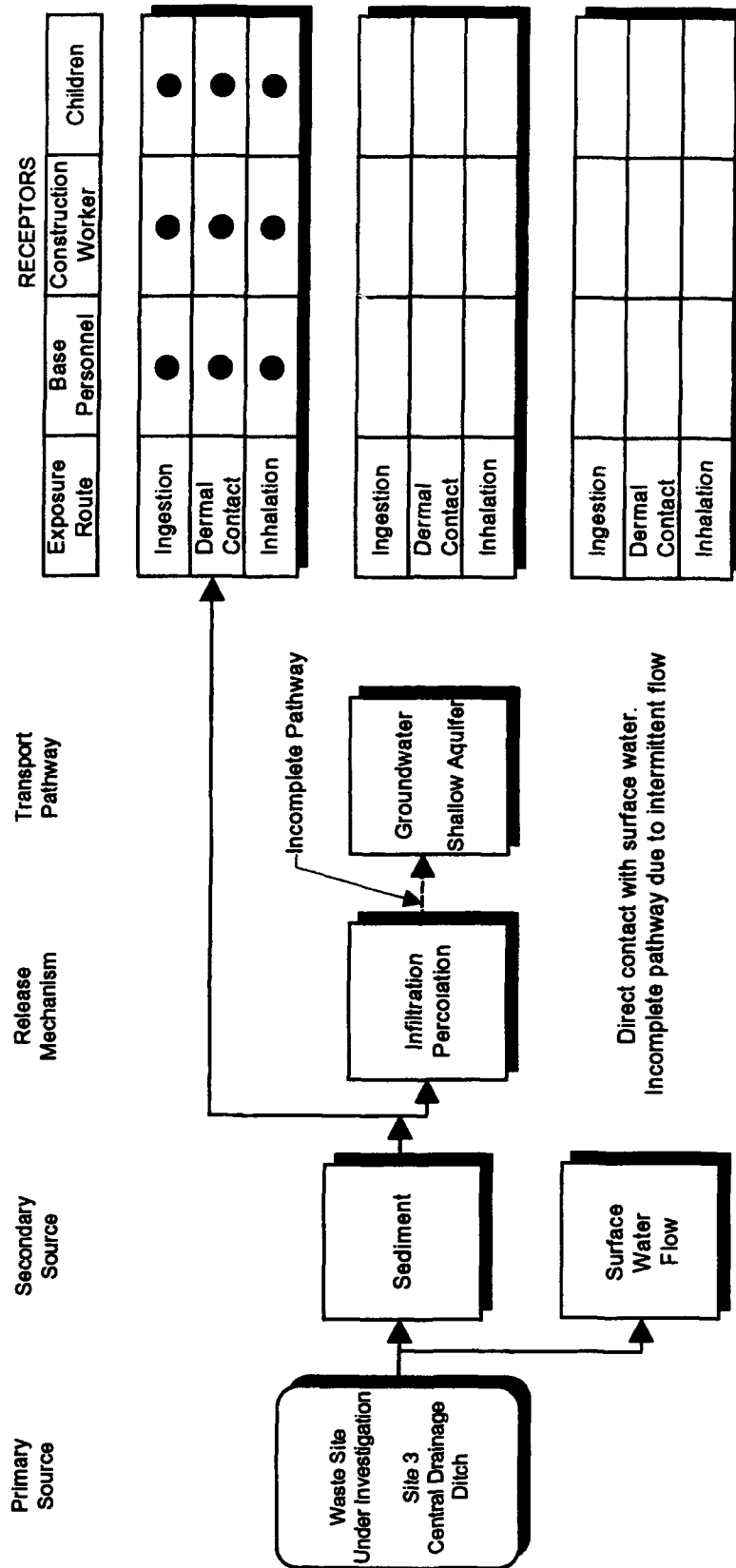
Sites 1, 2, and 6 -
Conceptual Site Model

Idaho Air National Guard
Gowen Field, Boise, Idaho

Figure: 4-6

Project: 01-0827-07-0880-010

Conceptual Site Model : Site 3



Site 3 - Conceptual Site Model

Idaho Air National Guard
Gowen Field, Boise, Idaho

Figure: 4-7

Project: 01-0827-07-0880-010

Base personnel (such as maintenance workers), and construction workers are the most likely receptor groups at potential risk of exposure to chemicals present at the waste sites under investigation. In this baseline assessment, the exposure pathways of principal concern for Sites 1, 2, and 6 are inadvertent ingestion and dermal exposure to soils (i.e., direct contact).

The inhalation exposure estimates for suspended soil or sediment particulates (dust) originating from the waste sites is likely to overstate exposures, since Sites 1, 2 and 6 are infrequently visited by Base personnel. Volatile emissions from soils will not be considered further since the low levels of observed volatile organic contamination would result in extremely low emission rates, and because the exposure points are all outdoors where vapor concentration would not occur due to atmospheric dilution.

Site 6 is surrounded by an additional fence and Base personnel do not regularly visit the site (IANG, March 1991). Risk assessment will be conducted for potential exposure to soils in the vicinity of this site. During the summer months there is some release of volatile organics from Site 6 when the waste tar softens, however, there are no sample data for these emissions (a complex mixture of organics), which are typical of asphalt or tar used in construction. Therefore, these volatile emissions will not be considered further.

As noted above, the deeper aquifer that is used for potable water supply is not at risk of contamination from chemicals present at, or released from Sites 1, 2, and 6. Therefore, there is no conceptual site model of exposure to Base personnel or the surrounding community to site-related chemicals via the groundwater pathway. This exposure pathway is depicted as incomplete in Figure 4-6.

4.3.3.2 Conceptual Model for Site 3

Site 3 - Central Drainage Ditch is a drainage channel receiving surface runoff from the Base. Sediment samples were obtained along the length of the ditch as it passes through the Base in an effort to characterize stream bed contamination.

As discussed previously, access to the Base is controlled and restricted to National Guard personnel and maintenance workers. The only exception to this is the occasional use of the pavilion located centrally on Base near the Central Drainage Ditch. It is used periodically by the families of Base personnel for recreational activities. There are no housing facilities located on the Base and use of the pavilion by the public is very limited. A volleyball field is located in proximity to the pavilion but is used only by Base personnel (IANG, March 1991).

The pavilion is located approximately 40 yards north of the drainage ditch. Children related to Base personnel occasionally participate in recreational activities at the pavilion but reportedly do not play in the drainage ditch. However, because of the proximity of the pavilion to the ditch, a very conservative hypothetical exposure scenario of children to sediments is included in the baseline risk assessment. As an added conservative step, sediment exposures also have been included for Base personnel, maintenance, and construction workers. These workers could be exposed either from soils located in the ditch, from soils removed from the ditch, or from soils graded onto nearby areas. Inadvertent ingestion, dermal contact, and inhalation of dust are the pathways evaluated for these receptors. The central drainage ditch is not considered to be a major pathway for water flow off of the Base. The intermittent water flow in the ditch, and the presence of porous near surface soils that allow for the percolation of the limited runoff that discharges to the ditch, does not allow for the ditch to consistently transport water. Consequently, no off-Base receptors were considered as part of the exposure scenario.

Figure 4-7 is the conceptual site model for Site 3. As shown, runoff to the ditch (primary source) results in observed concentrations of chemicals in sediments (secondary contamination). The subsurface contaminant transport model for soils indicates that the chemicals in sediments are also unlikely to migrate from sediments to subsurface soils. Surface soils may, however, move to the atmosphere as entrained particulates. This occurrence would vary depending on the moisture content of the sediments.

Ingestion, dermal contact and inhalation of surface sediments (dust) are the exposure pathways of concern. Since the observed concentrations of volatile chemicals are low and all

exposures would occur outdoors, inhalation exposure to volatiles is not of concern. Therefore, exposure estimates to dust is likely to be overestimated for Site 3 since the sediments are likely to be moist due to intermittent flow in the ditch.

Direct contact with surface water via swimming or wading is not possible due to the intermittent flow, the infrequency with which Base personnel are in proximity and the implausibility of swimming or wading in the ditch.

4.3.4 Exposure Assumptions

This section presents the exposure equations and assumptions used in deriving intake estimates for use in risk assessment. Six exposure pathways are considered:

- Ingestion exposure of Base personnel to soils and sediments
- Dermal contact of Base personnel to soils and sediments
- Ingestion exposure of Construction workers to soils and sediments
- Dermal contact of Construction workers to soils and sediments
- Ingestion exposure of children of Base personnel to sediments in the Central Drainage Ditch
- Dermal exposure of children of Base personnel to sediments in the Central Drainage Ditch.

These are the pathways for which exposure is considered in the baseline risk assessment. Exposure point concentrations (EPCs) are the concentrations of chemicals reportedly available to human receptors at the point of contact. EPCs for the risk estimates are developed from appropriate sample data. Exposure assumptions and factors were selected to be upper-bound (conservative) estimates of potential health risks. These estimates are characterizations, not absolute projections or measurements of adverse human health effects.

The EPCs for this baseline risk assessment are the arithmetic averages of the environmental concentration that the receptor may experience over the exposure period (EPA 1989a). Because uncertainty is associated with any estimate of exposure concentration,

the upper confidence limit (i.e., the 95 percent upper confidence limit) of the arithmetic average is recommended by EPA for use in risk assessment (EPA 1989a).

The 95th percent upper bound estimate on the arithmetic mean generally falls above the arithmetic average and below the maximum observed sample data value. Risk estimates based upon these reasonable maximum exposure (RME) EPCs serve to characterize upper bound risks to human health. If the sample set is small, or if there is considerable variability in measured concentrations, the RME estimate of the arithmetic mean may exceed the maximum value observed at the site. Under these circumstances, EPA recommends replacing the upper confidence level (UCL) with the maximum observed concentration for use in the baseline risk assessment.

The baseline risk assessment is based on both the arithmetic mean and the upper confidence limit of the arithmetic mean of the contaminant concentrations detected in soils and sediments. In cases where the mean or upper confidence limit of the mean exceeded the maximum, EPCs were obtained by substituting maximum concentrations. In addition, two sets of exposure parameters are used, one representing average exposures and another representing upper-bound RMEs. Use of the arithmetic mean and the upper confidence limit of the mean (or maximum) for concentrations, and of most likely exposure (MLE) and RME exposure parameters is intended to provide a range of estimates of the potential risks to human health. A range of estimates is preferable since single point estimates tend to falsely convey more certainty than is appropriate, and thus do not reflect the inherent uncertainty of the risk assessment. Exposure point concentrations used in the baseline risk assessment are presented as summary statistics Appendix H, and exposure parameters are presented in Table 4-7.

A relative absorption factor of 1.0 is used for the ingestion pathways, indicating that absorption in humans is equivalent to that of the laboratory test species of which the toxicity values were derived. All chemicals are assumed not to transform or degrade over the period of exposure. The use of the intake equations presented in Section 4.3.4.1 is in accordance with methods presented by EPA in the RAGS (EPA 1989a,b, 1991a and 1992d).

**Table 4-7. Intake Equation Exposure Parameters - Idaho Air National Guard
124th Reconnaissance Group, Gowen Field, Boise, Idaho**

Exposure Route and Parameter	Parameter Definition	Units	Base Personnel		Construction Worker		Children at Play (ages 1 to 6 years)	
Ingestion of solids/sediments	Concentration	mg/kg	RME	MLE	RME	MLE	RME	MLE
	Contact rate	mg/day	100	h	500	d	200	a
	Units conversion	mg/kg	1 x 10E6	1 x 10E6	1 x 10E6	1 x 10E6	1 x 10E6	1 x 10E6
	Exposure frequency	days/year	80	h	250	f	18	h
	Exposure duration	years	20	e	2	f	6	i
	Body weight	kg	70	a	70	a	15	a
	Noncancer averaging time	days	7,300	c	730	c	2,190	c
	Cancer averaging time	days	25,550	b	25,550	b	25,550	b
Inhalation of airborne solids/sediments	Concentration	mg/kg	RME	MLE	RME	MLE	RME	MLE
	Particulate emission factor	m3/kg	4.63 x 10E9	k	4.63 x 10E9	k	4.63 x 10E9	k
	Inhalation rate	m3/day	20	a	30	d	20	a
	Exposure frequency	year	80	h	250	f	18	h
	Exposure duration	years	20	a	2	f	6	i
	Body weight	kg	70	a	70	a	15	a
	Noncancer averaging time	days	7,300	c	730	c	2,190	c
	Cancer averaging time	days	25,550	b	25,550	b	25,550	b
Dermal exposure to solids/sediments	Concentration	mg/kg	RME	MLE	RME	MLE	RME	MLE
	Units conversion	mg/kg	1 x 10E6	1 x 10E6	1 x 10E6	1 x 10E6	1 x 10E6	1 x 10E6
	Surface area	cm2/day	5,800	j	5,800	j	2,010	j
	Soil to skin adhesion factor	mg/cm2	1	j	1	j	1	j
	Absorption factor for inorganics	none	0.001	g	0.001	g	0.001	g
	Absorption factor for inorganics	none	0.01	g	0.01	g	0.01	g
	Exposure frequency	days/year	80	h	250	f	18	h
	Exposure duration	years	20	a	2	f	6	i
	Body weight	kg	70	a	70	a	15	a
	Noncancer averaging time	days	7,300	c	730	c	2,190	c
	Cancer averaging time	days	25,550	b	25,550	b	25,550	b

- a - USEPA, RAGS 1991, Supplemental Guidance, Standard Default Exposure Factors
b - USEPA, RAGS 1989, Part A
c - equal to ED
d - elevated value assumed due to excavation
e - site-specific value; personal communication with IANG personnel
f - assumes a two year full-time project with excavation
g - Relative Absorption Factor recommended by EPA Region IV
h - assumption made for value two times average (typical) reported for site as a reasonable upper-bound estimate.
i - RME value adopted for MLE
j - Dermal Exposure Assessment: Principles and Applications (USEPA, 1992)
k - USEPA, RAGS 1992, Part B
l - covers ages 1 to 6 years

4.3.4.1 Exposure to Soils and Sediments

Sampling data are available for chemicals in soils to a depth greater than 100 feet BLS. In general, there is no potential for direct exposure to chemicals in soils at a depth greater than 6 to 18 inches BLS. During construction activities (e.g., excavation such as construction of foundations or basements), however, workers may be exposed to soils to a depth of approximately 15 feet BLS. The baseline risk assessment, therefore, evaluates construction worker exposures to chemicals in soils to a depth of 15 feet BLS. Human health effects from exposure to soils at depths greater than 15 feet BLS will not be considered. Nonconstruction exposures to Base personnel and children will be based on surface soil data where available, and soils at 15 feet BLS if surface soil data is unavailable.

Base personnel including IANG staff involved with daily activities may inadvertently contact surficial soils and sediments. Incidental ingestion exposure by Base personnel of soils and sediments may occur during maintenance and inspection activities at the sites under investigation. Base personnel indicate that activities at these sites is very infrequent and that soil exposure is minimal. Exposure frequency is expected to average one event per week at any of the sites and twice this value as a reasonable maximum exposure. Exposures are assumed to occur over a 20 year period (IANG, March 1991).

Base personnel or others involved with heavier work, such as excavation, would come in contact with shallow or deeper soils at relatively higher contact rates (i.e., more soil is ingested on a day of exposure than for other receptors). Construction activities are assumed to occur for a full-time worker (250 days per year) over a 2 year period. Exposure parameters for the worker are a reasonable estimate based upon professional judgment.

Exposure of Base personnel children to sediments in the vicinity of the pavilion (i.e., in Site 3 - Central Drainage Ditch) is considered unlikely. Children were included in the risk assessment in order to comprehensively evaluate human health effects and to conservatively evaluate the significance of the observed levels of sediment contamination. Although the pavilion is used throughout the year for recreational activities, a National Guard family member would not use the pavilion more than one day a month (IANG, March 1991). It is assumed that

most guard units use facility pavilions on an average of two times per year. Exposure of children ages 1 to 6 years is projected to occur while the children are playing in the ditch during pavilion activities sponsored by the Base. Exposures are assumed to occur 9 days per year, with a reasonable maximum exposure assumed to be twice this amount (18 days per year).

Intake estimates for ingestion exposure to soils in the vicinity of Sites 1, 2, 6, and sediments in Site 3 are determined as follows:

$$Intake = C \times \frac{CR \times CF \times EF \times ED}{BW \times AT}$$

where

- C = Chemical concentration in soils or sediments (mg/kg)
- CR = Contact rate (g/day)
- CF = Units conversion factor (1×10^{-6} kg/mg)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years)
- BW = Average body weight (kg)
- AT = Averaging time for noncarcinogenic effects (days), or Averaging time for cancer risk estimates (days).

Intake estimates for soil and sediment inhalation exposures via airborne dusts are estimated as follows:

$$Intake \text{ (mg/kg-day)} = \frac{CS \times IR \times EF \times ED}{PEF \times BW \times AT}$$

where

- C = Chemical concentration in soil/sediment (mg/kg)
- CF = Units conversion factor (1×10^{-6} kg/mg)
- IR = Inhalation Rate (m^3 /day)
- PEF = Particulate emission factor (kg/m^3)

- EF = Exposure frequency (days/year)
 ED = Exposure duration (days)
 BW = Average body weight (kg)
 AT = Averaging time for noncarcinogenic effects (days), or
 Averaging time for cancer risk estimates (days).

Dermal exposure is assumed to occur simultaneously with inadvertent ingestion exposure during play, or maintenance and inspection activities. The skin surface area available for contact is assumed be somewhat less than the entire surface area of the body, such as arms and hands. Dose estimates for dermal exposures to soil in the vicinity of Sites 1, 2, and 6 and sediments in Site 3 are determined as follows:

$$Dose = C \times \frac{CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where

- C = Chemical concentration in soils or sediments (mg/kg)
 CF = Conversion factor (1×10^{-6} kg/mg)
 SA = Skin surface area available for contact (cm²)
 AF = Soil to skin Adherence Factor (mg/cm²)
 ABS = Soil and Sediment Relative Absorption factor (unitless)
 EF = Exposure frequency (days/year)
 ED = Exposure duration (years)
 BW = Average body weight (kg)
 AT = Averaging time for noncarcinogenic effects (days), or Averaging time for cancer risk estimates (days).

4.4 TOXICITY ASSESSMENT

The objectives of the toxicity assessment are to evaluate the inherent toxicity of the compounds under investigation, and to identify and select toxicological measures for use in evaluating the significance of the exposure. In the development of these toxicological measures,

available dose-response data are reviewed on the adverse effects to human and nonhuman receptors.

The baseline risk assessment has adopted two basic approaches to evaluating noncancer and cancer health effects to humans resulting from exposure to chemical contaminants. The methods are recommended by the EPA, and reflect a fundamental difference in proposed mechanism of toxic action. In assessing the potential for noncancer health effects, EPA assumes the existence of a threshold below which there are no adverse toxic effects. An example of a toxicologic threshold is when a repair process must be overwhelmed before adverse effects present themselves. In contrast, a "nonthreshold" exposure to a carcinogen always carries some risk of adverse effect. For example, an extremely low level of exposure to a carcinogen may result in chromosomal or enzyme changes leading to cellular proliferation associated with cancer.

EPA derives and publishes reference doses (RfDs) and reference concentrations (RfCs) for use in evaluating adverse noncarcinogenic effects. These are estimates (with uncertainty spanning an order of magnitude or greater) of daily human exposures, including sensitive subpopulations, that may go without appreciable deleterious effects during a lifetime (EPA 1989a). EPA derives RfDs and RfCs based on estimates of the no-observable-adverse-effect level (NOAEL) or lowest-observable-adverse-effect level (LOAEL) in humans or test animals. The assessment of the potential for noncarcinogenic effects (i.e., the use of RfDs and RfCs in risk assessment) is based on the assumption of a threshold below which adverse health effects are not anticipated to occur. Carcinogenesis, however, is generally thought to be a phenomenon for which the presumption of threshold effects is inappropriate (EPA 1989a). EPA does not therefore estimate an effects threshold for this class of chemicals. EPA uses a two part evaluation in which the subject chemical is first assigned a weight-of-evidence classification, and then a cancer potency (slope factor) is calculated.

The cancer potency factor is a plausible upper bound estimate of the slope of the dose-response curve in the low dose range. It is interpreted as the probability of a cancer response per unit intake of a chemical over a lifetime. In risk assessment, the cancer slope (potency)

factor is used to estimate the excess lifetime probability of a carcinogenic effect occurring in exposed receptors.

The weight-of-evidence classification evaluates the evidence that a given chemical is a carcinogen to humans and animals. These ratings are as follows:

- A: Human carcinogen
- B1: Probable human carcinogen - limited human data are available
- B2: Probable human carcinogen - sufficient data in animals, and inadequate or no evidence in humans
- C: Possible human carcinogen
- D: Not classifiable as to human carcinogenicity.

EPA develops cancer slope factors for carcinogens that have been rated A, B1, B2, and for many that have been rated class C. The cancer slope factor is a plausible upper bound estimate of the slope of the dose-response curve in the low dose range. It is interpreted as the probability that cancer will occur after intake of a specific dose. The cancer slope factor is used to estimate risk to the receptor from the given dose. The units of the cancer slope factor are in units of inverse dose, or $(\text{mg/kg/day})^{-1}$.

For the assessment of human health risk of exposure to chemicals at IANG, Gowen Field, the following toxicity values are of principal importance:

- RfDs for oral exposure - acceptable intake values for chronic exposure (noncarcinogenic effects)
- RfCs for inhalation exposure - acceptable intake values for chronic exposure (noncarcinogenic effects)
- Carcinogenic slope factors for oral exposure
- Carcinogenic slope factors for the inhalation route.

The primary sources of information for these data is the EPA Integrated Risk Information System (IRIS) data base (EPA 1993). IRIS is a computer-housed catalog of EPA risk assessment

and risk management information for chemical substances. Data in the IRIS system are regularly reviewed and updated monthly. If toxicity measures are not available on IRIS, EPA recommends use of the EPA Office of Research and Development (ORD) Health Effects Assessment Summary Tables (HEAST) (EPA 1992a) as the second current source of information.

Table 4-8 is a summary of the toxicity values used in the health risk assessment at IANG, Gowen Field. The toxicity values used in the risk assessment are from the IRIS database and the HEAST publications from EPA's ORD. Priority is given to the values obtained from the IRIS database as they have been verified by the EPA RfD/RfC Work Group or the Carcinogen Risk Assessment Verification Endeavor (CRAVE) Work Group. When a value is not available on IRIS, the HEAST tables are then consulted. Therefore, the risk assessment is based on the most current EPA-approved toxicity values for waste site evaluation. Since chromium samples were not distinguished as to the valence state, the risk assessment makes the conservative assumption that chromium is present in the most toxic form, hexavalent chromium (Cr^{+6}).

In instances of which toxicity information is not available, another approach has been taken to evaluate the toxic effects of a chemical or groups of chemicals. The following information was not available for this risk assessment:

- Toxicity values for the dermal pathway
- Verified reference dose for lead
- Reference doses or cancer slope factors for many PAHs
- Cancer slope factors for most dioxins and furans.

Dermal Toxicity Values -- Toxicity values are available only for the oral and inhalation pathways. EPA has not published toxicity values for evaluating the dermal contact pathway.

Table 4-8. Toxicity Values for Waste Site Evaluation: Ingestion and Inhalation Pathways
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho

COMPOUND	NONCARCINOGENIC									
	Effects		Uncertainty		Effects		Uncertainty		Source	Target Organ and Clinical Effect
	Oral Route (mg/kg/day)	RD-50 (mg/kg)	Oral Route (mg/kg/day)	Factor (chronic)	Inhalation Route (mg/kg/day)	RD-50 (mg/kg)	Inhalation Route (mg/kg/day)	Factor (chronic)		
INORGANICS										
Asimic	3.0E-04	3.0E-04	3	3	4c	4c	4c	4c	4c	skin, lacrimal, hyperpigmentation no observed effects
Beryllium	5.0E-03	5.0E-03	100	100	4c	4c	4c	4c	4c	kidney, prostate
Cadmium (total)	5.0E-04	5.0E-04	10	10	c	c	c	c	c	kidney, prostate
Cadmium (inorg)	1.0E-03	1.0E-03	10	10	c	c	c	c	c	kidney, prostate
Chromium	2.0E-02	2.0E-02	100	100	4c	4c	4c	4c	4c	no observed effects
Chromium (VI)	2.0E-02	2.0E-02	100	100	4c	4c	4c	4c	4c	no observed effects
Copper	3.0E-02	3.0E-02	100	100	4c	4c	4c	4c	4c	Gastrointestinal system, irritation
Lead	3.0E-02	3.0E-02	100	100	4c	4c	4c	4c	4c	CNS, blood
Nickel	2.0E-02	2.0E-02	300	300	4c	4c	4c	4c	4c	dec. body and organ weight
Selenium	5.0E-03	5.0E-03	3	3	4c	4c	4c	4c	4c	whole body clinical endpoints
Silver	5.0E-03	5.0E-03	3	3	4c	4c	4c	4c	4c	skin, eyes
Thallium	7.0E-04	7.0E-04	300	300	d	d	d	d	d	liver, blood; inc. apt and serum LDH
Zinc	2.0E-01	2.0E-01	10	3	4c	4c	4c	4c	4c	blood; anemia
* - values are for dithionite										
ORGANICS										
Acetone	1.0E-01	1.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Aniline	3.0E-01	3.0E-01	300	3000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Benzene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Benz(a)pyrene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Benz(b)fluoranthene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Benz(g,h,i)perylene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Benz(k)fluoranthene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Chrysene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
4,4'-DDT	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
4,4'-DDE	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
4,4'-DDT	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Dieldrin	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
2,4-Dichlorobenzene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Endosulfan I	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Endosulfan II	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Endrin	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Endrin Alderhyde	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Ethylbenzene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Fluorobenzene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Fluorene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Gamma-BHC (Lindane)	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Methoxychlor	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Methylene Chloride	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
2-Methylimidazole	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
4-Methyl-2-pentanone	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Naphthalene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Pentachlorophenol	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Phenanthrene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Pyrene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
1,2,3,4,6,7,8-HpCDF	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
1,2,3,4,7,8,9-HpCDD	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
OCDD	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
OCDF	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Tetrachloroethylene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Toluene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Trichloroethylene	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects
Xylenes	3.0E-01	3.0E-01	100	1000	4c	4c	4c	4c	4c	inc. liver, kidney weights, nephrotoxicity no observed effects

Table 4-8. Toxicity Values for Waste Site Evaluation:
Ingestion and Inhalation Pathways
Idaho Air National Guard, 124th Reconnaissance Group,
Gowen Field, Boise, Idaho (continued)

COMPOUND	CARCINOGENIC					
	Cancer Slope Factor (CSF): Oral Route (mg/kg/day) ⁻¹	WOE	Unit Risk Factor: Oral Route (μg/l) ⁻¹	Cancer Slope Factor (CSF): Inhalation Route (mg/kg/day) ⁻¹	Unit Risk Factor: Inhalation Route (μg/m ³) ⁻¹	Source (Inhal.)
INORGANICS						
Arsenic	1.70E+00	[A]	5.00E-05	5.00E+01	4.30E-03	[A]
Beryllium	4.30E+00	[B2]	1.20E-04	8.40E+00	2.40E-03	[B2]
Cadmium (water)	--	--	--	6.10E+00	1.90E-03	[B1]
Cadmium (food)	--	--	--	4.10E+00	1.90E-03	[B1]
Chromium	--	--	--	4.10E+01	1.20E-02	[A]
Chromium (VI)	--	--	--	4.10E+01	1.20E-02	[A]
Copper	--	[D]	--	--	--	--
Lead	--	[B2]	--	--	--	--
Nickel	--	[D]	--	--	--	--
Selenium	--	[D]	--	--	--	--
Silver	--	[D]	--	--	--	--
Thallium	--	[D]	--	--	--	--
Zinc	--	[D]	--	--	--	--
* - values are for thallous oxide						
ORGANICS						
Acetone	--	[D]	--	--	--	--
Acetone	--	[D]	--	--	--	--
Benzo(a)pyrene	2.90E-02	[A]	8.30E-07	2.90E-02	8.30E-06	[A]
Benzo(b)fluoranthene	7.30E+00	[B2]	2.10E-04	6.10E+00	1.70E-03	[B2]
Benzo(k)fluoranthene	1.02E+00	[B2]	--	1.02E+00	--	[B2]
Bis(2-ethylhexyl)phthalate	1.40E-02	[B2]	4.00E-07	--	--	--
Butyl benzyl phthalate	--	[C]	--	--	--	--
Chlorobenzene	--	[D]	--	--	--	--
Chrysene	3.21E-02	[B2]	--	3.21E-02	--	[B2]
4,4'-DDD	2.40E-01	[B2]	6.90E-06	--	--	--
4,4'-DDE	3.40E-01	[B2]	9.70E-06	--	--	--
4,4'-DDT	3.40E-01	[B2]	9.70E-06	--	--	--
Dieldrin	1.60E+01	[B2]	4.60E-04	--	--	--
2,4-Dinitrochlorobenzene	--	--	--	--	--	--
Endosulfan I	--	--	--	--	--	--
Endosulfan II	--	--	--	--	--	--
Endrin	--	[D]	--	--	--	--
Endrin Alderhyde	--	[D]	--	--	--	--
Ethylbenzene	--	[D]	--	--	--	--
Fluorene	--	[D]	--	--	--	--
gamma-BHC (Lindane)	1.30E+00	[C]	3.70E-05	--	--	--
Methoxychlor	--	[D]	--	--	--	--
Methylene Chloride	7.50E-03	[B2]	2.10E-07	--	--	[B2]
2-Methylnaphthalene	--	--	--	--	--	--
4-Methyl-2-pentene	--	--	--	--	--	--
Naphthalene	--	[D]	--	--	--	--
Perchloroethanol	1.20E-01	[B2]	3.00E-06	--	--	[B2]
Phenanthrene	--	[D]	--	--	--	--
Pyrene	--	[D]	--	--	--	--
1,2,3,4,6,7,8-HpCDF	1.50E+03	TBF	--	1.50E+03	--	--
1,2,3,4,7,8-HpCDD	1.50E+03	TBF	--	1.50E+03	--	--
OCDD	1.50E+02	TBF	--	1.50E+03	--	--
OCDF	1.50E+02	TBF	--	1.50E+03	--	--
Tetrachloroethylene	--	[D]	--	--	--	--
Toluene	--	[D]	--	--	--	--
Trichloroethylene	--	[D]	--	--	--	--
Xylene	--	[D]	--	--	--	--

**Table 4-8. Toxicity Values for Waste Site Evaluation: Ingestion and Inhalation Pathways
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho**

- a. RfD-S: Reference dose for subchronic exposure, oral route. RfD-C: Reference dose for chronic (long-term) exposure, oral route.
- b. RfC-S: Reference concentration for subchronic (short-term) exposure, inhalation route. RfC-C: Reference concentration for chronic (long-term) exposure, inhalation route.
- c. EPA TUS Data Base (April 1992 release-NTIS).
- d. USEPA ORD Health Effects Assessment Summary Tables (HEAST) FY 1992.
- e. The oral unit risk has been proposed by EPA. The oral slope factor was calculated from the unit risk by assuming an ingestion of 2 liters of water per day by a 70 kg adult.
- f. EPA has not developed a reference dose for lead. EPA recommends use of the lead biokinetic model to estimate blood lead levels for the purposes of risk assessment.
- g. Toxicity measures presented are for mixed xylenes.
- h. In the absence of toxicity data, the RfDs for pyrene have been adopted for this compound.
- i. The cancer slope factor for this compound has been estimated by multiplying the cancer slope factor for benzo(a)pyrene by a toxicity equivalency factor (USEPA Region IV, Interim Guidance, February 11, 1992). This method was also adopted for the inhalation slope factors (personal communication with Dr. Elmer Aiken, USEPA Region IV, October 19, 1992).
- j. EPA Office of Drinking Water MCL of 1.3 mg/L has been converted to intake estimate of 3.7E-02 mg/kg-day by assuming ingestion of 2 liters of water/day by a 70 kg adult.
- k. Reference dose for vinyl chloride was derived from the EPA OOW longer-term drinking water health advisory.
- l. RfD for chronic exposure to 70 kg adult derived from EPA ADI of 0.025 mg/day. Drinking Water Criteria Document for Benzene (USEPA 1985, EPA Office of Drinking Water).
- m. In the absence of data, the cancer slope factor for PCBs as a class of compounds has been adopted for Aroclor-1248, Aroclor-1254, and Aroclor-1260.
- n. EPA has withdrawn the chronic oral RfD for manganese from IRIS (Oct. 1992). In the absence of another value, the RfD previous to its withdrawal has been listed.
- o. Values are for metals in the form of soluble salts.
- p. Radionuclide slope factors from HEAST January 1992.
- q. EPA has withdrawn the chronic oral RfD for endosulfan from IRIS (Dec. 1992). In the absence of another value, the RfD previous to its withdrawal has been listed.

In the *Dermal Exposure Assessment* document (EPA 1992b), EPA states:

...if estimates of the gastrointestinal absorption fraction are available for the compound of interest in the appropriate vehicle, then the oral dose-response factor, unadjusted for absorption, can be converted to an absorbed dose basis...Lacking this information, the oral factor should be used as is [for evaluating dermal uptake] accompanied by a strong statement emphasizing the uncertainty involved.

The adjustment of the oral toxicity measure requires sufficient data from the principal laboratory studies on oral absorption efficiency in the species of which the toxicity measures are based. Since researching studies of gastrointestinal absorption estimates is beyond the scope of this risk assessment, the oral toxicity values have been used to estimate risk. It should be noted that because this approach uses cross-route absorption efficiencies and toxicologic mechanisms that may not be directly comparable, this evaluation is a source of uncertainty.

Dermal Absorption -- For soil, dermal absorption values of 0.001 (0.1 percent) for inorganic analytes and 0.01 (1 percent) for organic compounds were used based on EPA Region IV recommendations (EPA 1992c). These values are relative absorption factors which convert intake (applied dose) to absorbed dose (i.e., the amount of chemical absorbed into the blood stream).

Lead -- Lead does not have a verified reference dose. Therefore, lead exposures have been analyzed by estimating blood lead levels using EPA's uptake/biokinetic computer program, LEAD 0.5 (EPA 1991d). The approach using the lead uptake model and the corresponding results are presented in Section 4.5.1.2.

PAHs -- Many PAHs do not have published reference doses for noncancer effects or slope factors for carcinogenic effects. In order to evaluate these effects, PAHs exhibiting noncancer effects were assigned a reference dose equivalent to that of pyrene (EPA 1992b).

Two approaches to risk assessment may be adopted for PAHs exhibiting carcinogenic effects. The first approach is to assume that the cancer slope factor for all carcinogenic PAHs

are equivalent to that of benzo(a)pyrene, which is the only PAH for which an agency-verified slope factor exists. This method is conservative, in that benzo(a)pyrene has a greater cancer potency than the other carcinogenic PAHs. This also means that the cancer risk posed by PAHs will be intentionally overestimated.

The second approach is a more realistic, scientifically-based refinement over the first approach. Using this approach, relative potency factors have been applied to the detected carcinogenic PAHs, relating their cancer potencies to the cancer slope factor of benzo(a)pyrene, which is $7.3 \text{ (mg/kg-day)}^{-1}$. For these substances, the relative cancer potency factors are fractional multipliers used to yield substance-specific oral cancer potency factors that are generally somewhat less than that of benzo(a)pyrene. The relative cancer potency factors are presented in Table 4-9 and have been integrated into the toxicity table (Table 4-8) and risk calculations for IANG, Gowen Field.

Table 4-9. Relative Potency Factors for Carcinogenic PAHs

Chemical	Relative Potency Factor
Benzo(a)pyrene	1.00
Benzo(b)fluoranthene	0.100
Benzo(k)fluoranthene	0.100
Chrysene	0.010
Benzo(g,h,i)perylene	1.00
Pyrene	0.081

EPA recommends against quantitative evaluation of carcinogenic PAHs for the dermal contact route until appropriate toxicity values become available. Because compounds such as benzo(a)pyrene cause skin cancer at the point of application, it is imprecise to use the oral slope factor to evaluate these risks (EPA 1992b). The alternative, however, is to remove dermal PAH exposures from the quantitative risk assessment. As an added conservative measure, carcinogenic PAHs for the dermal contact route were included in the quantitative risk estimates and evaluated using the oral slope factors. Although this approach is uncertain, the direction

of the introduced bias is toward overestimating risk when compared to exclusion from the quantitative estimates.

Dioxins and Furans -- Dioxins and furans are a class of related chemicals that are of potential concern since the fire training area at Site 1 contains these substances. The primary toxicologic endpoint of concern for these substances is cancer. However, a cancer slope factor is available for only one of these substances: 2,3,7,8-TCDD (1.5×10^5 [mg/kg-day⁻¹]). This is an extremely high cancer potency value (i.e., small amounts of dioxins and furans are associated with relatively large cancer effects). However, this potency factor is currently under review and may eventually be revised.

In a manner similar to that described above for the PAHs, published toxicity equivalence factors are currently under review by EPA. The approach is a scientifically based and more realistic refinement than the approach of assuming cancer slope factor equivalence for all congeners. The toxicity equivalence factor approach has been used in the baseline risk assessment in an effort to more realistically account for the potential toxic effects related to dioxins and furans (EPA 1992c). The toxicity equivalence factors are applicable only to oral and inhalation cancer potency values, and are multipliers relating the appropriate cancer potency of a given dioxin and furan to that of 2,3,7,8-TCDD. The available toxicity equivalence factors are presented in Table 4-10.

Table 4-10. Toxicity Equivalence Factors for Dioxins and Furans

Analyte	Toxicity Equivalent Factor
1,2,3,4,5,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDD	0.01
OCDD	0.001
OCDF	0.001

4.5 RISK CHARACTERIZATION

This section presents the risk characterization for IANG, Gowen Field. Risk characterization integrates the exposure and toxicity assessments by comparing estimates of intake or dose with appropriate toxicity values. This in turn provides an indication of the potential for adverse effects to exposed receptors. The objective of the baseline risk characterization is to determine if exposure to chemicals associated with the IANG, Gowen Field sites poses risks that exceed EPA targets for human health or adverse ecological effects. The results of the risk assessment may thus support the determination of need for site remediation.

Section 4.5.1 presents an overview of risk characterization methods used in this assessment. This is followed by a summary of key considerations and assumptions in Section 4.5.2. Section 4.5.3 presents the results of risk characterization for each site, and includes an evaluation of background concentrations. Section 4.5.4 is an evaluation of the uncertainties associated in the risk estimates.

4.5.1 Risk Characterization Methods

4.5.1.1 General EPA Methods for Risk Assessment

This risk characterization presents a separate evaluation of noncarcinogenic and carcinogenic effects. The assessment distinguishes cancer from noncancer effects because organisms typically respond differently following exposure to carcinogenic or noncarcinogenic agents. The risk characterization evaluates adverse noncarcinogenic effects in terms of hazard quotients (HQ) for individual chemicals, and hazard indices (HI) for noncancer health effects following exposure to multiple chemicals or across multiple exposure pathways.

The cancer risks are probabilistic estimates of the excess (incremental) lifetime cancer risk (ELCR) of cancer for an individual that are specifically attributable to exposure to site-related chemicals. The cancer risk estimates are determined by multiplying the route-specific intake or dose estimates by cancer slope factors. The terms *excess* or *incremental* imply risk above and beyond that not originating at the site. It does not mean that site-related health effects have been excluded, in fact include all risks related to the observed contamination at the sites. The cancer risk estimates in this assessment are incremental risks associated with long-term

exposure to carcinogens; for as much as decades of contact with contaminated environmental media. Given the no threshold assumption for carcinogenesis adopted by EPA, every exposure to carcinogens is assumed to carry an increased risk of cancer.

The procedure for calculating risk associated with exposure to carcinogenic compounds has been established by EPA (EPA 1989a,c; EPA 1991c). A nonthreshold, dose-response model is used to calculate a cancer slope (potency) factor (which mathematically is the slope of the dose-response curve) for each chemical. To derive an estimate of risk, the cancer slope factor (CSF - defined below) is then multiplied by the estimated chronic daily dose experienced by the exposed individual:

$$\text{Risk} = \text{CDI} \times \text{CSF}$$

where

Risk = Upper bound estimate of the excess lifetime cancer risk to an individual (unitless probability).

CDI = Chronic daily dose averaged over a 70 year period (mg/kg body weight/day).

and,

CSF = 95% upper-bound estimate of the slope of the dose-response curve (mg/kg body weight/day)⁻¹.

The slope factor CSF is used to convert estimates of daily intake or dose averaged over a lifetime, to incremental excess risk of an individual developing cancer. EPA notes that use of this equation assumes that the dose-response relationship is linear in the low-dose portion of the multistage model dose-response curve (EPA 1991c: A linearized multistage dose response model is most commonly used by EPA in deriving the slope estimates). Given this assumption, the slope factor is a constant and risk is directly proportional to intake.

EPA indicates that use of the linear equation (above) for risk estimation is valid only at risk levels $< 1 \times 10^{-2}$. The Agency recommends use of the following equation (based on the "one-hit" model of carcinogenesis) as an alternative at sites where exposure and intakes are projected to be quite high, and risk levels may exceed 1×10^{-2} .

$$\text{Risk} = 1 - \exp(-\text{CDI} \times \text{CSF})$$

In evaluating risk of exposure to more than one carcinogen, the risk measure for each compound may be summed (in the absence of information on antagonistic or synergistic effects) to provide an overall estimate of total carcinogenic risk (EPA 1989a).

$$\text{Risk}_T = \sum_{i=1}^n \text{Risk}_i$$

where

Risk_T = The combined excess lifetime cancer risk across chemical carcinogens.

and,

Risk_i = The risk estimate for the i^{th} chemical of n chemicals under evaluation.

This is conducted for each source of environmental release, associated exposure pathway, and receptor group at risk of exposure. Population risks are derived by multiplying the overall risk level (summed for all subject chemicals) by the number of people exposed. This would yield a measure of the additional incidence of developing cancer (i.e., additional number of new cases) in the exposed population over a lifetime (i.e., 70 years) of exposure.

The traditionally accepted practice of evaluating exposure to noncarcinogenic compounds has been to experimentally determine a NOAEL and to divide this by a safety factor to establish an acceptable human dose, for example, acceptable daily intake or RfD. The RfD is then compared to the average daily dose experienced by the exposed population to obtain a measure of concern for adverse noncarcinogenic effects:

$$\text{HQ} = \frac{\text{Dose}}{\text{RfD}}$$

where

HQ = Hazard Quotient: potential for adverse noncarcinogenic effects

Dose = average daily dose for subchronic or chronic exposure (mg/kg body weight/day)

and,

RfD = acceptable intake for subchronic or chronic exposure (mg/kg body weight/day).

Dose and the RfD are expressed in the same units and are based upon common exposure periods (i.e., chronic, subchronic, or shorter-term). If HQ is > 1 , then there may be potential for adverse noncarcinogenic effects at the given exposure/dose level. Guidelines for evaluating exposure to mixtures of noncarcinogens is presented by EPA (EPA 1989a). Essentially, this involves summing the hazard quotient (ratios of daily dose/RfD) for all chemicals under evaluation. If the sum of these ratios is > 1 , then there is the potential for adverse noncarcinogenic effects. Under these circumstances, EPA recommends segregating the compounds into groups of like or common toxicological effects, and again to evaluate the potential for manifestation of the various adverse health effects identified.

4.5.1.2 EPA Risk Characterization Method for Lead

Recent toxicologic evidence indicate significant adverse health effects are apparent in children at relatively low levels of exposure to lead. Health effects associated with low level lead exposures include reproductive effects, neurological effects and learning disorders. At the present time, toxicologic studies indicate that there may not be a threshold of exposure below which adverse effects do not occur. Given the uncertainty surrounding an acceptable exposure below which there would be no adverse effects for lead, EPA has recently withdrawn the RfD for lead. In response to these recent developments, the Center for Disease Control (CDC) has established a guideline for acceptable blood lead levels in children of 10 (micrograms of lead per deciliter of blood) (lowered recently from 25 $\mu\text{g}/\text{dl}$).

Direct monitoring of blood lead levels in exposed populations are not available for the waste sites at IANG, Gowen Field. The risk characterization for lead at IANG, Gowen Field

is, therefore, based on an alternative method using a biokinetic model developed by EPA for this purpose.

The model, LEAD 0.5 (EPA 1991d), has been developed by EPA to estimate blood lead levels in children based upon uptake originating from various sources in the environment. The LEAD 0.5 model is distributed with default exposure parameters, which may be reasonably used in the absence of site-specific data. The model was designed to accept either default or site-specific inputs, and model input parameters were adjusted to be consistent with the exposure parameters used for chemicals other than lead. In evaluating lead in soils at IANG, Gowen Field, only exposure parameters were adjusted in the LEAD 0.5 model. No adjustment was made to the default absorption methodology used in the model.

4.5.1.3 Interpreting the Risk Estimates

EPA guidelines for interpreting noncarcinogenic and carcinogenic effects have been adopted in the baseline risk assessment. EPA has established target risk levels for use in determining the need for site remediation. For carcinogenic effects, the total excess lifetime cancer risk to the individual of exposure to all contaminants should not exceed the target range of 10^{-4} to 10^{-6} . Cancer risks less than 10^{-6} are not typically considered a concern. Although the 10^{-6} risk level is identified by EPA as a "point of departure" in evaluating the results of risk assessment, the revised National Contingency Plan (NCP) clearly indicates that the 10^{-4} level is the upper bound of the target concern risk range (EPA 1991c).

For noncarcinogenic effects, EPA specifies that cleanup should be based on targeted levels of exposure as determined by the EPA RfDs, taking into account the effects of multiple contaminants and multiple exposure pathways at the site. If the HQ (ratio of daily intake or dose over the RfD) is > 1 , then there may be excessive noncarcinogenic effects at the given exposure/dose level. For multiple noncarcinogens, the hazard quotients for all the chemicals under evaluation are summed. If this sum is > 1 , then there may be excessive noncarcinogenic health effects to mixtures of chemicals. EPA subsequently recommends segregating the compounds into groups of like or common toxicological effects, and reevaluating the potential for unacceptable health effects.

* In the special case of lead exposures, the appropriate target is defined as a maximum of 5 percent of the exposed population exceeding the CDC blood lead cutoff. This is based on EPA guidance as an acceptable point of reference (EPA 1991e):

"We recommend a model projection benchmark of either 95 percent of the sensitive population having blood lead levels below 10 $\mu\text{g}/\text{dl}$ or a 95 percent probability of an individual having a blood lead level below 10 $\mu\text{g}/\text{dl}$."

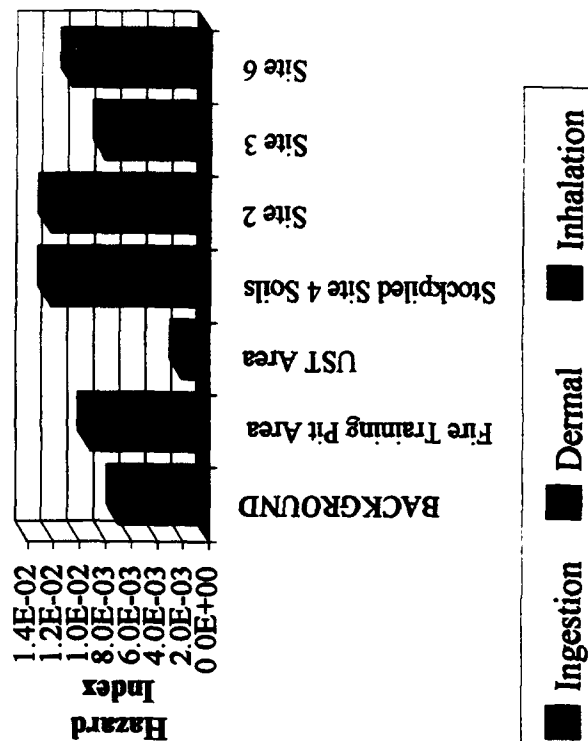
The target for lead exposures is thus defined as a maximum of 5 percent of the exposed population exceeding the CDC blood lead cutoff.

4.5.1.4 Methods for Evaluating Background Soil Concentration

Soil samples from each site are evaluated relative to background concentrations using a two-step process. In the first step, risk assessment has been conducted using background soil concentrations. These results are compared to the results of risk assessment using data from the IANG, Gowen Field sites under investigation. The comparison of background to site risk is graphically depicted as bar charts; noncancer health effects and cancer risk for background, and for each IANG, Gowen Field site evaluated (Figures 4-8 through 4-13).

The second method is a statistical comparison of site contamination versus background soil levels using a tolerance interval approach. In order to evaluate the significance of individual inorganic analytes we have compared concentrations for each analyte at a given site, to the upper tolerance limit on the distribution of the background soil samples for each detected inorganic analyte. The tolerance limit is an upper-bound (percentile) estimate on distribution of the background data set. The tolerance interval conservatively identifies a proportion of the background data set as representative of all background concentrations. The upper limit of the tolerance interval was estimated for the background data set using a nonparametric method (Washington State 1992). The tolerance interval comparison provides evidence that inorganic chemicals found within the tolerance interval are not site-related soil contaminants, and may be naturally-occurring substances.

SITE VERSUS BACKGROUND HAZARD INDICES FOR BASE PERSONNEL



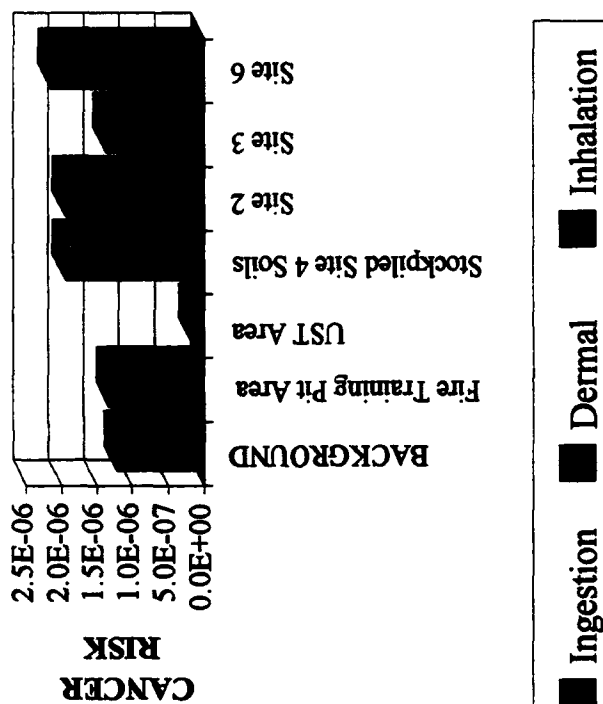
Site Versus Background Hazard
Indices for Base Personnel

Idaho Air National Guard,
Gowen Field, Boise, Idaho

Figure: 4-8

Project: 01-0827-07-0880-011

SITE VS BACKGROUND CANCER RISK FOR BASE PERSONNEL

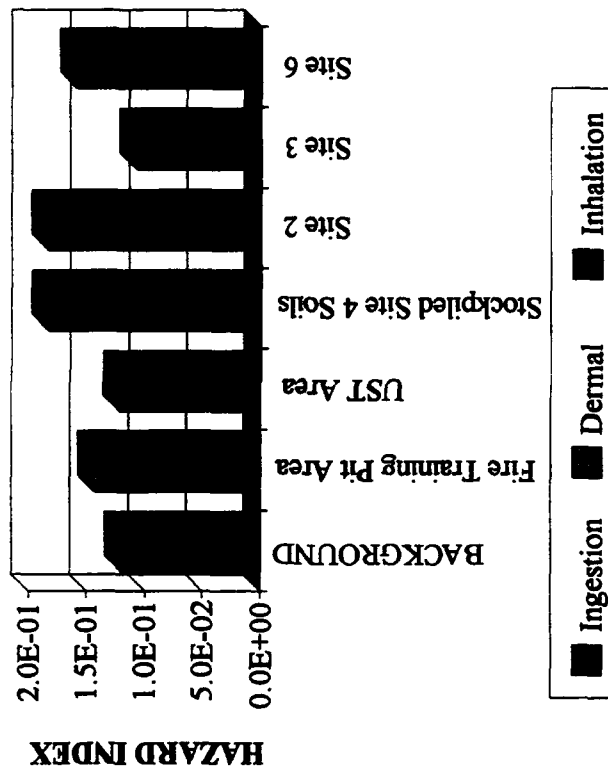


Site Versus Background Cancer
Risk for Base Personnel

Idaho Air National Guard,
Gowen Field, Boise, Idaho

Figure: 4-9 Project: 01-0827-07-0880-011

SITE VERSUS BACKGROUND HAZARD INDICES FOR CONSTRUCTION WORKER

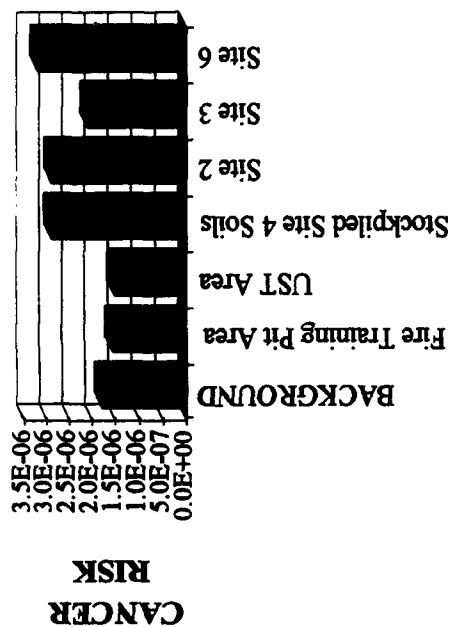


Site Versus Background Hazard
Indices for Construction Worker

Idaho Air National Guard,
Gowen Field, Boise, Idaho

Figure: 4-10 Project: 01-0827-07-0880-011

SITE VERSUS BACKGROUND CANCER RISK FOR CONSTRUCTION WORKER

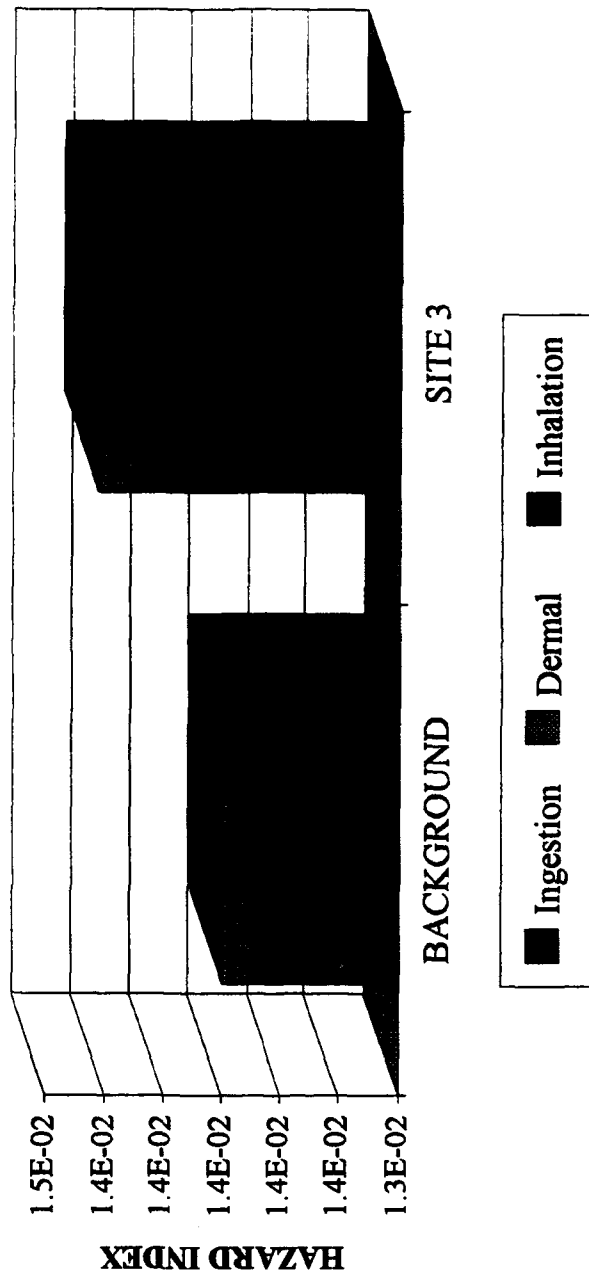


Site Versus Background Cancer
Risk for Construction Worker

Idaho Air National Guard,
Gowen Field, Boise, Idaho

Figure: 4-11 Project: 01-0827-07-0880-011

SITE VERSUS BACKGROUND HAZARD INDICES FOR PLAYING CHILD

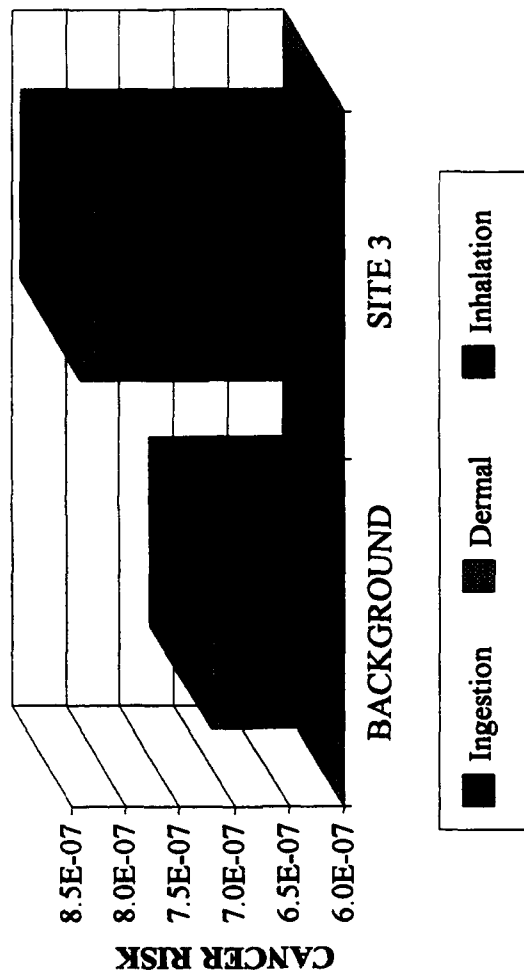


Site Versus Background Hazard
Indices for Playing Child

Idaho Air National Guard,
Gowen Field, Boise, Idaho

Figure: 4-12 Project: 01-0827-07-0880-011

SITE VERSUS BACKGROUND CANCER RISK FOR PLAYING CHILD



Site Versus Background Cancer
Risk for Playing Child

Idaho Air National Guard,
Gowen Field, Boise, Idaho

Figure: 4-13 Project: 01-0827-07-0880-011

The tolerance interval comparison conducted for IANG, Gowen Field determines the number of site soil samples (for a detected analyte) that exceed the upper limit of the tolerance interval. This number is reported as a proportion (i.e., the number of soil samples exceeding the background tolerance interval over the total number of soil samples for a given analyte). Site sample concentrations exceeding the upper tolerance limit for each chemical are concluded to be statistically different from background (i.e., site-related). Site samples within the tolerance interval (below the upper tolerance limit) are concluded to be indistinguishable from background concentrations (i.e., not site-related contaminants). The results of the background comparisons are presented in Section 4.5.2.

4.5.2 Risk Characterization Results for IANG, Gowen Field

The risk assessment at IANG, Gowen Field evaluates the potential for adverse effects associated with inadvertent contact with soils and sediments. Exposure of Base personnel and workers to soils at Sites 1, 2, 3, and 6 is of principal concern. The assessment also examines potential exposures of children of Base personnel to sediments in the vicinity of the picnic pavilion. As discussed previously, groundwater in the shallow aquifer is not a source of drinking water. Further, transport modeling of chemicals in the vadose zone indicate that contaminants in the soil column will not reach the shallow aquifer. For these reasons, a quantitative risk assessment for groundwater is not warranted and has not been included in this report. Groundwater is evaluated by comparison with ARARs.

Both current and future land use has been considered in the baseline risk assessment of IANG, Gowen Field. As part of the baseline risk assessment, an expanded land use analysis has been conducted to determine if future use of IANG, Gowen Field (i.e., in the event of Base closure) could include residential or agricultural scenarios. The results of the land use assessment indicate that future residential and agricultural use of Sites 1, 2, 3, and 6 is precluded by the presence of, and proximity to the air field. Therefore, the risk assessment is based on existing current uses of the sites under investigation.

This baseline risk assessment differs from the previous preliminary human health risk evaluation conducted as part of the SI Addendum in that it incorporates additional information and a number of new analyses. The following is a summary of this additional analyses.

- New surface soil data obtained during the 1992 sampling program has been used to refine the risk assessment of inadvertent soil ingestion and dermal contact.
- Risk assessment has been based on the use of two point estimates: 1) a conservative RME estimate and 2) a less conservative or MLE estimate. Use of two point estimates help to bound the results of risk assessment and assist in the evaluation of uncertainty.
- The EPA lead biokinetic model has been used to evaluate the significance of observed levels of lead in soil. EPA has withdrawn the reference dose for lead and use of an alternate risk assessment method becomes necessary.
- Site data on contaminants in soils are statistically compared to background concentrations through the use of a tolerance interval approach.

Methods for all of these analyses have been discussed in previous sections of this baseline risk assessment.

Table 4-11 presents the RME results of the EPA LEAD 0.5 biokinetic model for background as well as Sites 1, 2, 3, and 6 at IANG Gowen Field. MLE results for lead are included in Table I-1 of Appendix I. Further information is included in Appendix I, which presents detailed output from the model. The tables show the percentile of children exceeding the 10 $\mu\text{g/dl}$ blood lead concentration cutoff guideline. These percentages are acceptable for all of the sites under consideration, as shown by the comparison to the target of no more than 5 percent exceeding the guideline.

As currently developed, the LEAD 0.5 model is designed for analysis of exposures to children, not adults. As an additional point of comparison, the soil lead EPCs at each site may be compared to recent EPA soil cleanup guidelines for lead (EPA 1989c). The soil lead guidelines establish a range of 500 to 1,000 mg/kg total lead in soil as interim cleanup levels protective of residential populations. The greatest soil lead at sites under consideration (155 mg/kg) does not approach the lower end of the cleanup guidelines.

**Table 4-11. LEAD 0.5 Uptake/Biokinetic Model Results using RME Assumptions:
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho**

	Background	Fire Training Pit Area	UST Area	Stockpiled Site 4 Soils	Site 2	Site 3	Site 6
Percentile Exceeding 10 $\mu\text{g Pb/dL}$ Blood Lead Level	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Geometric Mean of the Projected Blood Lead Level ($\mu\text{g Pb/dL}$ blood)	1.57	2.43	1.68	1.84	1.49	1.56	1.52
Sensitive Age Group (months)	6 to 12	6 to 12	6 to 12	6 to 12	6 to 12	6 to 12	6 to 12

* Results were estimated using default LEAD 0.5 intake assumptions with the following exceptions:

- the particulate emission factor, in conjunction with measured lead concentrations in soil, was used to calculate airborne lead concentrations (10^{-7} to 10^{-9} $\mu\text{g/m}^3$) in place of the default setting ($0.200 \mu\text{g/m}^3$),
- soil ingestion rates for children were adjusted for consistency with the risk assessment (i.e., 200 mg/day) and UCL values were used as the exposure point concentration,
- lead concentrations in drinking water were treated as zero for consistency with the risk assessment.

body of the report. The more detailed characterization tables are presented in Appendix F. In Tables 4-12 through 4-17 a risk characterization summary is provided for each site. As an additional point of comparison, Table 4-18 presents hypothetical risk estimates for background soils. Each table presents quantitative results of risk assessment and a letter designator interpreting the estimates in light of EPA target risk ranges. In the summary tables, acceptable noncancer and cancer risk estimates are indicated with an "A." "U" designates risk exceeding the EPA target cancer risk range. Cancer risk estimates within the EPA target (acceptable) cancer risk range are designated with an "R."

4.5.2.1 Fire Training Pit Area Soils

Noncancer Health Effects — As shown in Table 4-12, all noncancer risk estimates for the Fire Training Pit Area are acceptable. Hazard Indices are all below 1.0 for both Base personnel (HI = 0.009) and the construction worker scenarios (HI = 0.1). This indicates that no adverse noncarcinogenic effects are anticipated for the defined exposures to these receptors.

Cancer Risks — Table 4-12 presents the summed cancer risks for soil exposures to Base personnel and construction workers. Each of these fall into the defined EPA target cancer risk range.

Lead Effects — Table 4-11 indicates that soil exposures at the Fire Training Pit Area do not exceed the CDC blood lead reference concentration (upper limit of 10 $\mu\text{g}/\text{dl}$). The most sensitive age group's RME geometric mean blood lead concentration is 2.4 $\mu\text{g}/\text{dl}$, with 0 percent exceeding the limit. Although Fire Training Pit Area is associated with the greatest blood lead concentration, less than 5 percent are expected to exceed the target.

Comparisons to Background — Figures 4-8 through 4-13 compare noncancer hazard indices and cancer risk for each receptor at the sites with that of background. The comparisons indicate that although the health effects associated with the Fire Training Pit Area slightly exceed that of the background, they are essentially similar to one another, and none exceed EPA risk targets.

Table H-1 located in Appendix H presents a detailed tolerance interval comparison of Fire Training Pit Area soils to background. For the shallow soil data set, the substances and

Table 4-12. Risk Estimate Summary - RME Risks
Fire Training Pit Area
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho

MEDIA	ROUTE	OCCUPATIONAL					
		BASE PERSONNEL		CONSTRUCTION WORKERS			
		Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer
Soil	Ingestion	7.9E-03	A	9.3E-07	A	1.4E-01	1.5E-06
	Inhalation	3.4E-07	A	3.0E-09	A	1.8E-06	1.5E-09
	Dermal	1.3E-03	A	3.8E-07	A	5.0E-03	2.5E-08
Soil Total	Combined	9.2E-03	A	1.3E-06	R	1.4E-01	1.6E-06

"A" - Acceptable noncancer health effects (HI < 1) or cancer risk (ELCR < 1 x 10⁻⁶)
 "R" - within acceptable cancer risk range (ELCR >= 1 x 10⁻⁴ and <= 1 x 10⁻⁶)
 "U" - Unacceptable noncancer health effects (HI > 1) or cancer risks (ELCR > 1 x 10⁻⁴)

Table 4-13. Risk Estimate Summary - RME Risks
Underground Storage Tank Area
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho

MEDIA	ROUTE	OCCUPATIONAL					
		BASE PERSONNEL		CONSTRUCTION WORKERS			
		Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer
Soil	Ingestion	2.0E-03	A	1.6E-07	A	1.2E-01	A
	Inhalation	8.5E-08	A	1.9E-09	A	1.5E-06	A
	Dermal	1.2E-04	A	9.7E-09	A	2.2E-03	A
Soil Total	Combined	2.1E-03	A	1.7E-07	A	1.2E-01	A

"A" - Acceptable noncancer health effects (HI < 1) or cancer risk (ELCR < 1 x 10⁻⁶)

"R" - within acceptable cancer risk range (ELCR ≥ 1 x 10⁻⁴ and ≤ 1 x 10⁻⁶)

"U" - Unacceptable noncancer health effects (HI > 1) or cancer risks (ELCR > 1 x 10⁻⁴)

**Table 4-14. Risk Estimate Summary - RME Risks
Stockpiled Site 4 Soils
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho**

MEDIA	ROUTE	OCCUPATIONAL					
		BASE PERSONNEL		CONSTRUCTION WORKERS			
		Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer
Soil	Ingestion	2.1E-03	2.3E-07	A	3.3E-02	A	3.6E-07
	Inhalation	9.0E-08	1.8E-09	A	4.2E-07	A	8.6E-10
	Dermal	1.3E-04	1.4E-08	A	4.0E-04	A	4.4E-09
	Combined	2.2E-03	2.4E-07	A	3.3E-02	A	3.6E-07
Soil Total							

"A" - Acceptable noncancer health effects (HI < 1) or cancer risk (ELCR < 1 x 10⁻⁶)

"R" - within acceptable cancer risk range (ELCR >= 1 x 10⁻⁴ and <= 1 x 10⁻⁶)

"U" - Unacceptable noncancer health effects (HI > 1) or cancer risks (ELCR > 1 x 10⁻⁴)

Table 4-15. Risk Estimate Summary - RME Risks
Site 2 - Former Fire Training Area
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho

		OCCUPATIONAL							
MEDIA	ROUTE	BASE PERSONNEL		CONSTRUCTION WORKER					
		Noncancer	Cancer	Noncancer		Cancer			
Soil	Ingestion	1.2E-02	A	1.8E-06	R	1.8E-01	A	2.9E-06	R
	Inhalation	5.0E-07	A	4.0E-09	A	2.3E-06	A	1.9E-09	A
	Dermal	7.0E-04	A	1.1E-07	A	2.2E-03	A	3.3E-08	A
	Combined	1.2E-02	A	1.9E-06	R	1.8E-01	A	2.9E-06	R
Soil Total									

"A" - Acceptable noncancer health effects (HI < 1) or cancer risk (ELCR < 1 x 10⁻⁶)
 "R" - within acceptable cancer risk range (ELCR ≥ 1 x 10⁻⁴ and ≤ 1 x 10⁻⁶)
 "U" - Unacceptable noncancer health effects (HI > 1) or cancer risks (ELCR > 1 x 10⁻⁴)

Table 4-16. Risk Estimate Summary - RME Risks
Site 3 - Central Drainage Ditch
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho

MEDIA		ROUTE	OCCUPATIONAL										RECREATIONAL	
			BASE PERSONNEL				CONSTRUCTION WORKER				CHILD			
			Noncancer		Cancer		Noncancer		Cancer		Noncancer		Cancer	
Soil	Ingestion	6.8E-03	A	1.3E-06	R	1.1E-01	A	2.1E-06	R	1.4E-02	A	8.3E-07	A	
	Inhalation	2.9E-07	A	4.4E-09	A	1.4E-06	A	2.1E-09	A	3.1E-07	A	1.4E-09	A	
	Dermal	4.2E-04	A	1.3E-07	A	1.3E-03	A	4.1E-08	A	1.5E-04	A	1.4E-08	A	
	Combined	7.2E-03	A	1.4E-06	R	1.1E-01	A	2.1E-06	R	1.4E-02	A	8.4E-07	A	
Soil Total														

"A" - Acceptable noncancer health effects (HI < 1) or cancer risk (ELCR < 1 x 10⁻⁶)
 "R" - within acceptable cancer risk range (ELCR >= 1 x 10⁻⁴ and <= 1 x 10⁻⁶)
 "U" - Unacceptable noncancer health effects (HI > 1) or cancer risks (ELCR > 1 x 10⁻⁴)

Table 4-17. Risk Estimate Summary - RME Risks

Site 6 - Tar Pit

Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho

MEDIA	ROUTE	OCCUPATIONAL					
		BASE PERSONNEL		CONSTRUCTION WORKERS			
		Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer
Soil	Ingestion	1.0E-02	A	2.0E-06	R	1.6E-01	A
	Inhalation	4.3E-07	A	5.3E-09	A	2.0E-06	A
	Dermal	5.8E-04	A	1.2E-07	A	1.8E-03	A
	Combined	1.1E-02	A	2.1E-06	R	1.6E-01	A
Soil Total							

"A" - Acceptable noncancer health effects (HI < 1) or cancer risk (ELCR < 1 x 10⁻⁶)

"R" - within acceptable cancer risk range (ELCR ≥ 1 x 10⁻⁴ and ≤ 1 x 10⁻⁶)

"U" - Unacceptable noncancer health effects (HI > 1) or cancer risks (ELCR > 1 x 10⁻⁴)

**Table 4-18. Risk Estimate Summary - RME Risks
Background Soils
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise, Idaho**

MEDIA	ROUTE	OCCUPATIONAL						RECREATIONAL		
		BASE PERSONNEL		CONSTRUCTION WORKER		CHILD				
		Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer	
Soil	Ingestion	6.6E-03	A	1.2E-01	A	1.4E-02	A	1.4E-02	A	A
	Inhalation	2.9E-07	A	1.5E-06	A	3.0E-07	A	3.0E-07	A	A
	Dermal	3.8E-04	A	1.4E-03	A	1.4E-04	A	1.4E-04	A	A
Soil Total	Combined	7.0E-03	A	1.2E-01	A	1.4E-02	R	1.4E-02	A	7.2E-07

"A" - Acceptable noncancer health effects (HI < 1) or cancer risk (ELCR < 1 x 10⁻⁶)

"R" - within acceptable cancer risk range (ELCR >= 1 x 10⁻⁴ and <= 1 x 10⁻⁶)

"U" - Unacceptable noncancer health effects (HI > 1) or cancer risks (ELCR > 1 x 10⁻⁴)

the respective proportion of samples exceeding the upper tolerance limit include cadmium (2/5), copper (4/5), and lead (5/5). For the deeper (to 15 feet) soils, the substances include beryllium (2/11), cadmium (2/11), copper (3/11), arsenic (1/11), lead (3/11), and thallium (5/11). Based upon these results, only copper and lead appear to exceed background levels.

As shown in Table 4-11, lead exposures to site background soils are projected to result in a RME geometric mean blood lead concentration of 1.6 $\mu\text{g}/\text{dl}$, with 0 percent exceeding the target blood lead concentration. Comparison of the Fire Training Pit Area and background blood lead projections indicates that soil lead at the Fire Training Pit Area appears to be elevated over that expected in site background soil. Both site and background RME blood lead concentrations are, however, below the EPA target.

4.5.2.2 UST Area Soils

Noncancer Health Effects — Table 4-13 indicates that all noncancer risk estimates for the UST Area are acceptable, with the HIs below 1.0 for Base personnel and for the construction worker scenarios. The results indicate that no adverse noncancer health effects are expected for these receptors.

Cancer Risks — As presented in Table 4-13, combined cancer risks for soil exposures to Base personnel and construction workers are acceptable. Only the construction worker scenario falls into the defined target cancer risk range, and the cancer risks for Base personnel were below the range.

Lead Effects — As shown in Table 4-11, RME lead exposures at the UST Area are projected to result in an RME geometric mean blood lead concentrations of 1.7 $\mu\text{g}/\text{dl}$, with 0 percent of the most sensitive age group (6 to 12 months) exceeding the CDC blood lead target concentration. This is below the 5 percent lead model benchmark.

Comparisons to Background — Figures 4-8 through 4-13 compare noncancer hazard indices and cancer risk for each receptor at the sites with those of the background. The

comparisons show that the health effects for the UST Area are lower than that of the background. These are, however, comparable to one another.

Table H-1 in Appendix H shows the tolerance interval comparison for the UST Area and background soils. This indicates that the proportion of several inorganic substances exceeds the upper limit of the background tolerance interval. The shallow soil UST Area data set includes only lead (2/4). For deeper soils (to 15 feet), the substances include beryllium (10/24), cadmium (2/24), chromium (7/24), copper (6/11), nickel (5/24), silver (7/24), arsenic (4/24), lead (3/24), and thallium (14/24).

For lead exposures, Table 4-11 presents the comparison to the projected blood lead RME geometric mean concentration of 1.6 $\mu\text{g}/\text{dl}$ with 0 percent exceeding for background soils demonstrates that soil lead concentrations at UST Area are indistinguishable from lead in site background soils.

4.5.2.3 Stockpiled Site 4 Soils

Noncancer Health Effects — Table 4-14 indicates that all noncancer risk estimates for the Stockpiled Site 4 Soils are well below EPA risk targets, with the HI below 1.0 for Base personnel and for the construction worker.

Cancer Risks — As shown in Table 4-14, combined cancer risks for soil exposures to Base personnel and construction workers are acceptable, and are below the defined acceptable cancer risk range ($< 1 \times 10^{-6}$).

Lead Effects — Table 4-11 indicates that blood lead concentrations among the most sensitive age group (6 to 12 months) at the Stockpiled Site 4 Soils are acceptable. Blood lead levels are projected to reach an RME geometric mean of 1.8 $\mu\text{g}/\text{dl}$, with 0 percent exceeding the target blood lead level of 10 $\mu\text{g}/\text{dl}$.

Comparisons to Background — Figures 4-8 through 4-13 compare noncancer hazard indices and cancer risk for the appropriate receptor at each site with those of the background.

The comparisons indicate that the health effects associated with the Stockpiled Site 4 Soils exceed that of the background, although as noted they are all within or below EPA targets and are very similar to one another.

Table H-1 in Appendix H presents the tolerance interval comparison for the Stockpiled Site 4 Soils and background soils. Several inorganic substances exceed the upper limit of the background tolerance interval. The proportion of detects exceeding this limit for the Stockpiled Site 4 Soils data set (to 15 feet) includes beryllium, lead (3/4), and thallium (1/4).

As shown in Table 4-11, background soil lead exposures for the most sensitive receptors are projected to result in an RME geometric mean blood lead concentration of 1.8 $\mu\text{g}/\text{dl}$, with 0 percent exceeding 10 $\mu\text{g}/\text{dl}$. This indicates that lead exposures correspond with those expected in site background soils and provides evidence that the lead is not a site-related contaminant.

4.5.2.4 Site 2 Soils

Noncancer Health Effects — Table 4-15 indicates that all noncancer risk estimates for stockpiled Site 4 soils are below EPA risk targets, with the HIs for Base personnel and construction worker below 1.0

Cancer Risks — As shown in Table 4-15, the total soil cancer risk for soil exposures to Base personnel and for construction workers are acceptable, and both are within the defined EPA target cancer risk range. As shown in Table H-1 of Appendix H, the primary exposure route in both cases is soil ingestion.

Lead Effects — Table 4-11 indicates RME exposures to lead in soil at Site 2 are below the EPA target. Exposures to the most sensitive population (ages 6 to 12 months) are projected to result in an RME geometric mean blood lead concentration of 1.5 $\mu\text{g}/\text{dl}$ with 0 percent exceeding 10 $\mu\text{g}/\text{dl}$ upper limit.

Comparisons to Background — Figures 4-8 through 4-13 compare the site and background noncancer hazard indices and cancer risk for each receptor. Although the noted

health effects for Site 2 exceed those of the background, they are all below EPA targets and are similar to one another.

As shown in Table H-1 of Appendix H, several inorganic substances at Site 2 exceed the upper limit of the background tolerance interval. The substances and the proportion of detects exceeding the tolerance interval at Site 2 (to 15 feet) include chromium (1/17), copper (2/17) and arsenic (11/17).

For lead exposures presented in Table 4-11, exposures to background soils result in an RME geometric mean blood lead concentration of 1.5 $\mu\text{g}/\text{dl}$ with 0 percent exceeding the 10 $\mu\text{g}/\text{dl}$ upper limit. This is consistent with the projected RME geometric mean blood lead concentration of 1.5 $\mu\text{g}/\text{dl}$ projected for Site 2 soil lead exposures. Lead exposures at Site 2 are thus similar to that expected in the site background soils, and thus may not represent site-related contamination.

4.5.2.5 Site 3 Soils

Noncancer Health Effects — As indicated in Table 4-16 all noncancer risk estimates for Site 3 have HIs less than one for Base personnel, the construction worker, and children playing. These noncancer health effects estimates are below EPA targets for the exposures described in the exposure assessment.

Cancer Risks — As presented in Table 4-16, the total soil cancer risk for soil exposures to Base personnel, construction workers, and playing children are all acceptable. The children's cancer risk is less than 1×10^{-7} . Base personnel and the construction worker cancer risks fall within the defined target cancer risk range ($< 1 \times 10^{-7}$).

Lead Effects — Table 4-11 indicates that blood lead levels for the most sensitive population (ages 6 to 12 months) at Site 3 are projected to result in an RME geometric mean blood lead concentration of 1.6 $\mu\text{g}/\text{dl}$ with 0 percent exceeding the CDC blood lead cutoff concentration. This is acceptable since it is below the benchmark reference of less than 5 percent exceeding the 10 $\mu\text{g}/\text{dl}$ upper limit.

Comparisons to Background — As shown in Figures 4-8 through 4-13, the Site 3 noncancer HIs and cancer risk for each receptor slightly exceed background. None exceed EPA targets and all are very similar to one another.

As shown in Table H-1 in Appendix H, several inorganic substances at Site 3 exceed the upper limit of the background tolerance interval. The substances and the proportion of detects exceeding the tolerance interval at Site 2 (to 15 feet) include beryllium (9/11), cadmium (1/11), chromium (7/11), copper (3/11), arsenic (3/11), and lead (3/11).

For lead exposures at Site 3, Table 4-11 presents the comparison of the RME geometric mean blood lead concentration for Site 6 (1.5 $\mu\text{g}/\text{dl}$) with the projected background RME geometric mean blood lead concentration (1.6 $\mu\text{g}/\text{dl}$). This indicates that Site 3 lead exposures are the same as that expected for the site background soil exposures. The lead in Site 3 soil may thus not be site-related.

4.5.2.6 Site 6 Soils

Noncancer Health Effects — Table 4-17 indicates that all noncancer risk estimates for Site 3 are acceptable, with HIs less than one for Base personnel and the construction worker. These noncancer health effects estimates are all below the EPA target for the considered exposures.

Cancer Risks — As presented in Table 4-17, the total soil cancer risk for soil exposures to Base personnel, and construction workers are all within the EPA target cancer risk range. The Base personnel and construction worker's cancer risks fall below the defined acceptable cancer risk range ($< 1 \times 10^{-6}$).

Lead Effects — Blood lead levels for the most sensitive population (ages 6 to 12 months) at Site 6 are presented in Table 4-11, and are projected to reach an RME geometric mean of 1.5 $\mu\text{g}/\text{dl}$ with 0 percent exceeding the 10 $\mu\text{g}/\text{dl}$ limit. This is below the EPA benchmark reference of less than 5 percent exceeding the limit.

Comparisons to Background -- Figures 4-8 through 4-13 indicate that the site and background noncancer HIs and cancer risks for each receptor at Site 6 slightly exceed those of the background. Once again, however, they are all similar to one another and none exceed EPA targets.

As shown in Table H-1 in Appendix H, several inorganic substances at Site 6 exceed the upper limit of the background tolerance interval. The substances and the respective proportion of detects exceeding the tolerance interval include beryllium (3/3), chromium (3/3), copper (2/3), nickel (2/3), and arsenic (1/3).

For lead exposures, Table 4-11 presents the comparison of the projected Site 6 blood lead levels (1.5 $\mu\text{g}/\text{dl}$ with 0 percent exceeding) and the background RME geometric mean blood lead concentration (1.6 $\mu\text{g}/\text{dl}$ with 0 percent exceeding). The comparison indicates that lead exposures at Site 6 are similar to that expected for the site background soils.

4.5.2.7 Groundwater

As noted previously, groundwater is not a source of drinking water for Base personnel. A risk assessment of exposure to chemicals in this resource has not been conducted. However, in order to evaluate the significance of the analytes detected in groundwater, two analyses have been conducted:

- Comparison of groundwater concentrations with ARARs
- Transport modeling to evaluate the relationship between observed soil contaminants and the potential for groundwater degradation over time.

The results of these analyses were presented in Section 4.2.2. To briefly summarize the findings, only one element, lead, exceeds the Federal action level and the nonenforceable Federal MCLG established in 1992. Only groundwater samples from the 1987 data set, and not the 1990 to 1991 data set, exceeded the Federal MCL for lead that previously existed. Currently, no enforceable Federal MCL exists for lead in groundwater. Selenium exceeds the state of Idaho drinking water MCL but not the Federal MCL. Selenium exceeded the 1990

Federal MCL, however, it is below the current Federal MCL of 50 mg/L established in 1992. The state of Idaho MCL currently remains at the former Federal MCL concentration. As detailed in Appendix G, the soil vadose zone transport model indicates that soil contaminants at the sites are unlikely to migrate into the shallow or deep aquifers.

4.5.3 Evaluation of Uncertainty

In the following section, an evaluation is presented of the sources of uncertainty in the baseline health risk assessment of the IANG, Gowen Field waste sites, and the relative influence of these sources on the result of the evaluation. It is essential to recognize the uncertainty inherent in risk assessment. Uncertainty is inherent in the selection of key input parameters and in every step of the risk assessment process. Risk assessment of waste sites must not be viewed as yielding single value, invariant results. Rather, the results of risk assessment are estimates that span a range of possible values, and which may be understood only in light of the assumptions and methods used in the evaluation.

Given that the verified toxicity values used in risk assessment are established by EPA (i.e., RfDs and CSFs), the greatest other sources of uncertainty arise from the determination of exposure point concentrations, the development of exposure scenarios, and the derivation of long-term intake or dose estimates for the human receptors at greatest risk.

Uncertainty will always surround estimates of environmental concentrations at waste sites. The objective is to understand, minimize, and quantify this uncertainty in risk assessment. Given the objective of protecting human health and the environment, it is prudent to design the site investigation program to minimize the number of conclusions based on underestimates of risk (e.g., concluding there is no significant difference between background and site concentrations, when in fact site concentrations are higher).

Exposure assessment may introduce considerable uncertainty in the risk assessment process. Uncertainty in all elements of the exposure assessment are brought together and compounded in the estimate of intake or dose. The professional judgment of the risk assessor becomes particularly important, and the risk assessor must examine and interpret a diversity of

information including:

- The nature, extent, and magnitude of contamination.
- Transport of chemicals in the environment.
- Identification of exposure routes.
- Identification of receptor groups currently at risk, and potentially at risk in the future.
- Activity patterns of receptors and receptor groups.

Based on this information, the risk assessor must develop exposure scenarios and quantify all parameters needed in the equations to estimate intake or dose (EPA 1989a).

The intake or dose equations will vary depending upon the exposure route under consideration (e.g., ingestion exposure, dermal exposure). For the purpose of quantifying intake or dose, each of the variables in these equations such as chemical concentration, is commonly taken as point estimates. In actuality, each of these variables is characterized by a distribution of possible values. Quantitative uncertainty analysis is difficult because of the quantity and quality of data available, or the commitment of time and resources. However, it is important to understand this approach, and the limitations of risk assessments that do not use these methods.

Table 4-19 presents a summary of the principal sources of uncertainty in the baseline human health risk assessment of contaminants present at, or released from the IANG, Gowen Field sites. In keeping with EPA guidance (EPA 1989a), the table is a qualitative (order of magnitude) assessment incorporating simple relative influences of principal sources of uncertainty on the overall results of risk assessment.

4.6 BASELINE HUMAN HEALTH RISK ASSESSMENT: REVISIONS

A baseline human health risk assessment has been conducted for the Idaho Air National Guard, 124th Reconnaissance Group, IANG, Gowen Field, Boise, Idaho. The assessment examines the potential for adverse noncarcinogenic and carcinogenic effects following long-term exposure to site-related contaminants. The risk assessment evaluates the significance of observed levels of contamination in soils at IANG, Gowen Field Site 1 - Current Fire Training Area,

Table 4-19. Qualitative Uncertainty Estimates
Idaho Air National Guard, 124th Reconnaissance Group, Gowen Field, Boise Idaho

Assumptions	Effect on Risk Estimates		
	Potential for Overestimating Risk	Potential for Underestimating Risk	Potential for Over or Underestimating Risk
ENVIRONMENTAL SAMPLING/ANALYSIS			
Sufficient number of samples			M
Precision and accuracy of chemical analysis		L	
Statistical Analysis			M
EXPOSURE ASSUMPTIONS			
Contact, uptake, and absorption rates are representative of exposed populations	L to M		
Assumption that chemicals do not transform or degrade over time	L		
Exclusion of residential scenario, and land use will remain restricted to the public.		L	
TOXICITY ASSESSMENT			
Use of EPA derived Reference Doses and Cancer Slope Factors			M
Dermal exposure risks are estimated using oral RfDs			M
Use of equivalency factors for PAHs, and Dioxins and Furans	L		
RISK CHARACTERIZATION			
Likelihood that receptors under evaluation are actually at risk	M		
Assumption of additivity of toxic effects across chemicals and pathways			M

L - low. Effect on risk estimate by less than an order of magnitude.

M - moderate. Effect on estimate by one to two orders of magnitude.

Site 2 - Former Fire Training Area, Site 3 - Central Drainage Ditch, and Site 6 - Tar Pit and in groundwater beneath the Base. This baseline risk assessment expands upon the preliminary human health risk evaluation previously reported in the Site Inspection Addendum (SAIC 1992). This revision of the risk assessment incorporates additional information and a number of new analyses:

- New surface soil data obtained during the 1992 sampling program are used to refine the risk assessment of inadvertent soil ingestion and dermal contact.
- The status of Site 5 - Former Wood Preserving Operation has been altered since the last risk assessment was submitted. The area is scheduled for construction activities that would cover the site with a concrete parking area. The Idaho Department of Environmental Quality (IDEQ) has accepted this activity as an effective waste control management control measure and recommend no further activity is required. Surface soils at the site will no longer be exposed and all potential for human exposure will be eliminated (the site will be paved). Consequently, Site 5 was not included in the assessment.
- Surface soils from the stockpiled Site 4 - Oil Patch in Drainage Field soils (located at Site 1) were sampled.
- Site 1 - Current Fire Training Area is divided into three subareas for the purpose of risk assessment: the Fire Training Pit Area; the Underground Storage Tank (UST) area; and the Stockpiled Site 4 Soils. Risk assessment results are presented separately for each of these areas.
- The risk assessment makes available two point estimates: 1) a conservative RME estimate and 2) a less conservative or MLE estimate. Use of two point estimates helps to bound the results of risk assessment and assist in the evaluation of uncertainty.
- The EPA lead biokinetic model is used to evaluate the significance of observed levels of lead in soil. EPA has withdrawn the reference dose for lead and use of an alternate risk assessment method becomes necessary.
- Site data on contaminants in soils are statistically compared to background concentrations through the use of a tolerance interval approach.
- Quantitative risk assessment has not been conducted for groundwater. The significance of chemicals in groundwater has been evaluated by comparison with ARARs and no identified contamination exceeded enforceable ARARs.
- Potential for contamination of the groundwater resource was evaluated through the use of transport modeling. The EPA PRZM-2 was used to evaluate the potential for transport of chemicals in the soil column to the shallow aquifer. Fire Training Pit Area was chosen as the area to be modeled because of the high concentration for contaminants identified in this area. The geology at all sites is considered

homogeneous and the results of the model would not differ if another site were chosen.

- Ecological risks have not been evaluated, since it would not be appropriate for the areas under investigation. The sampled areas are small fractions of the larger local habitat, and are not suitable for wildlife because of the predominance of man-made structures (e.g., pavement and buildings).

These additions and changes to the preliminary human health risk evaluation (SAIC 1992) complete the risk assessment requirements for the evaluation of the need for site remediation.

4.7 SUMMARY OF THE BASELINE RISK ASSESSMENT

The baseline risk assessment of IANG, Gowen Field Site 1 - Current Fire Training Area, Site 2 - Former Fire Training Area, Site 3 - Central Drainage Ditch, and Site 6 - Tar Pit is intended to evaluate risks to human health and to support the determination of the need for site remediation. The assessment examines the potential for adverse noncarcinogenic and carcinogenic effects following long-term exposure to site-related contaminants. Based on the available information, there is no unacceptable current or future site-related chemical health effects for Base personnel, construction workers, or children visiting IANG, Gowen Field. The risk assessment also compared environmental quality data with ARARs.

This report indicates that human health risks are the appropriate indicators for determining the need for site remediation. Based on the recent environmental assessment of IANG, Gowen Field, an ecological risk assessment is not required. The environmental assessment indicated that the sampled areas are not suitable natural habitats (e.g., paved, buildings), and represent only a small fraction of any identifiable undisturbed ecosystem. The results of the baseline risk assessment may be summarized as follows:

- There is no immediate endangerment to human health due to the presence of chemicals in groundwater, soils, or sediments at IANG, Gowen Field Sites 1, 2, 3, and 6.
- Based on the land use analysis, land use at IANG, Gowen Field is unlikely to change, and is highly unlikely to ever involve residential or other exposures to the general public.

- Based upon the results of soil transport analysis, there is virtually no likelihood that soil contaminants will migrate to the shallow aquifer.
- Noncancer health effects and cancer risks to Base personnel and construction workers undergoing long-term exposure to chemicals in soils and sediments are within the target range established by EPA for waste site remediation. The Hazard Quotients and Hazard Indices are at least an order of magnitude less than 1, and the projected excess lifetime risks of cancer are within the range of 10^{-7} to 10^{-6} .
- No adverse noncarcinogenic or carcinogenic effects would be anticipated for hypothetical sediment exposure of visiting children at or near the Central Drainage Ditch in the vicinity of the picnic pavilion.
- Health effects related to lead exposures to children at the sites are below the EPA target, based upon the lead exposure analysis.
- A significant portion of the identified health effects (all are acceptable) appear to be consistent with what would be expected in the background.
- Groundwater quality was evaluated by comparison with ARARs. The most recent observed concentrations of chemicals in groundwater at the sites under investigation are in compliance with the currently enforced Federal ARARs.
- Neither Base personnel or the general public is exposed to groundwater in the shallow aquifer beneath the IANG, Gowen Field. Ingestion of groundwater is not an exposure pathway of concern. Based on analysis of the available data, there is no hydraulic connection between the shallow aquifer and the few shallow private wells within the vicinity of the Base.
- The potential for migration of contaminants from the Fire Training Pit Area to the groundwater table was evaluated using a soil transport model. The model results indicate that these contaminants will not affect the groundwater resource.

It is important to recognize the uncertainty inherent in the risk assessment process. The results have been presented as ranges, which are better indicators of the distributions of potential outcomes than are single point estimates. Such distributions reflect the range of possible values of all component variables (i.e., the range of values for exposure and toxicity factors). As conducted, the baseline risk assessment of IANG, Gowen Field sites yield average and upper-bound estimates of the potential for adverse health effects. Given the conservative approach to the risk assessment, it is very unlikely that the potential risks to human health have been underestimated.

4.8 ENVIRONMENTAL ASSESSMENT

4.8.1 Overview

This section briefly examines the environmental setting at the sites under investigation at Gowen Field, and evaluates the need for an ecological risk assessment. The Air National Guard (ANG) conducted an environmental assessment (EA) for Gowen Field in 1991 (ANG 1991). The EA was prepared with respect to requirements specified under the National Environmental Policy Act (NEPA), to evaluate potential environmental effects of a proposed aircraft conversion plan. The EA includes a comprehensive ecological analysis that applies to the Installation Restoration Program (IRP) sites currently under investigation. The EA studied existing biological resources at IANG, Gowen Field including terrestrial vegetation and biota, aquatic vegetation and biota, and potentially threatened or endangered species. The following sections refer to, and summarize the results of the EA that relate to the current study areas.

4.8.2 Ecological Setting

Gowen Field and the sites under investigation are located within a highly developed urban environment at an airport on the outskirts of a large city (Boise). The sites under investigation are within the perimeter of Gowen Field, and because of the developed environment and controlled access of the Base, habitats for wildlife are limited. The EA confirms that no wetlands are located in the vicinity of Gowen Field, and the central drainage ditch does not meet the criteria for designation of a wetland (ANG 1991).

Plant species at Gowen Field include native sagebrush (*Artemisia tridentata* ssp. *wyomingensis*, *Artemesia arbuscula*) and grasses (*Agropyron spicatum*, *Festuca idahoensis*), as well as non-native species. The non-native species are disturbance vegetation types, that predominant as a result of Base construction. Buildings and roads are common within the areas of the sites under investigation and much of the vegetation is part of a maintained landscape. Landscape maintenance is a component of the overall base management and includes mowing and the use of herbicides that act to minimize and control vegetative growth (ANG 1991).

Gowen Field is surrounded by a maintained perimeter fence that obstructs visits or inhabitation by large mammals such as deer. Mammals identified as inhabiting the site area are

those consistent with an urban environment and include rabbits and rodents. Larger mammals, including coyotes, badgers, and skunks, may be found within the perimeter of Gowen Field to a limited extent. Other animals found within the base perimeter include lizards and snakes (e.g., Great Basin fence lizard, northern side-blotched lizard, Great Basin whiptail, Great Basin gopher snake, and striped whipsnake) (ANG 1991).

Birds enter the Base area, and the species identified are those associated with a developed environment. Waterfowl and birds of prey are only infrequently found in the Base area because of the disturbed natural environment and the lack of suitable habitats. No bodies of water are on Base that might support aquatic biota or attract prey species to the area (ANG 1991).

Data obtained from the U.S. Fish and Wildlife Service indicate that no proposed threatened, endangered, or candidate species are present in the vicinity of Gowen Field and the sites under investigation. Furthermore, the Idaho Natural Heritage Program indicates that the area does not support state sensitive plant or animal species. Since the area is heavily developed, this scenario is unlikely to change significantly in the future (ANG 1991).

4.8.3 Summary of Ecological Evaluation

An ecological risk assessment is typically conducted to evaluate the potential for adverse effects in non-human receptors associated with exposure to contaminants present at, or released from, sites under investigation. Based upon information available from the EA conducted for Gowen Field, an ecological risk assessment is not needed for the sites currently under investigation.

Adverse ecological effects related to the contamination identified at the investigated sites are unlikely because of the lack of vegetation or wildlife that is indigenous to Gowen Field. The contamination observed at the sites is limited to the site areas and represents a small portion of Gowen Field. The area surrounding the sites is highly developed by the ANG and urban in character. Most of the vegetation is not native, having been introduced after construction of the base. No critical habitats are found within the vicinity of the sites under investigation. Wildlife

habitats in the area are those characteristic of a highly disturbed urban environment. Continuing aircraft operations and concurrent noise limit habitat use even further.

Based on the reported findings of the EA for Gowen Field, the ecological evaluation indicates that there is neither the presence of threatened or endangered species, nor the presence of critical habitats at the sites under investigation. Based on the future land use scenarios outlined in Section 4.3.2, this situation is likely to continue into the future. Further evaluation of the environmental setting and associated risks to flora and fauna are not required in determining the need for site remediation. The results of the baseline human health risk assessment are most appropriately used in determining the need for further activities at Gowen Field.

5. CONCLUSIONS AND RECOMMENDATIONS

A Site Inspection (SI) has been conducted under the Installation Restoration Program (IRP) at Idaho Air National Guard (IANG), Gowen Field, Boise, Idaho. Initial SI activities were conducted in 1987. At the conclusion of these activities, data gaps existed that required an additional phase of investigation. The second phase was conducted in 1990. In 1992, SI activities were performed at IANG, Gowen Field to supplement the results obtained during the previous two phases. Specifically, the objectives of the 1992 program were to collect data to be used to prepare a baseline risk assessment and to provide information to help determine the need for removal actions at specific sites. The conclusions and recommendations from the SI activities conducted at IANG, Gowen Field are presented in this section.

5.1 CONCLUSIONS

The field program that SAIC implemented at IANG, Gowen Field in September 1992 consisted of drilling a soil boring to collect geotechnical samples, test pit sampling of surface soils, sampling drill cuttings generated during the SI for TCLP analyses, and measuring groundwater levels. Data analysis activities included geologic and hydrogeologic data evaluation, chemical data reduction, a quality assurance/quality control (QA/QC) program evaluation, vadose zone modeling, and a baseline human health risk assessment. No data gaps were identified following the field investigation and data analysis activities.

Both current and future land use have been considered in the risk assessment of Site 1 (which included three areas of concern: Fire Training Pit Area, Underground Storage Tank Area, and Stockpiled Site 4 Soils), Sites 2, 3, and 6 at IANG, Gowen Field. The land use analysis of IANG, Gowen Field indicates that future residential and agricultural use of Sites 1, 2, 3, and 6 is precluded by the presence of, and proximity to the air field. Current land use and existing exposure pathways are appropriate as the basis for long-term human health risk assessment of the IANG, Gowen Field sites. In general, the results of the risk assessment indicate that there is no immediate or substantial endangerment to human health due to the presence of chemicals in groundwater, soils, or sediments at IANG, Gowen Field Sites 1, 2, 3, and 6.

- Excess lifetime cancer risks for Base personnel and construction workers at all sites fall within the target range established by EPA for waste site remediation. No adverse noncarcinogenic effects are anticipated following exposure to soils and sediments. The Hazard Quotients and Hazard Indices are orders of magnitude less than 1.
- No adverse noncarcinogenic effects would be anticipated for hypothetical exposure of children to sediments in the vicinity of the Site 3 - Central Drainage Ditch and picnic pavilion. Cancer risk estimates for visiting children are very low ($< 10^{-6}$) and are considered inconsequential.
- Risk estimates for hypothetical exposure of children to lead in soils/sediments were evaluated using the EPA biokinetic model. All results fell below the reference blood lead level established by EPA, and are considered acceptable.
- A tolerance interval approach was used to statistically compare site-related soil concentrations with background data. The results of this analysis indicate that levels of inorganics in soils are largely indistinguishable from background.
- Neither Base personnel nor the general public is exposed to groundwater in the shallow aquifer beneath the IANG, Gowen Field sites under investigation. Groundwater quality was evaluated by comparison with ARARs. The observed concentrations of chemicals in groundwater at the sites under investigation are in compliance with the currently enforced Federal ARARs. Only lead from the 1987 (not the 1990 to 1991) data set exceeded the Federal MCL and the nonenforceable MCLG that existed at the time of data collection. Currently, no Federal MCL exists for lead in groundwater. Selenium exceeds the state of Idaho MCL, but not the recently adjusted Federal MCL. Neither lead nor selenium were determined to be site-related.
- The results of the vadose zone transport modeling (PRZM-2) indicate no transport to the shallow groundwater aquifer (170 feet BLS) over the 30 year simulation period. The model conservatively assumed no biodegradation or chemical transformation. Projected concentrations in soils at depth range from 0.2 mg/Kg for xylene to less than 0.001 mg/kg soils for benzene. Given the low projected soil concentrations and the conservatism built into the transport model, degradation of the groundwater resource is not of concern for periods exceeding 30 years.
- Results of the Environmental Assessment conducted at Gowen Field indicate that there are no threatened or endangered species or critical habitats at the sites under investigation (ANG 1991).
- Gowen Field is located within Airport Influence Zone C1, which does not permit residential or other public use of the land (Boise Airport Authority 1993).

It is important to recognize the uncertainty inherent in the risk assessment process. The results must be interpreted in light of the fundamental assumptions adopted in the exposure and

toxicity assessments. Given the conservative approach to the risk assessment, it is very unlikely that the potential risks to human health have been underestimated.

The original soils at Site 4 that were removed and stockpiled at Site 1 in 1985 were analyzed as part of the September 1992 field program. The analytical results of the Stockpiled Site 4 Soils were evaluated as part of the risk assessment and the risk assessment results indicated that there is no immediate or substantial endangerment to human health due to the presence of any chemicals. Based on the fact that all of the contaminated soils that were present at Site 4 were removed from the original site and stockpiled at Site 1, and these stockpiled soils showed no risk, it is anticipated that Site 4 presents no risk to human health.

IDEQ, Permits and Enforcement Division, reported that investigation-derived soils must be drummed, appropriately tested, and if results indicate contamination, transported to a Resource Conservation and Recovery Act (RCRA)-D landfill. Petroleum-contaminated soils associated with investigations such as UST removal may be land farmed. If TCLP analytical results indicate that no parameter exceeded the associated regulatory action level, these soils may be spread on the investigated site (IDEQ 1992).

Based on the TCLP results for the drummed and stockpiled soils at Site 1 - Current Fire Training Area, these soils may be spread on the site at the discretion of IANG. The soils that are stockpiled on the existing berm for the fire training pit may remain in this area based on the results of the baseline risk assessment.

Based on the TCLP results for the stockpiled soils at Site 2 - Former Fire Training Area, the stockpiled soils from Site 4 - Oil Patch in Drainage Field, and the stockpiled and drummed soils at Site 6 - Tar Pit, all the soils can be spread at each of the investigated sites.

5.2 RECOMMENDATIONS

The results of the baseline human health risk assessment *do not* indicate the need for remediation at IANG, Gowen Field Sites 1, 2, 3, or 6. The fact that the risk assessment indicates no remediation is required for the Stockpiled Site 4 Soils, no remedial action is recommended for Site 4 - Oil Patch in Drainage Field. Risks to human health of exposure to

soils and sediments fall within the target risk ranges established by EPA for waste site remediation. Contaminants in the soil column will not result in degradation of the groundwater resource over time. Therefore, it is recommended that decision documents be prepared for Site 2, Site 3, Site 4, and Site 6 indicating that no further IRP investigations or remediation are required at the sites.

It is recommended that the Underground Storage Tank Area present at Site 1 be closed in accordance with relevant State of Idaho requirements. It also is recommended that the soils that were generated during the SI field program be spread at the sites where they were generated. This recommendation is based on TCLP analytical results of the soil and guidance from IDEQ.

The presence of Site 6 - Tar Pit presents a safety hazard to humans and animals who may enter the area. Though no further IRP activities are warranted based on the baseline risk assessment, it is recommended that disposal options for the tar be developed. This potential course of action would eliminate the safety hazard associated with the tar pit.

The SI Addendum - 2 and the recommendations outlined above have been reviewed by IDEQ, the Air National Guard Readiness Center (ANGRC), and IANG regarding the thoroughness and completeness of data collection, data evaluation, and analysis. In addition, the IRP investigation at Gowen Field has been reviewed by IDEQ, ANGRC, and IANG to ensure that all aspects of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Federal Resource Conservation and Recovery Act (RCRA), and the Idaho Hazardous Waste Management Act (HWMA) have been addressed.

Following their review of the SI Addendum - 2, IDEQ, ANGRC, and IANG concurred with the proposed recommendations for each of the IRP sites of concern. IDEQ stated in their review of the SI Addendum - 2 that all applicable RCRA/HWMA concerns were addressed and that the data contained in the SI Addendum - 2 indicated that hazardous waste constituents were below regulatory levels at the sites of concern. The IDEQ review letter is presented as an Attachment and appended to Section 6.

The next step in the IRP process will be to prepare individual Decision Documents for Sites 2, 3, 4, and 6. The Decision Document for Site 5 was prepared in September 1992. Site 1 will be closed in accordance with State of Idaho regulatory requirements, and the appropriate Closure Reports and Decision Documents will be prepared. The site-specific Decision Documents for the areas of concern will present the investigation activities conducted at the site, summarize the results, and detail the recommendations and rationale to support the proposed recommendations.

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ATTACHMENT
IDAHO DIVISION OF ENVIRONMENTAL QUALITY REVIEW LETTER



IDAHO DEPARTMENT
OF HEALTH AND WELFARE

DIVISION OF
ENVIRONMENTAL QUALITY

1410 North Hilton, Statehouse Mail, Boise, ID 83720-9000 (208) 334-0502

Cecil D. Andrus

October 21, 1993

Steven D. Argyle, Major
Idaho Air National Guard
124th Fighter Group
Boise Air Terminal (Gowen Field)
P. O. Box 45
Boise, Idaho 83707-0045

Dear Major Argyle:

DEQ has received and reviewed the Draft IRP Site Inspection Addendum - 2 (Addendum) for Gowen Field. Below are DEQ's comments on the Addendum concerning the applicability of the Federal Resource Conservation and Recovery Act (RCRA)/Idaho Hazardous Waste Management Act (HWMA) rules, regulations, and standards.

► **Comment 1: 1.3.1.1 Site 1 - Current Fire Training Area**

"Of the 400,000 gallons of flammable material burned in the pit, the Hazardous Materials Center (HMTc 1985) estimated 300,000 gallons were unusable fuel, including JP-4, which was not suitable for use in fighter aircraft; 80,000 gallons were waste oil; and the remaining 20,000 gallons were mineral spirits and halogenated solvents."

According to the information contained in the Addendum, some of this material was placed into Site 1 after the November 1980 effective date of the Federal RCRA requirements. If the regular addition of mineral spirits and halogenated or F-listed solvents occurred after the 1980 date, Site 1 would be considered a Land Disposal Unit (LDU) under RCRA/HWMA subject to 40 CFR, Subpart 264 permitting requirements.

However, the sample analyses for both volatile and semi-volatile, organic halogens indicated F-listed (F001 and F002) constituents were not detected in the soil at Site 1. However, if soil (which has detectable F-listed constituents) is excavated or actively managed, the soil must be managed and disposed of as a RCRA/HWMA hazardous waste.

► **Comment 2: 1.3.1.2 Site 2 - Former Fire Training Area**

"The chemical makeup of the 26,400 gallons of waste is similar to that of the waste at Site 1 - Current Fire Training Area."

If solvent wastes were disposed of in this area, the waste may not be a regulated hazardous waste, based on the time period when Site 2 was being used (pre-1981). Toxicity Characteristic Leaching Procedure (TCLP) analysis was performed on the soil at Site 2. According to the Addendum, no solvent constituents were detected at or above TCLP regulatory levels. However, if soil which exceeds TCLP regulatory levels is excavated or actively managed from Site 2, the soil must be managed and disposed of as a RCRA/HWMA hazardous waste.

► **Comment 3: 2.1 Field Program Summary**

"The field program developed by SAIC consisted of drilling a soil boring to collect geotechnical samples, test pit sampling of surface soils, sampling drill cutting generated during the SI for toxicity characteristic leaching procedure (TCLP) analysis, and measuring groundwater levels."

► **2.2 Confirmation and Delineation Activities**

"A thorough chemical characterization is required of these drill cutting soils before a decision can be made regarding their disposal. The most thorough analysis for soil characterization that is generally accepted by licensed, regulated disposal facilities is the TCLP analysis dictated by 40 CFR 261.24."

► **5.1 Conclusions**

"If TCLP analytical results indicate that no parameter exceeds the associated regulatory action level, these soils may be spread on the investigated site (IDEQ 1992)."

According to the data in the Addendum, the drill cutting soil analyses did not detect any TCLP constituents above regulatory levels. If the soil does not contain regulated levels of TCLP constituents, the soil may be determined to be a non-regulated waste.

► **Comment 4: 5.2 Recommendations**

"It is recommended that the Underground Storage Tank Area present at Site 1 be closed in accordance with relevant State of Idaho requirements."

RCRA/HWMA has relevance concerning the management and disposal of the surrounding soil and/or any sludges contained in underground storage tanks (UST). If lead exceeds the TCLP regulatory level of 5.0 mg/l in surrounding soil, the soil is a D008-regulated hazardous waste. If any TCLP constituent(s) is/are detected to

Major Argyle Letter
October 21, 1993
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exceed the regulatory level(s) in the sludge of an UST, the sludge is a regulated hazardous waste. All regulated hazardous wastes must be managed and disposed of according to the RCRA/HWMA requirements.

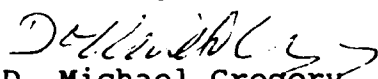
► **Comment 5: TCLP Analysis for Hazardous Determination.**

According to the Addendum, the TCLP was performed on soils at Site 3 - Central Drainage Ditch, Site 4 - Oil Patch in Drainage Field, and Site 6 - Tar Pit. The analyses indicated no hazardous waste constituents above TCLP regulatory levels. Based on the known history of the Sites, the TCLP was the appropriate analytical method to perform for a hazardous waste determination. According to the sample results, there does not appear to be a RCRA/HWMA concern at Site 3, Site 4, or Site 6. Site 5 - Former Wood Preserving Area is currently being capped in situ to contain the contamination at the site and prevent the spread of hazardous constituents.

Based on the information provided in the Addendum, Gowen Field appears to have addressed the RCRA/HWMA concerns. The data contained in the Addendum indicates hazardous waste constituents are below regulatory levels in the areas of concern. However, be aware that, if any F-listed solvents are detected in soil at Site 1 or if any TCLP solvent constituents are detected above regulatory levels at Site 2, the excavation or active management of the soil may require the soil to be managed and disposed of as RCRA/HWMA-regulated hazardous waste.

If you have any questions, please contact me at (208) 334-5898.

Sincerely,


D. Michael Gregory
Hazardous Waste Compliance Officer
Permits and Enforcement

DMG:ls\gowen.rcv

cc: USsc3
SWIRO
COF 1.1