Final

Environmental Baseline Survey

Relinquishment of Jurisdiction Over Lands Identified as Unnecessary for Military Purposes

446th Missile Squadron of the Minuteman III Missile System

Grand Forks Air Force Base, North Dakota

Prepared for:

U.S. Air Force

Headquarters Air Force Space Command

Colorado Springs, Colorado

October 2005

Final

Environmental Baseline Survey

Relinquishment of Jurisdiction Over Lands Identified as Unnecessary for Military Purposes

446th Missile Squadron of the Minuteman III Missile System

Grand Forks Air Force Base, North Dakota

Prepared for:

U.S. Air Force

Headquarters Air Force Space Command

Colorado Springs, Colorado

October 2005

TABLE OF CONTENTS

VOLUME I — SQUADRON EBS

APPENDICES, VOLUME I

LIST OF FIGURES

LIST OF TABLES

VOLUME II — SITE-SPECIFIC EBSs

Labeled tabs identify each site-specific EBS.

This page intentionally left blank.

1. INTRODUCTION

The United States (U.S.) Air Force (Air Force or USAF) proposes to relinquish its jurisdiction over lands used for the Minuteman (MM) III Intercontinental Ballistic Missile (ICBM) system located within the deployment area west of Grand Forks Air Force Base (AFB), North Dakota (ND). The MM III missile system included the 446th, 447th, and 448th Missile Squadrons (MS), each containing 5 missile alert facilities (MAF) and 50 launch facilities (LF), along with a Hardened Intersite Cable System (HICS) that connected the missile system facilities. The Air Force will offer lands used for 14 MAFs and 149 LFs for sale to the public and will terminate various easements and licenses that were executed to support the MM III system. One MAF and LF have been reserved for transfer to the State of North Dakota as historical sites (see Section 5.1.1). The need for the relinquishment is to reduce defense costs, return land and the jurisdiction of land to private landowners, and comply with the provisions of the Strategic Arms Reduction Treaties (START). After all START requirements have been met, the General Services Administration will dispose of the real property. The disposal process is covered in Public Law 100-180, Section 2325 (10 *United States Code* (U.S.C.) § 9781). First priority of consideration is to current adjacent landowners, who must pay fair market value.

In support of this proposed relinquishment, the Air Force has prepared Environmental Baseline Surveys (EBS) of the 446th Missile Squadron (446 MS), including a general (squadron-specific) EBS and individual (site-specific) EBSs for each of the 55 MAF and LF sites. Separate EBSs have been prepared for relinquishment of the HICS easements and relinquishment of the LF and MAF properties within the 447 and 448 MSs; each squadron EBS includes a general (squadron-wide) EBS and individual (site-specific) EBSs for each MAF and LF site within the squadron. These EBSs were prepared in accordance with Air Force Instruction (AFI) 32-7066, *Environmental Baseline Surveys in Real Estate Transactions* (April 25, 1994); American Standards for Testing Materials (ASTM) Publication E 1527, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*; and Publication E 1528, *Standard Practice for Environmental Site Assessments: Transaction Screen Process*.

1.1. THE ENVIRONMENTAL BASELINE SURVEY

The purpose of an EBS is to identify, to the extent feasible, recognized environmental conditions in connection with a property transfer. These EBSs were conducted to:

- Document the nature, magnitude, and extent of any environmental contamination of property or interests in real property considered for acquisition, out-grant, or disposal.
- Identify potential environmental contamination liabilities associated with a transaction, and establish environmental due diligence.
- Develop enough information to assess health and safety risks.

- Protect human health and the environment.
- Determine possible effects of contamination on property valuation.
- Serve as the basis for notice of environmental condition when required under Section 120[h][1] of the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA) of 1980, as amended (42 U.S.C. 9620[h][1]), or any applicable state or local real property disclosure requirements.

1.2. ORGANIZATION OF THE MINUTEMAN III SYSTEM

The MM III missile system, formerly deployed at Grand Forks AFB under the 321st Missile Group, was geographically divided into three missile squadrons, the 446th, 447th, and 448th. Figure 1.2-1 shows the entire MM III deployment area with the squadron boundaries.

Each missile squadron, which included 5 MAFs and 50 LFs, was divided into five flights, each of which included one MAF and the 10 LFs that were under the control of that MAF. The 446 MS flights were designated as A, B, C, D, and E. All MAFs were numbered with the flight designation and a zero (A-0, B-0, C-0, D-0, and E-0). The LFs were numbered sequentially as 01 to 50 for the entire squadron, with the flight designation given before the number. The first 10 were in the A Flight, second 10 in the B Flight, and so on. Flights may be referred to in some documents using the phonetic alphabet, as shown in the table (see Appendix E for the phonetic alphabet). Table 1.2-1 shows the numbering system for the sites included in this EBS.

Table 1.2-1
Organization of the 446th Missile Squadron

Flight A* *"Alpha"	***Flight B* *"Bravo"***	***Flight C* *"Charlie"***	***Flight D* *"Delta"***	***Flight E* *"Echo"***
MAF A-0	MAF B-0	MAF C-0	MAF D-0	MAF E-0
LF A-1	LF B-11	LF C-21	LF D-31	LF E-41
LF A-2	LF B-12	LF C-22	LF D-32	LF E-42
LF A-3	LF B-13	LF C-23	LF D-33	LF E-43
LF A-4	LF B-14	LF C-24	LF D-34	LF E-44
LF A-5	LF B-15	LF C-25	LF D-35	LF E-45
LF A-6	LF B-16	LF C-26	LF D-36	LF E-46
LF A-7	LF B-17	LF C-27	LF D-37	LF E-47
LF A-8	LF B-18	LF C-28	LF D-38	LF E-48
LF A-9	LF B-19	LF C-29	LF D-39	LF E-49
LF A-10	LF B-20	LF C-30	LF D-40	LF E-50

1.3. BOUNDARIES OF THE SURVEY AREA

The 446 MS is located north and west of Grand Forks AFB, in northeastern North Dakota (see Figure 1.2-1). The 5 MAFs and 50 LFs are separated from each other by approximately 4 to 7 miles and lie within Cavalier, Pembina, Ramsey, and Walsh counties, as shown in Figure 1.3-1. Flight maps of the MAFs and LFs are found in Appendix B.

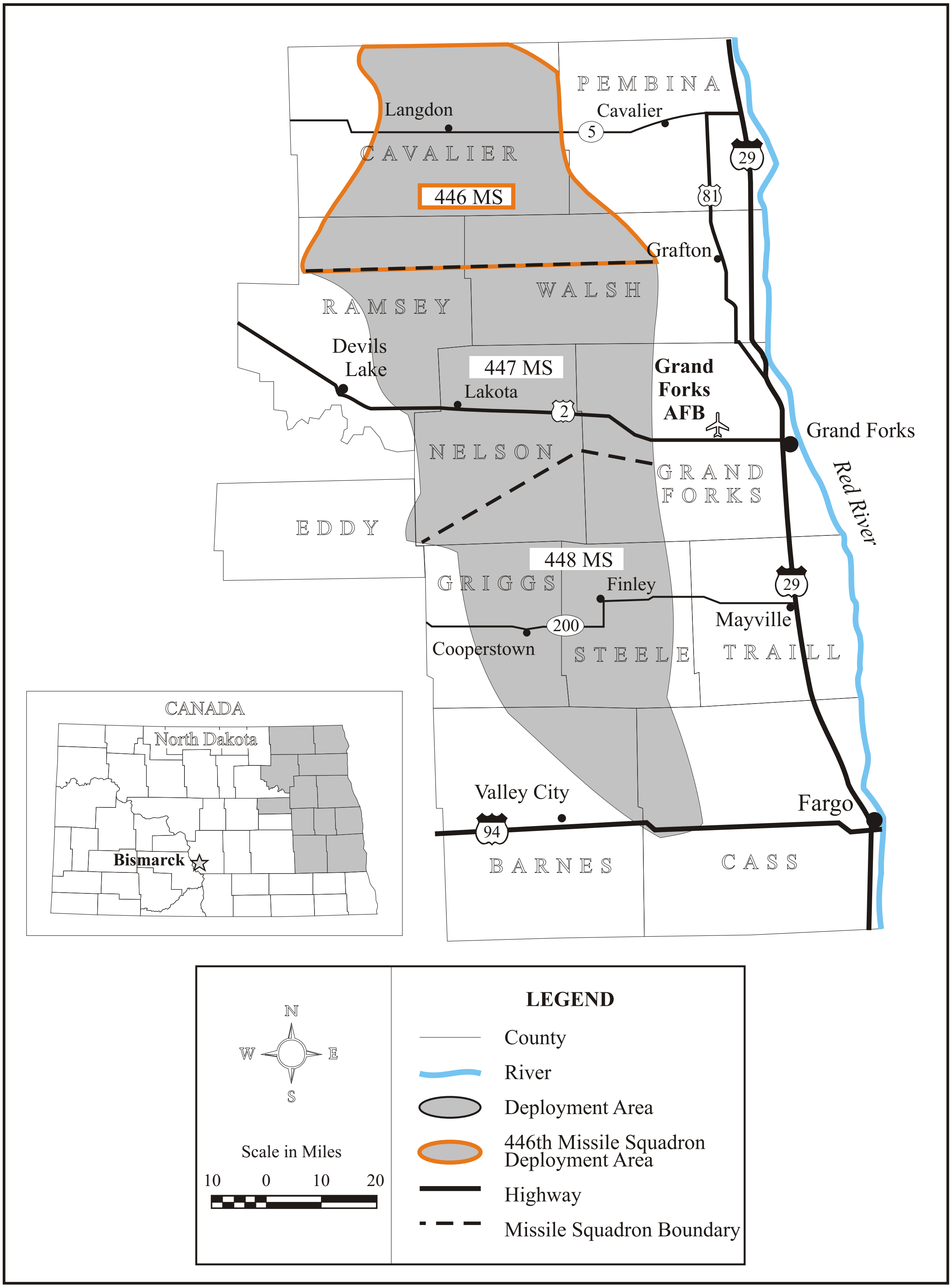

Figure 1.2-1. Minuteman III Deployment Area, Grand Forks AFB

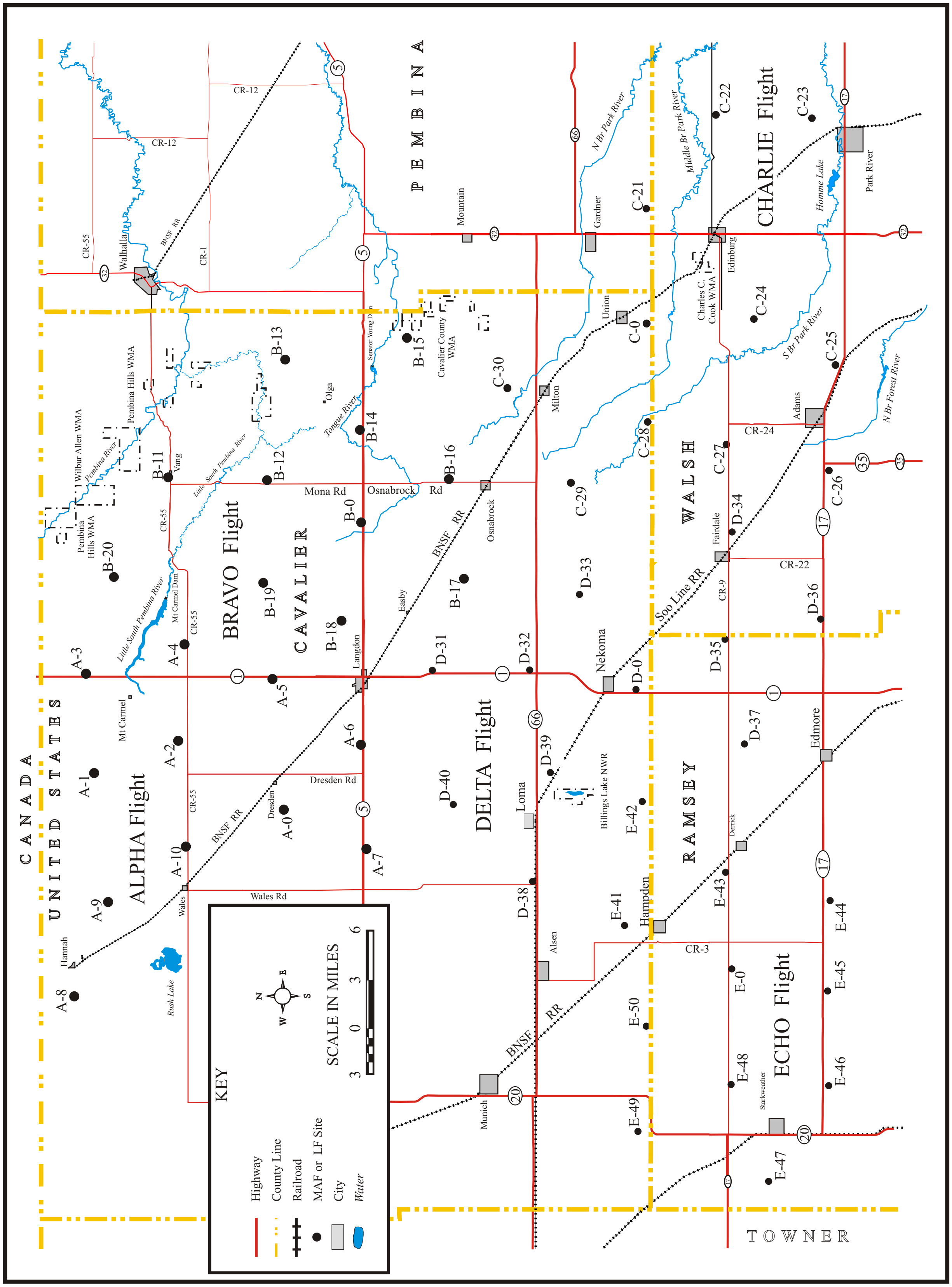

Figure 1.3-1. Map of the 446th Missile Squadron

1.4. ORGANIZATION OF THE ENVIRONMENTAL BASELINE SURVEY

Following this introductory section, Section 2 describes the survey methodology, and Sections 3 and 4 discuss findings for the subject properties and adjacent properties, respectively. Section 5 lists the applicable regulatory compliance issues, Section 6 presents conclusions, and Section 7 provides recommendations. Section 8 contains certifications as to the findings of the survey. Section 9 lists references, while Section 10 lists the preparers of the document.

Appendix A of this document provides additional information on applicable regulations and guidelines, and Appendix B contains diagrams of the HICS routes by flight. Appendix C lists site-specific characteristics, while Appendix D provides sampling results for individual sites. Appendix E contains a glossary and acronym list, including organizational designations and the phonetic alphabet.

This page intentionally left blank.

3. FINDINGS FOR SUBJECT PROPERTY

This section contains the history and current use of the property, including a description of activities at the former LFs and MAFs, followed by the environmental setting of the 446 MS deployment area, and discussions of hazardous substances. Detailed site-specific data are found in tabular format in Appendix C, Site-specific Characteristics.

3.1. HISTORY AND CURRENT USE

Regional land use in the 446 MS is generally rural and sparsely populated, consisting of small communities surrounded by agricultural areas. Agricultural land is primarily used for growing grains, sugar beets, soybeans, flaxseed, sunflowers, potatoes, hay, and other crops.

The Air Force purchased the property for the LFs and MAFs in the mid-1960s. The MM III system at Grand Forks included 150 LFs with one missile per LF, and 15 MAFs with one MAF per flight of 10 LFs. The 446 MS included 5 flights, with each flight composed of 10 LFs and a MAF, which were connected through the HICS. Section 1.2 further explains the squadron organization. Flight-specific maps are provided in Appendix B. These maps were scanned from the original Mylar® sheets created in the mid-1960s and overlaid on a current base map of the area. The original Mylar® sheets and additional maps included in the real property files can be accessed at the Real Estate Office, 319 CES/CERR, or the USACE Omaha District, Real Estate office.

3.1.1. Launch Facilities Prior To Dismantlement

An LF consisted of a launcher and associated launcher equipment building (LEB). All facilities were enclosed within a security fence, except a buried antenna (a grid of copper wires covered in non-polychlorinated biphenyls (PCB) plastic, approximately 400 feet by 400 feet, buried 4 to 8 feet deep) that was adjacent to each LF. The fenced sites average about 1.4 acres in size, but the Air Force owns a total of approximately 10 acres at each LF. Figure 3.1-1 shows a schematic of a typical LF prior to dismantlement. The LF launch tube was approximately 80 feet deep, of which the top 28 feet comprised the headworks. Including concrete and steel, the headworks was approximately 25 feet wide and 33 feet deep. The launch tube was 12 feet in diameter below the headworks. Figure 3.1-2 contains LF photographs. The top photo shows LF N-33, which was retained after dismantlement with its surface features intact for use as an historic site (see Section 5.11). The lower photo shows LF K-04 as a typical LF with all structures removed and the ground surface graded.

Dismantlement included demolishing the headworks of each LF silo and destroying the access shaft in the LEB. Prior to demolition, various regulated and hazardous materials (such as diesel fuel and sodium chromate solution) were removed from the facilities. Some recoverable material (e.g., steel, copper, aluminum, and the remaining mechanical equipment) was salvaged by the dismantlement contractor.

All underground storage tanks (UST) at the LFs were removed for salvage or closed in place in accordance with applicable North Dakota regulations. All LFs had an older deep-buried, 11,000-gallon UST; this UST was closed in place in accordance with North Dakota requirements. Most LFs with deep-buried tanks closed in place also had a new 4,000-gallon, double-walled shallow-buried UST that was removed for salvage (see Section 3.5).

The LEB blast door was welded shut, the upper level of the access shaft demolished, and the remainder filled with rubble. The dismantlement technique included explosive demolition of the headworks to the depth of the launcher equipment room (LER) floor (approximately 21 feet). This depth complied with START protocols that required explosive demolition to at least 6 meters (19.5 feet) or mechanical demolition to at least 8 meters (26.0 feet). For explosive demolition, everything above the floor of the LER, including the launcher closure door, was removed for salvage or became rubble. Concentric holes were drilled vertically in the concrete of the headworks for emplacement of explosives.

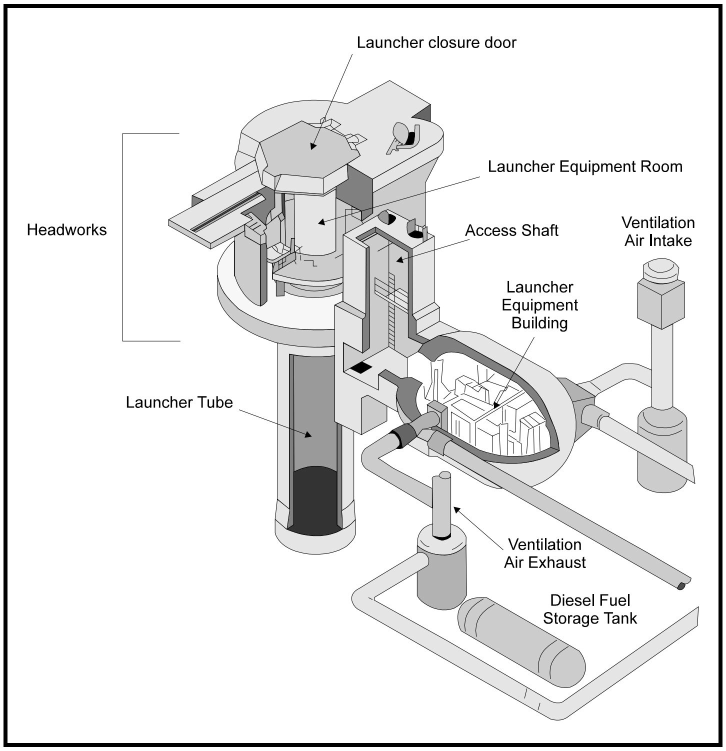

Figure 3.1-1. Launch Facility Schematic

To limit environmental impacts, the Air Force produced specifications for explosive demolition that prescribed maximum noise levels, ground attenuation, and debris criteria. The dismantlement contractor was required to use the minimum amount of explosives necessary to implode the concrete and steel into the launch tube. The demolition of each LF was designed to preclude the ejection of large pieces of debris outward from the launch tube. The rubble from the demolition was pushed into the launch tube along with fill material. A contractor then placed a steel-reinforced, 2-foot thick, 14-foot diameter, concrete cap over the launch tube, at a depth of approximately 28 feet. A 40-millimeter polymer liner was placed above the cap (at a depth of approximately 4 to 6 ft below ground level) to limit water incursion into the tube. A 90-day observation/verification period followed the demolition of the headworks. After the observation period, the remaining excavations were filled with rubble and gravel, backfilled, compacted, and contoured to leave a slightly mounded gravel surface to meld with existing gravel contours.

The cathodic protection system control was removed during the dismantlement and the wells were closed. The former antenna field (a pair of antenna wire arrays buried between 4 and 8 feet below the surface) was left in place at dismantlement. The HICS, which connects the LFs and MAFs, has marker posts that define the path of the cable. The HICS was abandoned in place, and the marker posts removed at the landowner’s discretion. Various power companies own the transformer pole and service connections to the LFs and are gradually removing them.

View of LF N-33 (Surface Features Intact)

View of Typical LF After Surface Grading, Showing K-04

Figure 3.1-2. Photographs of Launch Facilities

The Air Force and the dismantlement contractor have not disturbed the real property owned by the power companies. Azimuth markers were removed only at a landowner's request. The markers were buried in place unless the landowner requested removal; the Air Force excavated and removed the markers requested and buried them as launch tube fill. The fence around the site remains in place.

3.1.2. Missile Alert Facilities Prior To Dismantlement

The MAFs are located within a fenced area averaging about four acres; the Air Force actually owns approximately 20 acres at each facility. Located outside the security fence is a buried antenna (approximately 400 feet by 400 feet), and a dual-celled sewage lagoon that has been closed. Figure 3.1-3 shows the layout of a typical MAF, while Figure 3.1-4 includes photographs of a typical MAF.

Dismantlement of the MAFs included removing hazardous materials from the facilities, and retrieving salvageable materials, such as scrap metal. The sewage lagoon at each MAF was sampled and closed in accordance with federal and state regulations. Water wells located at the MAFs were not used since the quality of well water was inadequate. Rural water was delivered from local water suppliers to the MAFs. The water wells were closed in accordance with state requirements.

The dismantlement contractor was allowed to salvage items from the launch control center (LCC) and launch control equipment building (LCEB) after the Air Force removal operations were completed. Reusable components of the outside radio antennas were salvaged and other antenna components were used as rubble. After salvage operations, the blast door to the LCC and the LCEB door were welded shut. The elevator, elevator structure, controls, motor, and all structural steel stairs, platforms, and supports were removed from the elevator shaft. These items were removed through the service door. The vestibule in front of the LCC door and the entire elevator shaft and vestibule before the LCEB blast door were filled with rubble, sand, gravel, and dirt, and compacted to within one to two feet of the top of the shaft. A reinforced concrete cap was placed over the shaft to prevent settlement and to deny access to the abandoned LCC structure. Air intakes and exhaust ducts were filled and sealed with a 2-foot cap of reinforced concrete.

The MAFs had four to six fuel tanks used for diesel fuel, gasoline, or heating oil. The tanks ranged in size from 500 gallons to 15,000 gallons, and were usually USTs. Some smaller "day" tanks were also found within the facilities. Each MAF also had a 40,000-gallon, deep-buried tank formerly used to store distilled water. All of the tanks at the MAFs were older tanks that were removed or closed in place in accordance with state and federal regulations (see Section 3.5 for additional information on closure of these tanks). A 7,000-gallon tank for potable water remains for future reuse.

The cathodic protection system control was removed during the dismantlement and the wells were closed. The antenna located outside the fenced area is a grid of wires, buried three to four feet deep, which was left in place.

The MAF waste disposal system processed sewage from the launch control support building (LCSB) and LCC. Wastewater was discharged to the two-celled sewage lagoon by gravity flow drain lines and pumps. The sewage lagoon was located outside the security fence.

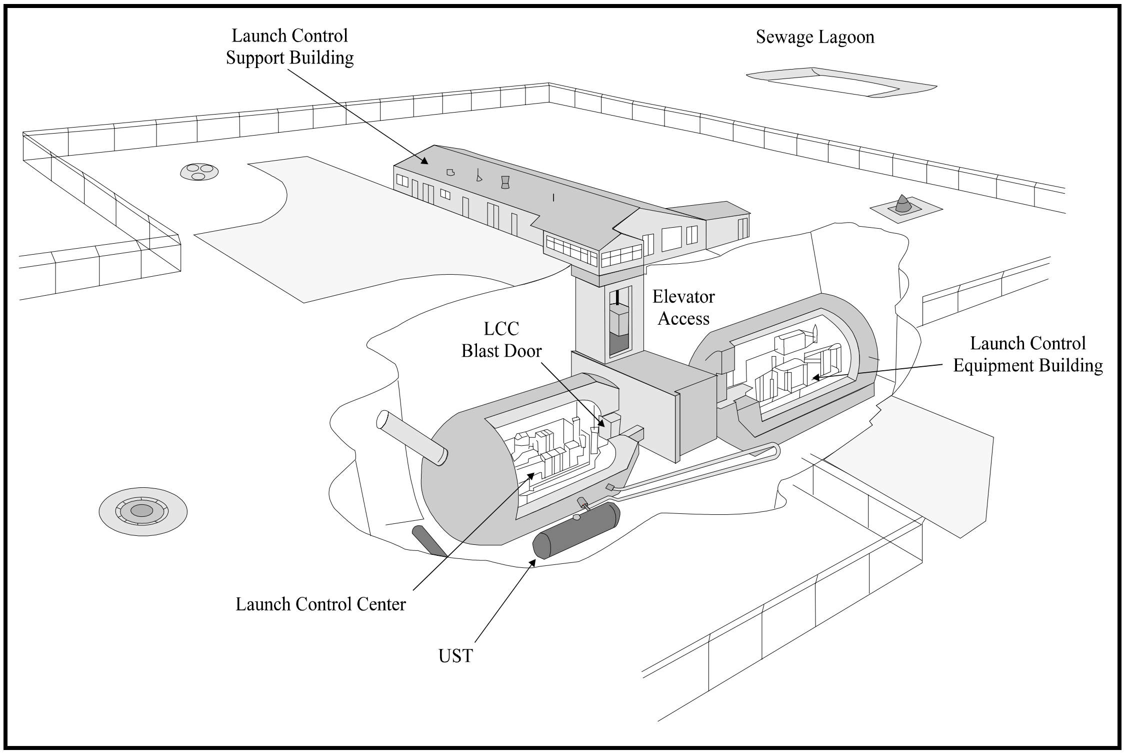

Figure 3.1-3. Missile Alert Facility Schematic

Solids in the lagoon were oxidized by bacterial action into an inert sludge, and sewage water was lost through evaporation. The lagoon contents, both liquids and sludge, were sampled prior to dismantlement. The liquids were properly handled, which included discharging sufficiently clean wastewater to surface waters, based on test results. Sludge disposal was dependent on test results. The dismantlement contractor drained the lagoons, leveled and graded the lagoons and berms for proper drainage, and stabilized and seeded the site with grasses specified by North Dakota regulations (NDCC Chapter 63-01.1-09).

The MAF buildings have not been demolished, but were left as a part of the real property. The MAF sites, including buildings and the surrounding fence, are being disposed of as described under the LF property disposition.

3.2. ENVIRONMENTAL SETTING

This section describes the climate, geology and soils, water resources, wetlands and prairie potholes, and floodplains in the deployment area of the 446 MS. Site-specific information on these features is provided in the EBSs for each LF and MAF.

3.2.1. Climate

The deployment area is located in the northern Great Plains near the geographic center of North America. The area is in a humid continental climate regime characterized by cool to warm summers and a large range of mean temperatures.

View of Former MAF A-0

View of Graded Sewage Lagoon at Former MAF A-0

Figure 3.1-4. Photographs of a Typical Missile Alert Facility

Mean daily maximum temperatures in the area range from the low teens (degrees Fahrenheit (°F)) in January to the low 80s°F in July and August. Mean daily minimum temperatures range from near -5°F in January to the high 50s°F in mid-summer. Extreme temperatures during cold arctic air masses have reached near -40°F in the region. Extreme high temperatures have reached near 105°F.

Mean precipitation in the area is about 20 inches per year, and is fairly evenly distributed across the 12 months, with a maximum in late spring and early summer at about 2.5 to 3.0 inches per month. Wind blows predominantly from the north in the winter and from the south during the summer. Mean wind speeds range from 7 to 9 knots (8 to 10 miles per hour (mph)) during most months.

3.2.2. Geology and Soils

The 446 MS deployment area lies within the physiographic province known as the Central Lowlands. The deployment area can be further separated into two physiographic subregions: the Red River Valley and the Drift Prairie (see Figure 3.2-1). The physiography of the deployment area varies from a nearly level lake plain in the Red River Valley, to rolling hills and small depressions in the Drift Prairie.

Sand, silt, and clay deposits from former glacial Lake Agassiz formed a broad, nearly level lake plain in most of Pembina County, the northeastern corner of Cavalier County, and the eastern half of Walsh County. At the western edge of the former Lake Agassiz, a series of beaches formed as the level of the lake varied over time. These beaches consist of sand, silt, and gravel deposited along a series of ridges and swales occurring from eastern Cavalier County to central Grand Forks County (USDA, 1972; USDA, 1977a, USDA, 1981; USDA, 1990a). West of these beaches, the Pembina Escarpment divides the Red River Valley (the lake bed of the former Lake Agassiz) from the Drift Prairie. The Drift Prairie is an area of glacial till (unsorted deposits of gravel, sand, silt, and clay) forming rolling hills, ridges, broad hills, and small, undrained depressions. Most LFs and MAFs in the 446 MS are located in the Drift Prairie, but a few LFs of Flight C are located in the Red River Valley.

Subsurface site reports from the construction of LFs and MAFs contain information on geologic layers to a depth of 1,000 feet (USAF, 1963). Surface layers generally consist of glacial till with layers of clay, silt, and sand to a depth of 20 to around 130 feet.

In some areas, this layer of glacial till extends to only 7 to 10 feet. In other areas, the glacial till extends as deep as 160 to 200 feet. The Pierre Shale underlies the glacial till at all sites in the 446 MS, except C-22 and C-23. The Pierre Shale is underlain by Colorado Shale and Limestone from about 400 feet to around 900 feet. The Dakota Shale and Sandstone is below the Colorado group. In some areas, Ordovician Limestone and Dolomite is encountered at a depth of 900 to 950 feet. Bedrock (Pierre Shale in most cases) is generally encountered at a depth of about 30 to 80 feet; however, at some LFs, it is found as shallow as 7 to 9 feet.

The 446 MS is located in portions of Pembina, Cavalier, Walsh, and Ramsey Counties. LFs and MAFs occur primarily in six soil series: Barnes, Buse, Cresbard, Hamerly, Svea, and Tonka, and in 16 other series to a lesser extent. Appendix C, Table C-1, lists the properties of soils occurring within the 446 MS.

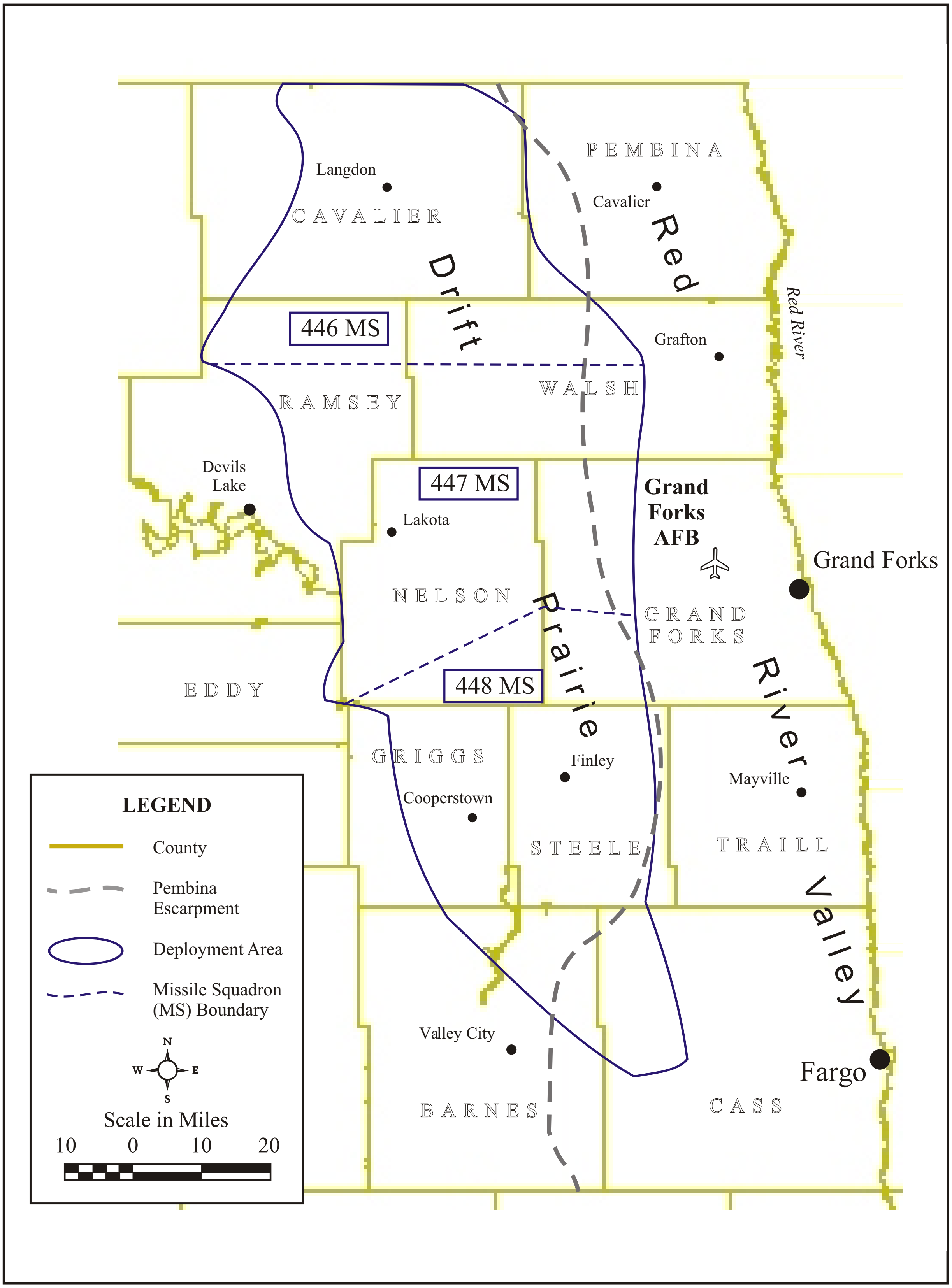

Figure 3.2-1. Physiographic Regions of the Deployment Area

These soils formed in areas affected by glaciation. The Barnes, Cavour, Cresbard, Easby, Hamerly, Parnell, Svea, Tonka, Vallers, Waukon, and Wyard soils formed in various locations on till plains. The Binford, Brantford, and Gilby soils developed on glacial lake beaches. The Divide, Renshaw, and Vang soils developed on glacial outwash plains. The Glyndon and Tiffany soils formed in glacial lake plains. Walsh soils developed in alluvial valley plains and on alluvial fans. Lamoure soils formed in floodplains.

These soils have a surface layer of loam and subsurface layers of clay, clay loam, or silty clay. Seven of these soils have sandy or gravelly subsurface layers. Permeability is generally moderate near the surface, and ranges from very slow to very rapid in the subsoil. Hydrologic groups vary from B to D (moderate to very slow water transmission within the soil). Many of the soils have a seasonally high water table. Five of these soils have a seasonally high water table either above the surface or within one foot of the surface. Eight of these soils have a seasonally high water table within one to six feet of the surface, while nine do not have a seasonally high water table within six feet of the surface. Six of the soil series are hydric soils, and nine additional series have hydric soil inclusions within them. The presence of hydric soils is one of the three criteria for wetland determination. The Lamoure soil (located only at LF C-29) experiences occasional brief flooding from March to October. No other soils at LFs in the 446 MS experience flooding.

Most of the soils have a low to moderate shrink-swell potential at the surface and a moderate to high potential in subsurface layers. Runoff ranges from ponded (occasional standing water) in flat areas to rapid flow in areas of higher slope. Slopes are generally between 0 and 3 percent, with slopes at some sites ranging from 3 to 6 percent. One LF in Walsh County is situated on a 6 to 9 percent slope.

The hazard of erosion by water is slight to moderate. The hazard of wind erosion ranges from slight to moderate for most of the soils, to high for Binford and Tiffany soils.

3.2.3. Water Resources

Water in the deployment area is provided primarily by rural water systems (i.e., water is piped to locations from municipal water sources). Private and public groundwater wells also exist within the deployment area. Most water in northeastern North Dakota is derived from well systems, typically within Glacial Drift Aquifers (USAF, 1999a). Water quality in the deployment area varies substantially for both surface water and groundwater. Generally, groundwater is too saline for domestic use, while surface waters are suitable for domestic use during periods of medium to high flow. Water with less than 500 milligrams per liter (mg/L) of total dissolved solids (TDS) is considered safe for most domestic uses.

Water at MAFs A-0, B-0, D-0, and E-0 was provided by rural water systems; a well at Cavalier Air Station provided water to C-0. Rural water system lines have been left in place for the potential new owners of the MAF sites. The two water tanks at the MAFs remain in place and could also be used by future owners to store water. Although water wells exist at the MAFs, the wells had not been used for drinking water for many years due to water quality problems (primarily high TDS levels). These water wells were closed in accordance with State guidelines (Vetter, 2001). The well depths vary from approximately 150 feet to 1,300 feet.

The LFs were unoccupied except during maintenance activities or missile component removal or emplacement, so no water wells were installed at the sites.

Because of the PCB coatings on the access shaft and ventilation shafts at the LFs and the potential to leach into shallow groundwater, no shallow drinking water wells can be installed at these sites. There are also deep-buried USTs that may have a PCB coating remaining at the LFs and MAFs (see Section 3.3 for a further discussion of this issue).

3.2.3.1. Surface Water

Northeastern North Dakota lies in the Central Lowlands physiographic region, which is primarily drained by the Red River of the North (USGS subregion 0902). This river drains 39,800 square miles of the United States, including 29,900 square miles of North Dakota All of the deployment area is located within this drainage. Figure 3.2-2 shows surface water features and drainage basin divides within the 446 MS deployment area.

The Red River of the North forms in southeastern North Dakota, where the Otter Tail and Bois de Sioux Rivers combine. North of this confluence, the Red River of the North forms the boundary between North Dakota and Minnesota, and therefore lies east of the deployment area.

The primary tributaries in the 446 MS generally flow easterly, and include the Pembina, Park, and Forest Rivers. The tributaries start in the Drift Prairie, where there is poor drainage, and flow through deeply incised valleys entering the Red River Valley, then develop nearly flat slopes in the lowlands before merging with the Red River of the North. The 446 MS lies west of the flood-prone area along the Red River of the North.

The Red River of the North subregion is divided into numerous hydrologic units, each of which is identified by a unique hydrologic unit catalog (HUC) number. The LFs and MAFs of the 446 MS are located in four hydrologic units:

- The Pembina River (HUC 09020313) starts in Cavalier County and enters the Red River of the North near Pembina in Pembina County, draining an area of 2,020 square miles. Its waters are used for fish and wildlife propagation, stock watering, municipal domestic water, recreation, and irrigation. The Tongue River is included within this HUC.
- The Park River (HUC 09020310) also starts in Cavalier County, and enters the Red River of the North southeast of Herrick in Walsh County. It drains 1,080 square miles. It is used for stock watering, municipal supply, recreation, and irrigation.
- The Forest River (HUC 09020308) starts in Walsh County and is 120 miles long, draining an area of 875 square miles and entering the Red River northeast of Warsaw. Its waters are used for fish and wildlife propagation, stock watering, municipal domestic water, and irrigation
- The Devils Lake basin (HUC 09020201) is located in Ramsey and northwestern Nelson Counties. This basin, covering an area of 3,580 square miles, is closed (runoff is retained within the basin and does not contribute to a river system). The Edmore Coulee is the major drainage in the Devils Lake basin lying within the 446 MS. Water is used for stock watering and wildlife production.

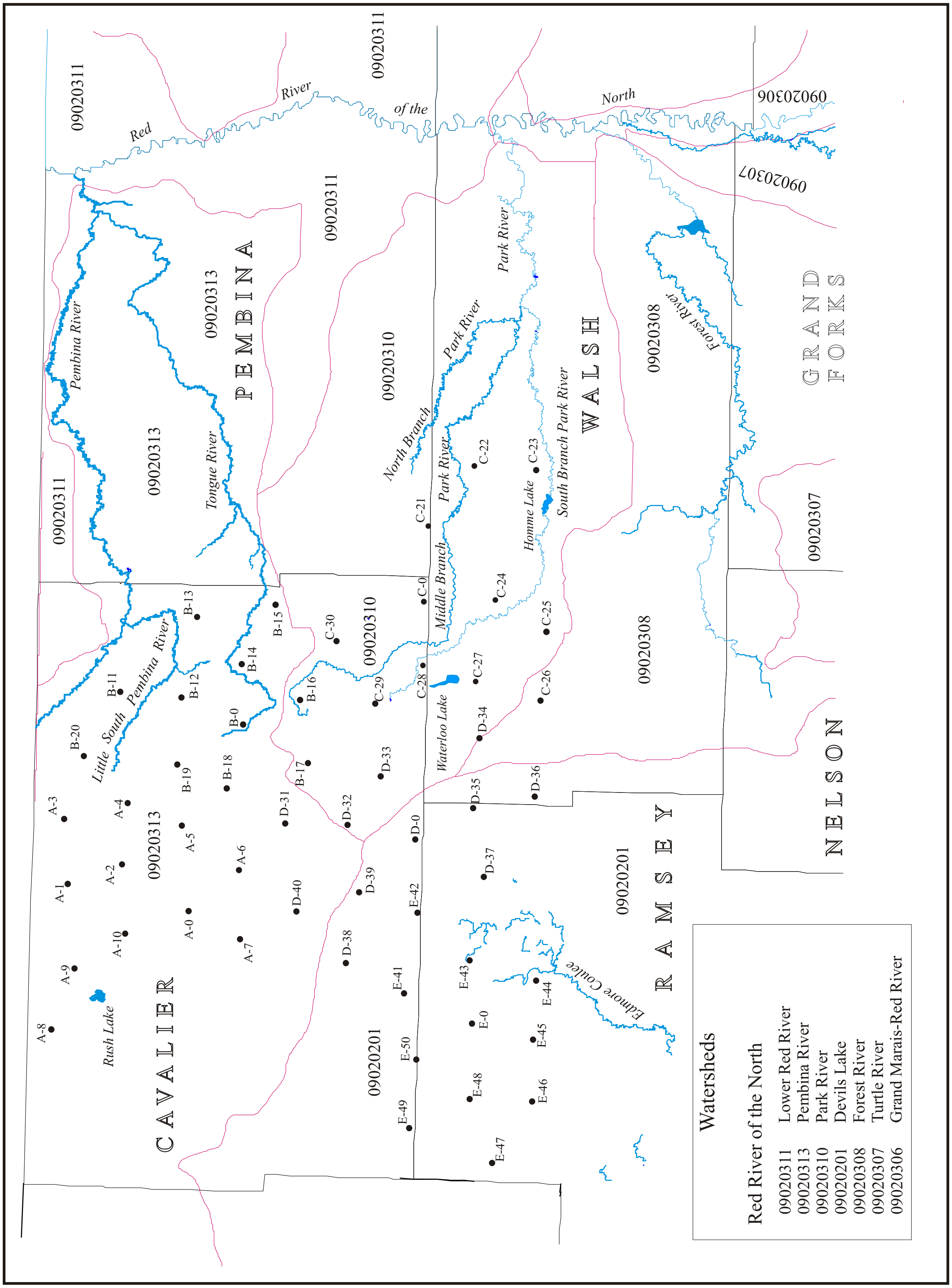

Figure 3.2-2. Surface Water in the 446th Missile Squadron

Small lakes are found throughout the deployment area of the 446 MS. Larger lakes include Rush Lake, Waterloo Lake, and Homme Lake. Numerous small reservoirs are also present in the region, typically ranging from about 50 to 400 acres.

According to the National Water Quality Inventory Report (NDDH, 2000), North Dakota reports that 69 percent of its surveyed rivers and streams have good water quality, which is defined as fully supporting aquatic life. Within the Red River Basin, 59 percent of the rivers and streams had good water quality. The leading sources of contaminants in rivers and streams are agriculture, the removal of streamside vegetation (which leads to siltation), and municipal sewage treatment plants. Natural conditions, such as low flows, also contribute to violations of standards.

Good water quality was found in 97 percent of the lakes surveyed. The leading sources of pollution in lakes are agricultural activities, municipal sewage treatment plants, and urban runoff/storm sewers.

The U.S. Public Health Service (USPHS) has established drinking water limits for chloride and sulfate content. Water with less than 500 milligrams per liter (mg/L) of TDS is considered safe for most domestic uses. Most of the rivers in northeastern North Dakota have average dissolved solids of less than 500 mg/L during medium to high flows, with water suitable for domestic use. During low flow periods, the rivers are generally too saline for domestic use. The Red River of the North has bicarbonate-type water and an average dissolved solid content of 330 mg/L. The Park River has sulfate-type water, with high calcium and magnesium content, and a TDS content of less than 1,000 mg/L. The Forest River has high calcium and magnesium content, with a TDS content of less than 1,000 mg/L. The Pembina River has bicarbonate type water with high calcium and magnesium content, and a TDS content of about 460 mg/L.

3.2.3.2. Groundwater

Two types of aquifers—bedrock and glacial drift—provide groundwater in northeastern North Dakota. The 446 MS is situated near shallow glacial-drift aquifers and shallower areas of the Pierre Aquifer. None of the LFs are located within one mile of a glacial-drift aquifer. The Dakota Aquifer is the major bedrock aquifer, but it is not widely used due to moderate salinity. Recharge of this aquifer occurs to the west of the deployment area. Limited quantities of water are found in the Pierre Aquifer, which is situated in Pierre Shale. Small, scattered aquifers in glacial drift provide groundwater to some areas.

The Pierre Aquifer consists of shale, marlstone, and claystone, and underlies much of the 446 MS. The aquifer is overlain by glacial drift or soil. Depth to the Pierre Shale ranges from 10 feet to greater than 130 feet. Recharge occurs throughout much of the deployment area from precipitation, snowmelt, or prairie potholes. Small amounts of water are yielded from fractures within the shale, generally at depths of 20 to 200 feet. This aquifer is used by some farms and municipalities, but is not a major groundwater source in the region.

Glacial-drift aquifers are scattered throughout most of the glaciated part of North Dakota and are the most important sources of groundwater in the state. These aquifers are composed of clay, silt, sand, and gravel. While these aquifers often yield little or no water in clay layers, yields can be high when glaciofluvial deposits of sand and gravel are present. These aquifers are generally shallow, from several feet to around 150 feet deep. Recharge is also from precipitation, snowmelt, or prairie potholes. The average recharge area is 10 to 20 square miles, with some small aquifers only having a recharge area of 3 to 4 square miles. Major glacial drift aquifers include the following:

- The Icelandic Aquifer is more than 20 miles long, as much as 9 miles wide, and underlies about 82 square miles. The aquifer consists mostly of very fine to medium sand interbedded with silt and clay. The aquifer is unconfined at the top and underlain by clay but generally becomes finer grained with increasing depth from west to east. Recharge is mainly from precipitation that is received on the surface of the aquifer. Water from this aquifer is predominantly very hard, fresh, and a calcium magnesium bicarbonate type that is be acceptable for most domestic and public uses (USGS, 1977).
- The Pembina Delta Aquifer is about 71 square miles in area and consists of clay, silt, sand, and gravel. Recharge to the Pembina Delta Aquifer is mainly from precipitation that is received in the immediate area; however, precipitation must percolate through several tens of feet of sediment before reaching the water table in much of the area. Groundwater in the Pembina Delta Aquifer is considered very hard, with a high dissolved calcium and magnesium content. Iron in the groundwater often exceeds drinking water standards. The Pembina Delta Aquifer is tapped for livestock, irrigation, and some domestic use (USGS, 1977).
- The Munich Aquifer underlies about 30 square miles and consists of shaly sand and gravel interbedded with clay and silt. The aquifer ranges in thickness from 0 to nearly 200 feet; the thicker part is confined beneath about 20 to 50 feet of glacial till. Recharge to the Munich Aquifer is derived primarily from local precipitation, which must percolate through the till, so maximum water levels are not attained until late fall or early winter. Some recharge may be by underflow from the Pierre Formation. Groundwater from the Munich Aquifer is predominantly very hard, slightly saline, and is a sodium sulfate type with a rather high concentration of iron. Concentrations of iron, sulfate, and TDS exceed drinking water standards. Discharge by wells is small, and is used by local farms (USGS, 1977).

Groundwater from the Dakota, Pierre Shale, and glacial-drift aquifers is generally hard and of the calcium bicarbonate or calcium sulfate type. It contains chemical constituents (such as sulfates or high salinity) that limit its use for domestic or industrial use, including irrigation. High concentrations of sodium and magnesium are found locally. The best quality water from these aquifers is found at higher elevations, where the TDS is less than 1,000 mg/L. In Pembina, Walsh, and Grand Forks Counties, these aquifers are contaminated by upward seepage from the Dakota Aquifer (NDGS, 1973b).

Water in the Pierre Aquifer is of the sodium chloride or sodium sulfate type, and the TDS content ranges from 700 mg/L to 12,500 mg/L. This water also exceeds the limits set by the U.S. Public Health Service for chloride and sulfate content.

3.2.4. Wetlands and Prairie Potholes

Wetlands are defined by the USACE (1987) as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." Wetlands are diverse ecosystems that provide natural flood control by storing spring runoff and heavy summer rains, replenish groundwater supplies, remove water pollutants, filter and use nutrients, provide a source of water for livestock and, in dry years, are valuable for crop and forage production. They provide habitat for many plant and animal species, including economically valuable waterfowl and 45 percent of the nation's endangered species. North Dakota has lost 49 percent of its original wetlands (NDDH, 2000).

Numerous prairie potholes exist throughout northeastern North Dakota. Prairie potholes tend to be seasonal water bodies that generally are not large or deep enough to maintain a fish population (other than small minnows, for example), and which are often associated with wetlands and lakes. Formed by glaciation, they are often found in large numbers grouped together. Prairie potholes typically fill with snowmelt and gradually dry out, although many are associated with surficial aquifers and retain water throughout the year. Some prairie potholes are characterized as ephemeral wetlands.[1]

Prairie potholes are prime waterfowl production (nesting) areas, and also provide habitat for waterfowl and other species during migratory seasons. Many areas within eastern North Dakota have been set aside to preserve wetland habitats. These areas range from 40 to 3,000 acres, and are managed to support migrating and nesting waterfowl, sustain native wildlife, and provide the public with outdoor recreational areas for hunting, trapping, bird watching, and other wildlife-oriented activities. The number and size of prairie potholes in North Dakota has increased over the past five years due to increased precipitation (Larson, 1995; HPRCC, 2003).

Appendix B provides maps showing streams and other surface waters in the 446 MS deployment area, but the types of other surface waters (wetland, prairie pothole, or pond) are not differentiated.

In the 446 MS, no fenced areas in MAFs or LFs are located within wetlands, although 10 sites have wetlands adjacent to or within the Air Force property boundaries; one of the 10 is categorized as an ephemeral wetland basin (USAF, 1999a; USEPA, 2003). The MAF sewage lagoons were formerly classified as wetlands but have since been closed. No closure permits were required from the USACE because the lagoons were not within a naturally occurring basin, connected to another wetland by an intermittent stream, or more than one-third acre (USAF, 1999a). Table C-2 lists wetlands within 1,000 feet of missile sites. Detailed information on wetlands near MAFs or LFs is provided in the site-specific EBSs (Section 3.2.5); regional and site maps showing wetlands are found within Appendix A of each site-specific EBS.

3.2.5. Floodplains

The 446 MS deployment area is not located within the 100-year floodplain of the Red River of the North or other perennial rivers in the deployment area (USAF, 1999a).

[1] Ephemeral wetlands are depressional wetlands that temporarily hold water in the spring and early summer or after heavy rains. Periodically, these wetlands dry up, often in mid to late summer. They are isolated without a permanent inlet or outlet, but may overflow in times of high water. Ephemeral wetlands are free of fish, which allows for the successful breeding of certain amphibians and invertebrates (USEPA, 2003).

3.3. HAZARDOUS MATERIALS AND WASTES

A material is hazardous when, because of its quantity, concentration, or physical, chemical, or infectious characteristics, it may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness, or pose a substantial present or potential hazard to human health or the environment. Hazardous materials used at the LFs and MAFs (and not addressed under other sections in this EBS) include oils and lubricants, cleaning solvents, ethylene glycol, sodium chromate solution (only at the LFs), lead-acid batteries, and mercury switches. These materials, and any wastes generated from their use and handling, have been removed from the LFs and MAFs. The only hazardous material remaining in the 446 MS sites is liquid propane, contained in two aboveground storage tanks (AST) located at each MAF (A-0, B-0, C-0, D-0, and E-0). The propane was used to heat the LCSB facilities during cold weather; these tanks and their contents have been left for the future owner of the property.

Under a Site Investigation program, sampling was performed at each site to determine if contamination due to the use or storage of these hazardous materials occurred. The following subsections provide a discussion of soil sampling conducted at the LFs and MAFs, the sampling of sewage lagoons at the MAFs, and groundwater sampling that was completed at five LF sites.

3.3.1. Soil and Coating Sampling at LFs

Soil sampling was conducted at all LFs at Grand Forks AFB, ND. A total of 79 samples were collected in the 446 MS. Soils samples were collected and analyzed for target analyte list (TAL) metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium (total), cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, silver, selenium, sodium, vanadium, thallium, and zinc), total petroleum hydrocarbons (TPH) (including diesel range organics (DRO) and gasoline range organics (GRO)). Results of these samples were compared to regulatory limits or risk-based health standards, where applicable. North Dakota has issued guidelines for TPH, setting the cleanup action level at 100 parts per million (ppm) (NDDH, 2001).

All sample results for TAL metals were below applicable regulatory limits (USAF, 1999d).

Testing for TPH indicated GRO above the North Dakota standard of 100 ppm at one site (E-44), with a reading of 200 ppm. Sample results for DRO were above the North Dakota standard of 100 ppm at four sites within the 446 MS: 230 ppm at C-24; 370 ppm at C-26, 560 ppm at C-27, and 24,000 ppm at E-44 (USAF, 2001a; USAF, 2000a; USAF, 1999b). Other sampling indicated that DRO were detected above cleanup action level guidelines at sites B-0 and D-0 (Klaus, 2001). Results are provided in Table C-3. Under NDDH Health Guidelines for petroleum hydrocarbon cleanup, the method selected for cleaning sites with contaminated soils is based on hydrogeologic conditions at the site, the potential for impacting population and groundwater used by wells or utilities, the presence of free product, potential impacts from vapors, and the future use of the land (NDDH, 2001). Based on the sample results and site factors, Grand Forks AFB personnel coordinated with staff from NDDH to determine a suitable action to address the contaminated sites. The NDDH gave its approval for the Air Force to blend the organically contaminated soil on site by excavating and spreading the soil near the surface to facilitate degradation of the organic contamination (Koop, 2001). Remediation at all identified sites has been completed in accordance with NDDH guidelines (Vetter, 2003).

Samples for analyzing PCBs were collected at LFs from waterproof coatings on ventilation shafts and access shafts, adjacent soils, and groundwater in ventilation shaft excavation. These are discussed in Section 3.14.

For other hazardous waste, North Dakota has followed federal regulations for land disposal, as found in 40 *Code of Federal Regulations* (CFR) 268. North Dakota and Federal regulations require testing of contaminated soil to determine the presence of hazardous waste. USEPA Region 8 has not established standards or remediation goals for contaminated soil.

3.3.2. Soil, Sludge, and Wastewater Sampling at MAFs

Soil and sludge samples were collected and analyzed at all five MAFs. Samples were analyzed for TAL metals, and none exceeded regulatory limits (USAF, 1999d).

Wastewater from sewage lagoons at all MAFs was sampled for oil and grease and TAL metals. All sample results were below regulatory limits.

3.3.3. Groundwater Sampling at LFs

The Environmental Impact Statement (EIS) on the Dismantlement of the MM III Missile System at Grand Forks AFB identified the potential for PCB contamination of groundwater due to leaching from buried coatings on ventilation and access shafts. The impact to groundwater was determined to be insignificant in the EIS (USAF, 1999a).

Groundwater modeling was performed using the Method of Characterization computer model. The Air Force submitted an application to the USEPA Region 8 for in-situ risk-based disposal of PCB bulk product waste as allowed under 40 CFR 761.62(c). Based on USEPA Region 8 comments on modeling results (regarding some of the selected physical parameters) in the EIS, the Air Force performed additional environmental modeling that evaluated a range in parameters to determine the sensitivity of the analysis. Results of the modeling were documented in a memorandum and submitted to USEPA Region 8, which approved in-situ risk-based disposal for the missile silos (USAF, 2001c). In order to extend the approval to allow destruction of the remaining silos, the Air Force needed to resolve all modeling issues. The Air Force agreed to collect field samples to provide inputs to the computer models, and to install groundwater monitoring wells (GMW) and sample for PCBs at five LFs. The USEPA Region 8 provided approval to demolish all of the remaining missile silos.

The Air Force developed a Groundwater Monitoring Plan for the 446 MS, providing rationale for site selection, identifying the well locations, and outlining the methods for sampling the wells. The Plan was submitted to USEPA Region 8 and approved in April 2001. Under the Plan, the Air Force would sample the sites for two years to monitor the potential presence of PCBs. Groundwater monitoring wells were installed at LFs B-13, C-21, C-22, C-28, and D-34, which were selected as a representative sample of LFs in the 446 MS. Three GMWs were installed at each site (one at a perceived upgradient location, one at the perceived downgradient location, and one for determining groundwater flow direction). The sampling is discussed in Section 3.14; results are presented in Table C-4.

3.4. INSTALLATION RESTORATION PROGRAM

The DoD implements CERCLA through its Defense Environmental Restoration Program (AFI 32-7020), which requires installations to identify, confirm, quantify, and remediate contamination associated with past hazardous material disposal sites. CERCLA, as amended by the *Superfund Amendments and Reauthorization Act* (SARA) (42 U.S.C. Sec. 9601, *et seq*.) provides Federal agencies with the authority to inventory, investigate, and clean up uncontrolled or abandoned hazardous waste sites. Areas that may be contaminated by hazardous materials or wastes through spills or leaks caused by DoD activities are being investigated and cleaned up through the Installation Restoration Program (IRP). There are no IRP sites associated with the LFs or MAFs.

3.5. STORAGE TANKS

Storage tanks can be aboveground or underground and can be associated with pipelines, hydrant fueling systems, or transfer systems. There were no known fuel pipelines, hydrant fueling, or transfer systems associated with the fuel systems of the LFs or MAFs. There were piping lines that connected the fuel storage tanks to dispensing systems or generators. All aboveground lines were removed. Buried lines were drained and closed in place (Vetter, 2001).

Numerous ASTs and USTs were used at the LFs and MAFs for fuel and water. Fuel storage tanks are closely regulated and must meet stringent guidelines for spill and leak protection as a result of historic problems with leaking tanks and fuel spills throughout the nation.

Prior to site dismantlement, tanks included deep-buried USTs at the LFs (30-35 feet deep) and MAFs (40-45 feet deep), shallow-buried USTs (ranging from about 3 to 10 feet deep) at the MAFs and LFs, and day tanks that were located within the LCEB at the MAFs and LEB at the LFs. Depending on their use, the tanks contained diesel heating fuel, diesel vehicle fuel, motor gasoline (MOGAS), or water. Some of the buried fuel tanks contained diesel fuel to run back-up power generators. Because they were used as a fuel source for the emergency generators, the USTs were deferred from federal regulation and the requirements under the North Dakota Storage Tank Regulations (1, Chapter 10) for release detection requirements. However, the tanks were still regulated for the December 1998 deadline for corrosion and spill or overfill protection, as well as proper closure. A 30-day notification was given to the State before UST removal or closure. The status of tanks installed at the MAFs and LFs is identified in Table 3.5-1.

At the MAFs, the deep-buried 15,000-gallon diesel fuel tank near the LCC and the 40,000-gallon demineralized water tank under the LCSB were left in place. The diesel tank was closed in accordance with state guidelines (cleaned and filled with sand). The water tanks were abandoned in place, as they are not regulated. The two propane tanks behind the garage have been left for the future owner of the property. All other tanks were removed.

The 1,000-gallon shallow-buried (3 to 4 feet to the top of the tank) diesel fuel tanks were removed from an area to the right of the gate, and the MOGAS tanks were removed. The 3,700-gallon shallow-buried heating oil tanks were removed.

Table 3.5-1 MAF and LF Storage Tank Status			
Size (Gallons)	**Location**	**Contents**	**Status**
40,000	Deep – MAF	Water	Abandoned
15,000	Deep – MAF	DF-2	Closed in Place
11,000	Deep – LF	DF-2	Closed in Place
4,000	Deep – LF	DF-2	Closed in Place
7,000	Shallow – MAF	Water	Abandoned
4,000	Shallow – MAF	DF-2	Removed
1,000	Shallow – MAF	DF-2	Removed
1,500	Shallow – MAF	MOGAS	Removed
1,000	Shallow – MAF	DF-2	Removed
500	Shallow – MAF	DF-1/DF-2	Removed
100	Day Tank – MAF	DF-2	Removed
100	Day Tank – LF	DF-2	Removed
480 (approx.)	Temporary Tank - LF and MAF	DF-2	Removed
DF = diesel fuel; MOGAS = motor gasoline Source: Vetter, 2001			

The 100-gallon diesel fuel tanks were removed from the LCEB and the 5-gallon diesel fuel tanks were removed from the LCSB; both of these were aboveground tanks.

At the LFs, the deep-buried 11,000-gallon USTs were closed in place in accordance with all applicable regulations (triple-rinsed and filled with an inert material (sand)); they were temporarily replaced with double-walled fiberglass USTs (4,000 gallons and 6 feet in diameter), including interstitial monitoring equipment. All of the piping was replaced at the same time, and the system tightness tested. The soils at all sites with these new USTs were examined, and cleaned if necessary, when the previous USTs were closed in place. Prior to site demolition, these shallow-buried 4,000-gallon USTs were removed in accordance with State requirements. The Air Force prepared tank closure reports (USAF, 2000c), which noted any soil contamination at the site (see Table C-4).

3.6. OIL/WATER SEPARATORS

There were no oil/water separators associated with the LFs or MAFs.

3.7. PESTICIDES

Pesticides are a group of biological or chemical materials that includes herbicides and insecticides. Pesticides vary greatly in toxicity, and can pose a threat to human health and safety and the environment, if improperly managed. Pesticides vary greatly in their persistence in the environment. Factors that influence the persistence of pesticides include soil type (coarse soil types allow more leaching), adsorption (clay and organic matter favor strong adsorption), solubility of the pesticide, and degradation rates (dependent on the chemical, sunlight, temperature, soil pH, soil moisture, and microbial activity). Pesticides were used at the MAFs and LFs and are still used by many adjacent private land owners.

Herbicides were used at regular intervals between the early 1960s and the late 1990s to control weed and plant growth. Arsenal®, a non-selective herbicide, was used in 1996 at the LFs and MAFs on a biannual basis, at a rate of 200 pounds (lbs) per site. Arsenal® is a systemic herbicide that is directly absorbed through the roots of the plant. Previous usage included Sprakil®, Weed Blast®, Pramitol® 25E, and Bromocil® 2-4-D. Herbicides were typically applied during late spring and early summer at rates below the maximum prescribed by the manufacturer. In addition, the herbicide Rodeo® was occasionally used to control aquatic vegetation, specifically cattails, at various locations. The sites are also mowed occasionally to control noxious weeds.

As part of the MM III Dismantlement EIS, a computer model, *Groundwater Loading Effects on Agricultural Management Systems* (GLEAMS), was used to evaluate the potential impact of residues from three pesticide ingredients (Imazapyr, Tebuthiuron, and Prometon). The other active ingredients (Diuron, Bromocil, and 2,4-D) persist less than two years. Results from the model showed that most pesticide residues are almost completely degraded within one year of application. Within the top 90 centimeters (cm) (36 inches) of soil, Imazapyr would degrade to less than 0.01 ppm (about 0.005 ppm in the top 1 cm [0.4 inches]) after two years. Tebuthiuron would degrade to about 0.07 ppm in the top 90 cm of soil after two years, and Prometon would degrade to about 0.35 ppm in the top 90 cm of soil after two years. There are no Federal or North Dakota regulatory limits on pesticide residues in soil. The modeling predicted that no leaching would occur below 36 inches and that three percent or less of the residue would run off into surface water. Any potential runoff would be substantially diluted in streamflow and would not exceed or even approach the maximum contaminant level (MCL) for drinking water (USAF, 1999a). Previous sampling in response to adjacent landowner complaints generally failed to detect pesticides, even though pesticide applications had been conducted within the previous months.

In recent years, Grand Forks AFB decreased herbicide use as part of a mandated reduction in overall pesticide usage. Less toxic and persistent herbicides were used, since spills or runoff of herbicides can damage crops in the fields that often surround the LFs and MAFs. Recent spot treatments have been used sporadically to supplement mowing for noxious weed control. Since these treatments involved smaller treatment areas and lower application rates than the previously modeled applications, they would also be predicted to result in negligible pesticide residues after one year. Few complaints over the past years were registered with the Air Force regarding herbicide damage to crops surrounding the LFs or MAFs. Table 3.7-1 provides information on herbicides used at the LFs and MAFs.

3.8. MEDICAL OR BIOHAZARDOUS WASTE

The LF sites were unoccupied, and were visited only during maintenance activities. Any medical waste generated at the site was returned to Grand Forks AFB for proper disposal. Air Force personnel temporarily lived at the MAFs and occasionally generated medical waste. All waste generated at the site was removed to Grand Forks AFB for disposal. There were no biohazardous wastes associated with the LFs or MAFs. Consequently, there is no risk of exposure to medical or biohazardous wastes at the dismantled sites.

Table 3.7-1 Herbicides Used at LFs and MAFs						
Years	**Product Name**	**Active Ingredient**	**CAS Number**	**Action**	**Amount**	**Concentration**
1996-1997	Arsenal®	Imazapyr	081334-34-1	NS[1] Herbicide	200 lbs/site biannually	0.5%
1995	Sprakil®	Tebuthiuron	34014-18-1	NS Herbicide	200 lbs/site biannually	1.0%
		Diuron	330-54-1			3.0%
1993-1994	Weed Blast®	Bromocil	314-40-9	NS Herbicide	200 lbs/site biannually	4.0%
		Diuron	330-54-1			4.0%
1990-1992	Pramitol® 25E	Prometon	1610-18-0	NS Herbicide	200 lbs/acre annually	5.0%
1989-1990[2]	Arsenal®	Imazapyr	081334-34-1	NS Herbicide	Unknown	Unknown
	Weed Blast®	Bromocil	314-40-9			
		Diuron	330-54-1			
1985-1986[2]	Bromocil®	Bromocil	314-40-9	NS Herbicide	Unknown	Unknown
	2,4-D	2,4-D	94-75-7			

[1] Non-selective
[2] Records for these years cannot be located; herbicides used in these years are based on interviews with Pest Management personnel.
Source: USAF, 1999a

3.9. ORDNANCE

Security forces were present at the MAFs to protect the facility as well as the surrounding LFs within the MAF's flight and adjacent flights. All weapons and ordnance used to protect the sites have been removed from the MAFs.

Each LF contained munitions that served as actuators for ballistic gas generators designed to remove the launcher closure door in the event of a launch. These munitions were removed before each site was demolished. Ordnance associated with the MM missiles was removed early in the deactivation process. There are no remaining munitions at the LFs or MAFs.

3.10. RADIOACTIVE WASTES

Reentry systems (RS), stored within the launch tube at LFs during missile deployment, were tightly sealed and designed to prevent leaks of radioactive material, and all have been removed from the LFs. Radioactive material within the warheads continuously emitted ionizing radiation in the form of alpha and beta particles, gamma rays and X-rays, and neutrons, measurable at a very low rate (below background levels) at a distance of three feet from the RS, and undetectable at a distance of 10 feet (NCRP, 1987). The steel liner of the LF was not irradiated above background levels to any significant degree from the presence of the RS in the launch tube, and any trace of latent radioactivity would have quickly dissipated to natural background levels after removal of the RS. The soil outside the launch tubes would not retain any latent radioactivity. Leaks of radioactive materials are not known to have occurred at Grand Forks AFB or in the deployment area (Rudolf, 1998). There is no risk of radiation exposure caused by past use of the site.

3.11. SOLID WASTE

Solid waste generated during operations at the LFs or MAFs was collected and returned to Grand Forks AFB for proper disposal. During dismantlement activities, any solid waste generated (except construction rubble) was collected and disposed off-site by a government contractor. Construction rubble generated at a site was placed down the launch tube at the LFs or the elevator shaft at the MAFs; the tube and shaft were subsequently sealed during dismantlement activities. North Dakota considers each site to be an inert solid waste site due to the demolition debris, and required the placement of a 40-millimeter-thick polymer liner 4 to 6 feet below grade level at the demolished LF sites (see Figure 3.1-2). No excavation or drilling can occur within the mounded area (over the launch tube) at these sites, although plowing around the periphery can occur.

3.12. WASTEWATER TREATMENT, COLLECTION, AND DISCHARGE

There were no wastewater treatment, collection, or discharge points associated with the LFs, since the sites were not occupied.

At each MAF a system was designed to treat, collect, and discharge wastewater. Sewage was collected and pumped to a dual-celled lagoon. The sewage lagoon sludge was landfarmed by removing the sludge, setting it aside, and grading the lagoon area. The sludge was then spread over the soil and mixed in with the top six inches of soil (USAF, 1999a; Koop, 2001). At the time of sampling, the primary lagoon had been cleaned out and no sludge remained for sampling. Seven sludge samples were collected from the secondary lagoon. One of the seven samples detected fecal coliform, but it was well below regulatory limits. Sludge samples for priority pollutant metals (PPM), molybdenum, ammonia, nitrate, nitrite, percent solids, and total nitrogen, phosphorus, and potassium were all below regulatory limits according to 40 CFR 503. Surface water samples for PPM, molybdenum, phosphorus, potassium, biochemical oxygen demand, total suspended solids, oil and grease, and pH were all below regulatory limits (USAF, 1999d).

The lagoon cells were closed in accordance with State requirements. Any remaining sewage sludge was stockpiled at one location, then the lagoon was graded out level with the surrounding land and the sludge was spread over the top 6 inches of soil. The disturbed area was then seeded with native grasses. At MAF E-0, improper grading during closeout resulted in nitrogen levels above the regulatory limit, and alfalfa was planted to balance the soil nitrogen (a USEPA-approved method). Subsequent soil sampling found nitrogen levels below the regulatory limit, and USEPA determined that no further remediation was needed (Koop, 2004). Details are found in the site-specific EBS for MAF E-0, in Volume II of this document.

3.13. ASBESTOS

At the LFs, the only item known to contain asbestos was the exhaust system for the diesel electric unit (DEU), which was removed as part of site dismantlement. The coatings found on some buried structures (such as the LEB access shaft) at the LFs may contain asbestos. None of the tanks at the LF tested positive for asbestos (Vetter, 2001). Any asbestos at the LFs was buried as part of the subsurface structure (disposed of in place, on site).

At the MAFs, the DEU exhaust systems in the LCSB and LCEB contain asbestos insulation under a metal sheet covering. MAFs may also contain asbestos at the elbows and joints of water pipe insulation on the heating system (asbestos sampling indicated that molded pipe joints on the heating system contained non-friable asbestos). Additional sources of asbestos at the MAFs include floor tiling (at the LCSB and the LCC), and vinyl base mastic and vinyl floor tiling in a closet at the LCSB (Hustad, 1997; Rudolf, 1998). The external coatings of the buried 15,000-gallon UST closed in place at the MAFs may contain asbestos.

3.14. POLYCHLORINATED BIPHENYLS

Liquid PCBs are a synthetic molecular additive formerly used in lubricating oils to enhance cooling characteristics. They were typically found in electrical transformers, fluorescent light ballasts, and machinery gear case oils, and were also used as a plasticizing agent and in waterproof coatings (e.g., at the LF underground structures). PCBs were used in the United States from 1929 to 1979 and are regulated by the *Toxic Substances Control Act* (TSCA) (15 U.S.C. Sec. 2601, *et seq*). PCBs are not regulated by CERCLA unless there is a release.

All equipment (e.g., electric filters, panels, and capacitors) that potentially contained PCBs was removed during the environmental safing process during the missile system dismantlement. Unless clearly identified as non-PCB, ballasts were handled as potentially containing PCBs. At the MAFs, light ballasts that potentially contained PCBs at the LCSB were removed and replaced only because of failure; some remaining ballasts may contain PCBs. All light ballasts were removed from the LFs.

The in-situ disposal of solid PCB occurred when debris from the implosion of LFs was left in place. The USAF and the USEPA addressed the issue of PCBs in non-liquid form during closure of the MM II facilities at Ellsworth AFB, South Dakota, and Whiteman AFB, Missouri. In November 1995, the two agencies entered into a Federal Facility Compliance Agreement (FFCA), a formalized plan to address PCBs in non-liquid form (including their potential inclusion within the HICS coatings) during closure of the MM II facilities. Subsequent to the FFCA, USEPA developed regulations pertaining to disposal of PCB bulk product waste (40 CFR 761.62(c)), which established a cleanup criterion of 100 ppm for a low occupancy site with an impermeable cap and restricted access (fenced site).

The Air Force and NDDH determined that PCB issues regarding the Grand Forks AFB MM III sites would be resolved with USEPA Region 8, rather than as specified in the FFCA. As noted in Section 3.3.3, the Air Force submitted an application to the USEPA Region 8 for in-situ risk-based disposal of PCB bulk product waste, as allowed under 40 CFR 761.62(c). The Air Force and USEPA Region 8 agreed that the Air Force would further evaluate potential levels of PCBs in the 446 MS, the first squadron scheduled for demolition.

Prior to the deactivation of each squadron, samples for PCBs were collected from UST coatings and adjacent soils. Testing revealed a PCB coating on some tanks at MAFs (Eggleston, 1997). The heating oil tanks (TK-106) and generator tanks (TK-107) were removed at the MAFs; all tested positive for PCBs (Hustad, 1998). Soil samples taken from around the tanks found PCBs at low levels, ranging from non-detectible amounts to 14 ppm (USAF, 1994b, 1995, 1996a, 1996b).

Sampling was also conducted in 1998 after deactivation. Sample results from waterproof coatings on access and ventilation shafts ranged from non-detect to 0.38 ppm (see Table C-6), with higher readings from ventilation shaft coatings. Adjacent soil samples collected at three LFs (A-03, D-32, and E-48) ranged from 0.81 to 7.9 ppm. Sump pump outfalls were sampled for PCBs at all LFs, and concentrations ranged from 0.021 to 3.8 ppm. All of the sample findings were well below the 100 ppm criterion for PCBs in soil.

PCBs can potentially leach into groundwater, where the drinking water criterion is 0.5 ppb. To investigate this possibility, groundwater monitoring is being conducted at 5 selected sites within the 446 MS, as discussed in see Section 3.3.3. Filtered[2] groundwater samples were used for comparison to drinking water MCLs. PCBs were not detected at four of the five LFs being monitored in the 446 MS. PCB (Arachlor 1254) was detected in one sample collected in June 2005 at LF C-22, at a level of 1 microgram per liter (µg/L). This sample was collected in sediment near the former vent shaft where PCB coatings were applied, and was not dissolved in the groundwater (filtered samples for groundwater were non-detect). Downgradient well samples did not detect PCBs. Groundwater monitoring will continue until June 2007 to confirm current sampling (USAF, 2005).

The coating on the deep-buried 15,000-gallon diesel fuel UST that was closed in place at each MAF might contain PCBs (Vetter, 2001). Within the entire MM III deployment area of Grand Forks AFB, only one deep-buried 11,000-gallon UST (at LF F-09 within the 447 MS) was tested for PCBs and none was detected.

The electric power suppliers in the deployment area were contacted to determine whether there had been any instances of insulating oil leakage and, if so, whether these transformers were suspected of being PCB transformers or PCB-contaminated[3]. The electric power suppliers have an easement with property owners for crossing private or Air Force lands (Nordham, 2001). The suppliers have full responsibility for all of their transformers. When the Air Force relinquishes the sites, the licenses between the Air Force and the electric suppliers will be terminated. Electric service is currently maintained at the MAFs; the future owners would become responsible for future electric service costs upon conveyance of the facility. Following is a summary of transformer status in the deployment area.

- Cavalier Electric Cooperative has no known PCB transformers in their service area; however, all transformers have not been tested. Transformers at the missile sites were tested in the summer of 2001 (Mickleson, 2001). There had been no PCB contaminant spills recorded within their system in the last five years.
- Cass County Electric Cooperative has removed all transformers at missile sites within its service area. There have been no PCB contaminant spills within the last five years within their system. If PCBs were found in the oil, the equipment was removed from service and refilled with PCB-free oil (Schmidt, 2001; Holmly, 2003).

[2] An unfiltered water sample may contain sediment and debris, while a filtered sample has been passed through a series of very fine screens and contains only water. The MCLs apply only to filtered samples. All samples were collected in accordance with USEPA methodology.

[3] According to 40 CFR 761.3, a "PCB-contaminated transformer" contains between 50 and 500 ppm of PCBs, while a "PCB transformer" contains greater than 500 ppm. A transformer containing less than 50 ppm is considered a "non-PCB transformer."

- Nodak Electric Cooperative has no known PCB transformers in their service area; the pole-type transformers at the missile sites do not contain PCBs. There have been no PCB spills recorded within their system in the last eight years, and their transformers at missile sites have been removed (Rodgers, 2003). Nodak's service area includes the area served by the former Sheyenne Valley Electric Cooperative.
- Otter Tail Power Company has removed most transformers and other equipment at missile sites within its service area; remaining equipment will be removed during scheduled maintenance, and no PCB-containing transformers remain (Van Voorhis, 2003). There have been no PCB contaminant spills recorded within their system in the last seven years (Graumann, 2003).

3.15. RADON

Radon is a naturally occurring odorless, colorless gas with radioactive qualities that may be harmful to human health. The region can present a risk of exposure from naturally occurring radon. Subsurface areas are a concern for radon gas to build up if structures are inadequately ventilated. The USEPA-recommended action level is 4 picocuries per liter (pCi/l); readings at Grand Forks AFB have ranged from about 4 to 20 pCi/l (Koop, 2001).

The LCC and LCEB at the MAFs were hermetically sealed areas with filtration units for nuclear, biological, and chemical elements. The LCSB did not contain a basement; subsurface areas are a concern for radon gas buildup if the areas are inadequately ventilated. No radon monitoring was conducted at the MAFs because the protected ventilation of the subsurface structures (Rudolf, 2001) was adequate to prevent radon buildup. Radon exposure at the LFs is negligible because of adequate ventilation on the surface.

3.16. LEAD-BASED PAINT

Lead-based paint was used on interior and exterior surfaces in buildings constructed prior to 1978. The subsurface facilities within the deployment area, including the LCEB and the LCC, were originally painted with paint containing red-lead pigment. At the LF, the interior of the launcher and LEB contain LBP. Although the lead content of the particular paint used is unknown, the paint used at the LFs and MAFs is conservatively assumed to contain 20 percent lead by weight (industrial paints contain 15 to 18 percent lead by weight (DuPont, 1990; Westinghouse Electric Corporation, 1990)). Other heavy metals, such as chromium and mercury, are also likely to be in the paint. (As discussed previously, soil test results for chromium, cadmium, mercury, zinc, and nickel were all below regulatory limits.) Subsurface structures potentially coated with LBP were buried in place. During Rivet Minuteman Integrated Life Extension (MILE) activities, portions of the original paint were chipped off exterior and interior surfaces at the LFs and left on the topside surface of each site (Hustad, 1997). The highest value for random samples for lead taken within the fence line of LF B-17 had a value of 260 ppm (USAF, 1999d); this concentration is below health criteria levels of 1,200 ppm for residential areas (TSCA Section 403).

Any LBP in the LCSB was removed prior to dismantlement. The only LBP remaining at the MAF is inaccessible below grade in the former LCC (Vetter, 2001). Traces of LBP may remain around door posts and jambs within the LCSB, but would be below the contaminant regulatory level of 5.0 mg/l (Koop, 2001).

4. FINDINGS FOR ADJACENT PROPERTIES

This section discusses the land use of properties adjacent to the former missile sites, and describes any contaminated sites found in the review of federal and state databases.

4.1. LAND USES

The former missile sites of the 446 MS are surrounded by agricultural areas used for production of various crops. Specific land uses are discussed in the site-specific EBSs.

Farming operations use chemical pesticides to increase yields. It is possible that pesticides may not be totally degraded and traces of some pesticides could be accumulating in the soil. A North Dakota State University (NDSU) survey of pesticide usage on agricultural land in the State found a total of 20.7 million acres treated with herbicides, insecticides, and fungicides in 1996 (NDSU, 1999). No specific information was provided on herbicide use in the deployment area, and no information on concentration levels of pesticides in farm land soil in North Dakota was available (see Section 3.7 of this EBS). There are no Federal or North Dakota regulatory limits on pesticide residues in soil.

Generally, pesticides degrade over time, and recently-used types of pesticides degrade more rapidly than chemicals used in the past. Pesticide fate modeling was performed as part of the MM III Dismantlement EIS. Based on the modeling results and on past experience, no significant concentrations of pesticides are expected on LF and MAF sites currently owned by the Air Force. Data on pesticide use by adjacent landowners were insufficient to draw conclusions on residual pesticide concentrations in the vicinity of the HICS.

4.2. SURVEYED PROPERTIES

Federal and state databases were investigated with due diligence based on the minimum search distances recommended by the ASTM guidelines for conducting Phase I site assessments (ASTM, 2000a, 2000b). Search distances are defined by ASTM Standards (NRC, 2005; NDDH, 2002, 2003; USEPA, 2005a, 2005b, 2005c, 2005d). The databases and their search distances are listed below, and the databases and findings are described in the following subsections. The contents of these databases change constantly; the findings are correct as of the dates given in Section 9, References.

• USEPA National Priorities List (NPL)	1.0 mile
• Federal Comprehensive Environmental Response, Compensation, and Liability Information System	0.5 mile
• Federal Resource Conservation and Recovery Information System (RCRIS)	0.5 mile
• Federal Toxic Release Inventory (TRI)	0.5 mile
• Federal Treatment, Storage, or Disposal (TSD) Facilities	0.5 mile
• Federal Emergency Response Notification System (ERNS)	Property only
• State Leaking Underground Storage Tanks (LUST)	0.5 mile
• State CERCLA	0.5 mile

4.2.1. National Priorities List

The NPL, compiled by USEPA pursuant to CERCLA (42 U.S.C. Sec. 9605(a)(8)(B)), identifies properties with the highest priority for cleanup pursuant to USEPA's Hazard Ranking system. USEPA's database of NPL sites was searched on September 19, 2005, and North Dakota has no current sites listed on the NPL. The listing shows two sites deleted in the mid-1990s, but neither was within the MM III deployment area.

***Findings*:** North Dakota has no current or proposed NPL sites (USEPA, 2005a).

4.2.2. Comprehensive Environmental Response, Compensation, and Liability Information System

In 1986, as part of SARA, Congress created the CERCLIS database to maintain all the related information. This system tracks information of all Superfund sites—both the most hazardous (the NPL) and those where cleanup is easier or less urgent. The CERCLIS list contains the names of all sites that the USEPA is currently investigating, or has investigated in the past, for a release of potential hazardous substances and possible inclusion on the NPL. Being included in CERCLIS does not mean that the site has been marked for cleanup by the Superfund program, nor does it mean that a hazardous substance has in fact been released there. Being in the CERCLIS means that USEPA needs to examine the situation and determine if there is cause for a Superfund cleanup or for further investigation. Sites of potential concern are those within a radius of a half-mile of the LFs or MAFs because of their potential to have a detrimental effect on the groundwater underneath the sites.

***Findings*:** There are no hazardous waste sites within a half-mile of any of the LFs or MAFs (USEPA, 2005a).

4.2.3. Resource Conservation and Recovery Information System

The RCRIS list contains hazardous waste data in support of the *Resource Conservation and Recovery Act* (RCRA), which requires that those who generate, transport, treat, store, and dispose of hazardous waste provide information concerning their activities to state environmental agencies. These agencies then provide the information to regional and national USEPA offices. A query of the database was conducted for counties in the 446 MS deployment area to determine RCRIS listings.

Findings: None of the MAFs or LFs in the 446 MS are listed as RCRIS sites, and there are no RCRIS sites within a half-mile of any of the LFs or MAFs (USEPA, 2005b).

4.2.4. Toxic Release Inventory

The TRI, established under the *Emergency Planning and Community Right-to-Know Act* of 1986 (EPCRA) and expanded by the *Pollution Prevention Act* of 1990, contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities.

Findings: There are no TRI sites within a half-mile of any LF or MAF (USEPA, 2005d).

4.2.5. *Resource Conservation and Recovery Act* Treatment, Storage, or Disposal Facilities

RCRA TSD facilities are those facilities on which treatment, storage, and/or disposal of hazardous wastes take place, as defined and regulated by RCRA. USEPA, in cooperation with the States, keeps a listing of TSD facilities. Both the TRI database and The National Biennial RCRA Hazardous Waste Report were searched for TSD facilities.

***Findings*:** There are seven TSD facilities in North Dakota, but none within the prescribed half-mile radius of an LF or MAF (USEPA, 2005c).

4.2.6. Emergency Response Notification System

The National Response Center maintains the ERNS and is the sole federal point of contact for reporting all oil, chemical, radiological, biological, and etiological discharges into the environment anywhere in the United States and its territories. The NRC database was searched to identify any spills associated with Air Force properties.

***Findings*:** No spills were identified as occurring at any of the LFs or MAFs (NRC, 2005).

4.2.7. Leaking Underground Storage Tanks

Under Subtitle I of RCRA, Congress directed the USEPA to establish regulatory programs to prevent, detect, and clean up releases from USTs containing petroleum or hazardous substances. The State of North Dakota is approved to administer and enforce a UST program in lieu of the federal program under Subtitle I of the RCRA of 1976 as amended, 42 U.S.C. Sec. 6991, *et seq*. Leaking USTs can threaten groundwater quality. The NDDH Division of Waste Management provided a listing of LUST sites within the 446 MS counties.

***Findings*:** A leaking tank was identified at MAF A-0 and the site was remediated. Information is included in the MAF's site-specific EBS.

4.2.8. *Comprehensive Environmental Restoration, Compensation, and Liability Act* Sites in North Dakota

The NDDH Hazardous Waste Program maintains a database of CERCLA sites by county. This database contains the same information as USEPA's database, but in a different format (see Section 4.2.2) (Herda, 2001).

***Findings*:** No CERCLA sites are found within a half-mile radius of an LF or MAF (USEPA, 2005a).

This page intentionally left blank.

5. APPLICABLE REGULATORY COMPLIANCE ISSUES

Compliance issues are environmental conditions that may affect the transfer or use of the subject property. These conditions include historic property, prehistoric sites, traditional cultural resources, sensitive habitats, threatened or endangered species, wetlands, floodplains, seismic conditions, mineral resources, prime and unique farmlands or timberlands, and water rights. Compliance issues also include violations or potential violations of federal, state, or local laws and regulations that have occurred on lands proposed for relinquishment. No prehistoric or traditional cultural resources have been found at any of the 446 MS sites.

5.1. LIST OF COMPLIANCE ISSUES

5.1.1. Historic Property

The State Historical Society of North Dakota (SHSND) and the Advisory Council on Historic Preservation were consulted as part of the MM III Dismantlement EIS (USAF, 1999a). The missile sites were considered as eligible for the National Register of Historic Places based on their roles in the Cold War. The Air Force and the SHSND have negotiated a Programmatic Agreement to retain a MAF (O-0) and LF (N-33), both located within the 448 MS, and those two sites were not dismantled. No restrictions for transfer of properties are required for MAFs or LFs within the 446 MS.

5.1.2. Sensitive Habitats

The LFs or MAFs in the 446 MS are not adjacent to or within any protected areas, such as national wildlife refuges, national or state wildlife management areas, or waterfowl protection areas. No disturbance to these protected habitats should occur if the lands are sold; therefore, no restrictions for the transfer of the properties are required.

5.1.3. Threatened and Endangered Species

No known threatened or endangered plant or animal species, or suitable habitat for such species, inhabit the LFs or MAFs within the 446 MS (USAF, 1999a). No impacts to any protected species or their habitat should occur if the properties are sold; therefore, no restrictions are required.

5.1.4. Wetlands

Wetlands are regulated under Section 404 of the *Clean Water Act* (CWA)[1] and Executive Order (EO) 11990, *Protection of Wetlands*. Region 6 of the USFWS manages Wetland Management Districts in North Dakota to provide wetland areas needed by waterfowl for

---

[1] Generally, CWA Section 404 requires that a permit be obtained before dredging or filling wetlands that are greater than one-third acre in size, within a naturally occurring basin, or connected to another wetland by a perennial or intermittent stream. More information on wetland permits in North Dakota can be found at http://www.nwo.usace.army.mil/html/od-rnd/ndhome.htm. More information on wetlands and prairie potholes can be found at the National Wetlands Inventory website, http://wetlands.fws.gov/.

nesting and feeding. Wetlands in the vicinity of the LFs and MAFs are discussed in Section 3.2.4 and Table C-2, and in the site-specific EBSs (Section 3.2.5).

There are 8 sites in the 446 MS having National Wetland Inventory wetlands within Air Force property boundaries; 3 of these also have nearby wetlands. An additional site has an ephemeral wetland within its property boundaries as well as nearby wetlands. These wetlands may be subject to the CWA, and future owners may be required to coordinate with the USACE before disturbing (e.g., filling) the wetlands.

Of the remaining 46 sites, 36 have nearby wetlands. The nearby wetlands would not be directly affected by the property transfer. Although it is unlikely these wetlands would be disturbed, they may be subject to the CWA.

No disturbance to wetlands would occur from selling the properties; therefore, no restrictions are required.

5.1.5. Floodplains

The MAFs and LFs in the 446 MS are not located within floodplains (USAF, 1999a). No impacts to any type of floodplain would occur if the properties are sold; therefore, no restrictions are required.

5.1.6. Seismic Conditions

The 446 MS is in a zone of low seismicity and there are no major faults in the deployment area (USAF, 1999a). Seismic conditions would not change as a result of the sale of the properties; therefore, no restrictions are required.

5.1.7. Mineral Resources

No economically recoverable mineral resources have been identified in the vicinity of the LFs or MAFs within the 446 MS; therefore, no restrictions are required.

5.1.8. Prime and Unique Farmlands or Timberlands

The determination of prime and unique farmland is based on soil type (soil series) as defined by the USDA Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service). The county soil surveys published by the NRCS contain detailed soil maps showing the areas that are prime farmland. The soil surveys are available from the USDA county extension agents.

Within the 446 MS, 6 former missile sites contain no prime farmland soils, 16 sites are partially designated as prime farmland, and 33 are completely covered with prime farmland soils. The sites or portions thereof designated as prime farmland are subject to the *Farmland Protection Policy Act* (Public Law 97-98), and restrictions would apply to the conversion of the land to a non-agricultural use. Table C3 shows the sites and their designations.

No timberlands have been designated in the vicinity of the LFs or MAFs.

5.1.9. Water Rights

If any water rights were acquired, they will be addressed in the Report of Excess to be prepared for each site by the USACE (Nordham, 2001).

5.2. DESCRIPTION OF CORRECTIVE ACTIONS

The dual-celled lagoon at MAF E-0 was evaluated for a reduction in nitrogen levels. Alfalfa, a plant which fixes nitrogen (i.e., absorbs excess nitrogen into the plant tissues), is planted to balance nitrate levels in the soil; this method has been approved by USEPA. Representatives of the Air Force and USEPA monitored the results of alfalfa growth at the sewage lagoon for a year and determined that no further action was needed.

Former LFs C-24, C-26, C-27, and E-44, and former MAFs B-0 and D-0, had sampled areas where DRO concentrations were above the criteria level; E-44 also had a GRO detection above the criteria level. The NDDH gave approval for the Air Force to incorporate the contaminated soil from areas with excess DRO and GRO concentrations into existing soil stockpiles (Koop, 2001; NDDH, 2001). The Air Force reduced the concentrations below criteria levels by excavating and spreading the soil near the surface to facilitate degradation of the organic contamination.

Groundwater sampling data from former LF sites B-13, C-21, C-22, C-28, and D-34 will be used to determine the potential for impacts from non-liquid PCB coatings at the other LFs. The results will also be used to evaluate the need, if any, for further action at the LFs. Monitoring is scheduled to continue at the five LFs in the 446 MS through June 2007.

At the present time, no further action is required for PCBs (see Section 3.14). If PCBs were to be detected in the future, the Air Force would perform remediation in accordance with applicable regulations and cleanup standards.

No other corrective actions were determined to be necessary.

This page intentionally left blank.

6. CONCLUSIONS

This section presents the property categories defined by AFI 32-7066, the conclusions for the 446 MS, and data gaps and assumptions. A summary table provides site-specific findings.

6.1. PROPERTY CATEGORIZATION

Potential site contaminants include, but are not limited to, hazardous materials, petroleum products, storage tanks and related systems, treatment systems and components, IRP sites and areas of concern, medical/biohazardous waste, ordnance (including lead), pesticides, radioactive materials and mixed waste, PCBs, and solid waste.

Section 2.1.2 of AFI 32-7066 categorized the findings of the analyses on the presence of hazardous substances or petroleum products or their derivatives for each property or area based on seven categories. Each EBS produced for a missile system facility within the 446 MS was categorized. The following seven categories follow new guidance provided in a February 9, 1999, memorandum on Interim Use of Environmental Baseline Survey Property Categorization Codes, from the U.S. Air Force Headquarters Environmental Division (HQ USAF/ILEV) (USAF, 1999b):

- *Category 1* – Areas where no release or disposal of hazardous or petroleum substances has occurred (including no migration of these substances from adjacent areas).
- *Category 2* – Areas where only release or disposal of petroleum substances has occurred.
- *Category 3* – Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require removal or remedial response.
- *Category 4* – Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions have been taken.
- *Category 5* – Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions are underway, but not yet taken.
- *Category 6* – Areas where release, disposal, and/or migration of hazardous substances has occurred, but remedial actions have not been implemented.
- *Category 7* – Areas that are not evaluated or require additional evaluation.

Property in Categories 1 through 4 is suitable for transfer by deed under CERCLA 120(h) requirements. Property in Categories 5 and 6 is unsuitable for transfer by deed under CERCLA 120(h) unless it can be shown that all necessary remedial actions have been taken and the property is awaiting reclassification into Category 4. Property in Category 7 is unsuitable for transfer by deed unless all necessary investigations are completed and the property is awaiting reclassification into one of the first four categories. Category 7 may be made suitable for transfer if further investigation reveals no contamination and the property can be reclassified into one of the first four categories.

6.2. CATEGORY FINDINGS

A Phase I EBS has been conducted for each LF and MAF. Based on the initial results of the site inspection and studies and relevant guidance material, categories have been assigned to individual LFs and MAFs within the 446 MS. The condition of each LF and MAF is defined within the site-specific EBSs and those findings are summarized in Table 6.2-1.

As Table 6.2-1 shows, 44 of the sites have been designated as Category 3, 11 sites as Category 4, and none as Category 5.

6.3. DATA GAPS AND ASSUMPTIONS

No data gaps have been identified for this EBS.

This report is based upon certain verbal information and representations provided by DoD and other government employees, documents provided by the DoD, and reports prepared by private consultants contracted by the DoD. Except as discussed, no attempt was made to independently verify the accuracy or completeness of that information; however, no inconsistencies or omissions of a nature that might call into question the validity of any of the information were found. To the extent that the conclusions in this report are based in whole or in part on such information, those conclusions are contingent on its accuracy and validity.

Table 6-2.1
Summary of Site Categorizations, 446 MS

Site	*Cat. 3*	*Cat. 4*	*Cat. 5*	*Site*	*Cat. 3*	*Cat. 4*	*Cat. 5*
A Flight							
MAF A-0		√		LF A-06	√		
LF A-01	√			LF A-07	√		
LF A-02	√			LF A-08	√		
LF A-03	√			LF A-09	√		
LF A-04	√			LF A-10	√		
LF A-05	√			*Subtotal for Flight:*	10	1	0
B Flight							
MAF B-0		√		LF B-16	√		
LF B-11	√			LF B-17	√		
LF B-12	√			LF B-18	√		
LF B-13	√			LF B-19	√		
LF B-14	√			LF B-20	√		
LF B-15	√			*Subtotal for Flight:*	10	1	0
C Flight							
MAF C-0		√		LF C-26		√	
LF C-21	√			LF C-27		√	
LF C-22	√			LF C-28	√		
LF C-23	√			LF C-29	√		
LF C-24		√		LF C-30	√		
LF C-25	√			*Subtotal for Flight:*	7	4	0
D Flight							
MAF D-0		√		LF D-36	√		
LF D-31	√			LF D-37	√		
LF D-32	√			LF D-38	√		
LF D-33	√			LF D-39	√		
LF D-34	√			LF D-40	√		
LF D-35	√			*Subtotal for Flight:*	10	1	0
E Flight							
MAF E-0		√		LF E-46	√		
LF E-41		√		LF E-47	√		
LF E-42	√			LF E-48	√		
LF E-43	√			LF E-49		√	
LF E-44		√		LF E-50	√		
LF E-45	√			*Subtotal for Flight:*	7	4	0
446 MS							
Total for 446 MS					**44**	**11**	**0**

This page intentionally left blank.

9. REFERENCES

Section 9.1 includes cited references as well as uncited sources that were used for background information, or for other EBSs being prepared to support the relinquishment of the former MM III missile system at Grand Forks AFB. Additional documents and maps were used as background materials in the preparation of the EBS graphics. Sections 9.2 and 9.3 contain lists of U.S. Army Corps of Engineers maps and property documents, respectively, and Section 9.4 lists the U.S. Geological Survey topographic maps that covered the MM III deployment area.

Certain information cited below (and within the document) was obtained from Internet sites maintained by government agencies or other reliable sources. The Internet citations (uniform resource locators, or URLs) were accurate at the time the data were collected and were rechecked as correct in October 2005. However, websites change frequently due to changes in data availability or reorganization of information, and the cited URLs may not work in the future. If this occurs, "backing up" to a less specific web address (e.g., an agency's home page) may allow retrieval of the information.

9.1 GENERAL REFERENCES

American Society for Testing and Materials, 2000a. *Standard Practice for Environmental Site Assessments: Transaction Screen Process*. Designation: E 1528-00. July.

_____, 2000b. *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*. Designation: E 1527-00. July.

ASTM—see American Society for Testing and Materials

Bartelson, Arnie, 2001. 319 CES/CEM, Grand Forks AFB, North Dakota. Personal communications. Various months.

Crone, Kelly, 2002. HQ AFSPC/CEV. Personal communication. July.

DuPont, 1990. Lead-Based Paint Chemical Content.

Eggleston, Andrea, 1997. 319 CES/CEV, Grand Forks AFB, North Dakota. Personal communication. December.

Fahrenkrug, Ervin, 2000-2004. HQ AFSPC/CEM. Personal communications. Various months.

Federal Emergency Management Agency, 2002. Floodplain maps. Various months. http://www.hazardmaps.gov/atlas.php

FEMA—see Federal Emergency Management Agency

Goodrun, Ronnie, 2001-2004. 319 CES/CER, Grand Forks AFB, North Dakota. Personal communication. Various months.

Graumann, Terry, 2001-2003. Otter Tail Power Company. Personal communications concerning PCB transformers.

Herda, Stephen, 2001. North Dakota Department of Health, Division of Waste Management. Personal communication concerning State of North Dakota CERCLA program. January.

High Plains Regional Climate Center, 2003. Fargo WSO [Weather Service Office] Airport, ND Monthly Total Precipitation. March.

Holmly, Jim, 2003. Cass County Electric Cooperative. Personal communication concerning PCB transformers. April.

HPRCC—see High Plains Regional Climate Center

Hustad, Greg, 1997-1998. 319 CES/CEM, Grand Forks AFB, North Dakota. Personal communications. Various months.

Kjosen, Mark, 2001-2003. HQ AFSPC/CEM. Personal communications. Various months.

Klaus, Chris, 2001. 319 CES/CEM, Grand Forks AFB, North Dakota. Personal communications. Various months.

Koop, Wayne, 2001-05. 319 CES/CEV, Grand Forks AFB, North Dakota. Personal communications. Various months.

Larson, Diane L, 1995. *Effects of Climate on Numbers of Northern Prairie Wetlands, Climatic Change*, 30:169-180, Northern Prairie Wildlife Research Center. http://www.npwrc.usgs.gov/ (Version 16 Jul 97)

McCullough, Dave, 2001-2004. 319 CES/CEV, Grand Forks AFB, North Dakota. Personal communications. Various Months.

Mickleson, Keri, 2001. Cavalier Electric Cooperative. Personal communication concerning PCB transformers. January.

National Council on Radiation Protection and Measurements, 1987. *Exposure of the Population in the United States and Canada from Natural Background Radiation*. Bethesda, Maryland. December.

National Response Center, 2005. National Response Center Database for Emergency Response Notification System (ERNS) List. September. http://www.nrc.uscg.mil/nrchp.html

NCRP—see National Council on Radiation Protection and Measurements

NDDH—see North Dakota Department of Health

NDDOT—see North Dakota Department of Transportation

NDGS—see North Dakota Geological Survey

NDSU—see North Dakota State University

NDSWC—see North Dakota State Water Commission

Ness, Mr. Carl, 2000. North Dakota Department of Health, Division of Waste Management. Personal communication concerning LUST sites. September.

Noordam, Walter, 2000-2004. U.S. Army Corps of Engineers, Omaha District, Real Estate Office. Personal communications. Various months.

North Dakota Department of Health, 2000. Division of Water Quality. *North Dakota Water Quality Assessment, 1998-1999: The 2000 Section 305 (b) Report to Congress.*

_____, 2001. Cleanup Action Level Guidelines for Gasoline and Other Petroleum Hydrocarbons. http://www.health.state.nd.us/ndhd/environ/ wm/pdf/cleanup.pdf

_____, 2002. Division of Waste Management. Documentation on Leaking Underground Storage Tank Sites. October.

_____, 2004. Environmental Health Section. Letter to HQAFSPC/CEV Concerning Closure Of Underground Storage Tanks.

_____, 2005. North Dakota Department of Health, CERCLA/Superfund Sites. http://www.health.state.nd.us/ndhd/environ/wm/ hwp/cercla.htm

North Dakota Department of Transportation, 1994-1996. Traffic Volume Maps for Barnes, Cass, Cavalier, Eddy, Grand Forks, Griggs, Nelson, Pembina, Ramsey, Steele, and Walsh Counties (deployment area).

North Dakota Geological Survey, 1973a. *Mineral and Water Resources of North Dakota*. Bulletin 63.

_____, 1973b. *Geology of Nelson and Walsh Counties, North Dakota, County Ground Water Studies 17—Part 1*.

_____, 1995. *Publications of the North Dakota Geological Survey*. December.

North Dakota State University, 1999. Pesticide Usage in North Dakota. November.

North Dakota State Water Commission, 2001-2003. Ground and Surface Water Data. http://www.swc.state.nd.us/dataresources.html

NRC—see National Response Center

Pavek, Tim, 2000. 28 CES/CEM, Ellsworth AFB, South Dakota. Personal communication. Various months.

Rodgers, Stanley, 2003-2004. HQ AFSPC/CEV. Personal communications. Various months.

Rodgers, John, 2003. Nodak Electric Cooperative. Personal communications concerning PCB transformers.

Rudolf, Scott, 1998, 2001-2002. 319 CES/CEM, Grand Forks AFB, North Dakota. Personal communications. Various Months.

Schmidt, Bradley, 2001. Cass County Electric Cooperative. Personal communication concerning PCB transformers. January.

Stensland, Judy, 2001-2003. 319 CES/CER, Grand Forks AFB, North Dakota. Personal communications. Various months.

Toutenhood, SSgt, 2000. Grand Forks AFB Cable Affairs Office. Personal communication. Various months.

USACE—see U.S. Army Corps of Engineers

USAF—see U.S. Air Force

U.S. Air Force, 1963. *Subsurface Site Investigation, Volumes II through XVI.* May.

_____, 1987. *Climatic Brief*. Air Weather Service, USAFETAC [U.S. Air Force Environmental Technical Applications Center], Scott AFB, Illinois. December.

_____, 1994a. *Environmental Assessment for Upgrade Missile Underground Storage Tanks.* Grand Forks AFB, North Dakota. February.

_____, 1994b. Waste Sample Analysis, 319 MDG/SGPB, Grand Forks AFB, ND. May.

_____, 1995. Sample Results for MM III Sites by Maxim Technologies, Inc. Grand Forks, ND. November 10.

_____, 1996a. Sample Results for MM III Sites by Maxim Technologies, Inc. Grand Forks, ND. June 18-21.

_____, 1996b. Sample Results for MM III Sites by USPCI. Tulsa, OK. May 7.

_____, 1998. Sample Analysis on HICS cross sections for organochloride pesticides and PCBs, 319 MDG/SGPB, Grand Forks AFB, ND. January.

_____, 1999a. *Final Environmental Impact Statement for Minuteman III Missile System Dismantlement, Grand Forks AFB, North Dakota* (April) and associated *Record of Decision* (signed 16 Aug 99).

_____, 1999b. *Interim Use of Environmental Baseline Survey (EBS) Property Categorization Codes*, February 9.

_____, 1999c. *Final Environmental Baseline Survey for the Hardened Intersite Cable System, Minuteman II Deactivation, Ellsworth AFB, South Dakota*. August.

_____, 1999d. *Final Site Investigation Report, 446th Missile Squadron, Grand Forks AFB, ND*. May.

_____, 2000a. *Final Site Investigation Report, 448th Missile Squadron, Grand Forks AFB, ND*. March.

_____, 2000b. *Final Environmental Baseline Survey, Echo Flight Launch Facilities, Ellsworth AFB, SD, Minuteman II Deactivation Site Disposals*. August.

_____, 2000c. Site-specific Tank Closure Reports. Various months.

_____, 2000d. *Draft Groundwater Monitoring Plan for the 447th and 448th Missile Squadrons, Minuteman III Missile System Dismantlement, Grand Forks AFB, ND.* (Note: this Plan was prepared as a contingency in case USEPA identified a need for sampling in the 447 and 448 MSs as a result of sampling data from the 446 MS. As of October 2005, USEPA has not required this Plan to be implemented.)

_____, 2001a. *Final Site Investigation Report, 447th Missile Squadron, Grand Forks AFB, ND*. January.

_____, 2001b. *Final Technical Memorandum, October 2000 Ground Water Sampling Result, Long Term Monitoring Program, 446th Missile Squadron, Grand Forks AFB, ND*. January.

_____, 2001c. *Final Groundwater Monitoring Plan for Five Launch Facilities, 446th Missile Squadron, Grand Forks AFB, ND*.

_____, 2004. *Final Groundwater Sampling Report for Five Launch Facilities, 446th Missile Squadron, Grand Forks AFB, ND*. May.

_____, 2005. *Final Supplemental Hydrogeologic Investigation Report*. August.

U.S. Army Corps of Engineers, 1964-1966. Real Property Documents for Minuteman Missile Sites and HICS at Grand Forks AFB, ND (see Section 9.2 for complete list).

_____, 1971-1983. Project Real Estate Maps for Minuteman Missile Sites and HICS at Grand Forks AFB, ND, showing acreages, easements, and licenses (see Section 9.3 for complete list).

_____, 1987. *Corps of Engineers Wetlands Delineation Manual*. Environmental Laboratory, Wetlands Research Program Technical Report Y-87-1 (on-line edition). U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. http://www.wes.army.mil/el/wetlands/wlpubs.html

_____, 1989a. Final Project Map, Segment FA-2. Air Force Facility Military Reservation.

_____, 1989b. Final Project Map, Segment FB-9. Air Force Facility Military Reservation.

_____, 1989c. Final Project Map, Segment FB-5. Air Force Facility Military Reservation.

USBC—see U.S. Bureau of the Census

U.S. Bureau of the Census, 2001-2003. Cartographic Boundary Files. http://www.census.gov/geo/www/cob/scale.html

_____, 2001-2003. Redistricting Census 2000 Topologically Integrated Geographic Encoding and Referencing (TIGER)/Line Maps, for deployment area counties, ND. Various months. http://www.census.gov/geo/www/tiger

USDA—see U.S. Department of Agriculture

U.S. Department of Agriculture, Soil Conservation Service, 1972. *Soil Survey of Walsh County, North Dakota*. September.

_____, Soil Conservation Service, 1977a. *Soil Survey of Pembina County, North Dakota*. July.

_____, Soil Conservation Service, 1977b. *Soil Survey of Eddy County and Parts of Benson and Nelson Counties, North Dakota*. March.

_____, Soil Conservation Service, 1981. *Soil Survey of Grand Forks County, North Dakota*. May.

_____, Soil Conservation Service, 1983. *Soil Survey of Cass County, North Dakota*.

_____, Soil Conservation Service, 1986. *Soil Survey of Ramsey County, North Dakota*. August.

_____, Soil Conservation Service, 1989. *Soil Survey of Nelson County, North Dakota*. June.

_____, Soil Conservation Service, 1990a. *Soil Survey of Cavalier County, North Dakota*. May.

_____, Soil Conservation Service, 1990b. *Soil Survey of Barnes County, North Dakota*. June.

_____, Soil Conservation Service, 1990c. *Soil Survey of Griggs County, North Dakota (advance unpublished copy).*

_____, Soil Conservation Service, 1994. *Soil Survey of Steele County, North Dakota (advance unpublished copy).*

USEPA—see U.S. Environmental Protection Agency

U.S. Environmental Protection Agency, 2005a. National Priorities List Sites and CERCLIS Hazardous Waste Sites. September. http://www.epa.gov/enviro/html/cerclis/

_____, 2005b. RCRIS Query Results for Deployment Area Counties in North Dakota. September. http://www.epa.gov/enviro/html/rcris/

_____, 2005c. List of Treatment, Storage, and Disposal Facilities in the United States. The National Biennial RCRA Hazardous Waste Report. September. http://www.epa.gov/epaoswer/hazwaste/data/biennialreport/

_____, 2005d. TRIS Query Results for Minuteman III Deployment Area Counties in North Dakota. September. http://www.epa.gov/triexplorer/

_____, 2003. Wetland definitions. http://www.epa.gov/ region5/water/ephemeralwetlands

USFWS—see U.S. Fish and Wildlife Service

U.S. Fish and Wildlife Service, 2001-2003. National Wetland Inventory Maps. Various months. http://wetlands.fws.gov/

USGS—see U.S. Geological Survey

U.S. Geological Survey, 1963-1994. Topographical maps of deployment area, North Dakota (see Section 9.4 for complete list).

Van Voorhis, Del, 2003. Otter Tail Power Company. Personal communication concerning PCB transformers and other electrical equipment. April.

Vetter, Larry, 2000-2004. 319 CES/CEM, Grand Forks AFB, North Dakota. Personal communications. Various Months.

Westinghouse Electric Corporation, 1990. Lead-based Paint Chemical Content.

9.2 U.S. ARMY CORPS OF ENGINEERS PROJECT REAL ESTATE MAPS

U.S. Army Corps of Engineers, 1971a. Final Project Map, Segment FA-11. Air Force Facility Military Reservation.

_____, 1971b. Final Project Map, Segment FA-10. Air Force Facility Military Reservation.

______, 1971c. Final Project Map, Segment FA-9. Air Force Facility Military Reservation.

______, 1971d. Final Project Map, Segment FA-8. Air Force Facility Military Reservation.

______, 1971e. Final Project Map, Segment FA-7. Air Force Facility Military Reservation.

______, 1971f. Final Project Map, Segment FA-6. Air Force Facility Military Reservation.

______, 1971g. Final Project Map, Segment FA-5. Air Force Facility Military Reservation.

______, 1971h. Final Project Map, Segment FA-4. Air Force Facility Military Reservation.

______, 1971i. Final Project Map, Segment FA-3. Air Force Facility Military Reservation.

______, 1971j. Final Project Map, Segment FB-10. Air Force Facility Military Reservation.

______, 1971k. Final Project Map, Segment FB-8. Air Force Facility Military Reservation.

______, 1971l. Final Project Map, Segment FB-7. Air Force Facility Military Reservation.

______, 1971m. Final Project Map, Segment FB-6. Air Force Facility Military Reservation.

______, 1971n. Final Project Map, Segment FB-4. Air Force Facility Military Reservation.

______, 1971o. Final Project Map, Segment FB-3. Air Force Facility Military Reservation.

______, 1971p. Final Project Map, Segment FB-2. Air Force Facility Military Reservation.

______, 1971q. Final Project Map, Segment FC-10. Air Force Facility Military Reservation.

______, 1971r. Final Project Map, Segment FC-9. Air Force Facility Military Reservation.

______, 1971s. Final Project Map, Segment FC-8. Air Force Facility Military Reservation.

______, 1971t. Final Project Map, Segment FC-7. Air Force Facility Military Reservation.

______, 1971u. Final Project Map, Segment FC-6. Air Force Facility Military Reservation.

______, 1971v. Final Project Map, Segment FC-5. Air Force Facility Military Reservation.

______, 1971w. Final Project Map, Segment FC-4. Air Force Facility Military Reservation.

______, 1971x. Final Project Map, Segment FC-3. Air Force Facility Military Reservation.

______, 1971y. Final Project Map, Segment FC-2. Air Force Facility Military Reservation.

______, 1971z. Final Project Map, Segment FD-10. Air Force Facility Military Reservation.

______, 1971aa. Final Project Map, Segment FD-9. Air Force Facility Military Reservation.

______, 1971bb. Final Project Map, Segment FD-8. Air Force Facility Military Reservation.

______, 1971cc. Final Project Map, Segment FD-7. Air Force Facility Military Reservation.

______, 1971dd. Final Project Map, Segment FD-6. Air Force Facility Military Reservation.

______, 1971ee. Final Project Map, Segment FD-5. Air Force Facility Military Reservation.

______, 1971ff. Final Project Map, Segment FD-4. Air Force Facility Military Reservation.

______, 1971gg. Final Project Map, Segment FD-3. Air Force Facility Military Reservation.

______, 1971hh. Final Project Map, Segment FD-2. Air Force Facility Military Reservation.

______, 1971ii. Final Project Map, Segment FE-11. Air Force Facility Military Reservation.

______, 1971jj. Final Project Map, Segment FE-10. Air Force Facility Military Reservation.

______, 1971kk. Final Project Map, Segment FE-9. Air Force Facility Military Reservation.

______, 1971ll. Final Project Map, Segment FE-8. Air Force Facility Military Reservation.

______, 1971mm. Final Project Map, Segment FE-7. Air Force Facility Military Reservation.

______, 1971nn. Final Project Map, Segment FE-6. Air Force Facility Military Reservation.

______, 1971oo. Final Project Map, Segment FE-5. Air Force Facility Military Reservation.

______, 1971pp. Final Project Map, Segment FE-4. Air Force Facility Military Reservation.

______, 1971qq. Final Project Map, Segment FE-3. Air Force Facility Military Reservation.

______, 1971rr. Final Project Map, Segment FE-2. Air Force Facility Military Reservation.

______, 1971ss. Final Project Map, Segment FE-1. Air Force Facility Military Reservation.

______, 1971tt. Final Project Map, Segment FA-1. Air Force Facility Military Reservation.

______, 1975a. Final Project Map, Segment FB-11. Air Force Facility Military Reservation.

______, 1975b. Final Project Map, Segment FB-1. Air Force Facility Military Reservation.

______, 1975c. Final Project Map, Segment FC-11. Air Force Facility Military Reservation.

______, 1975d. Final Project Map, Segment FC-1. Air Force Facility Military Reservation.

______, 1983a. Final Project Map, Segment FD-11. Air Force Facility Military Reservation.

______, 1983b. Final Project Map, Segment FD-1. Air Force Facility Military Reservation.

9.3 U.S. ARMY CORPS OF ENGINEERS REAL PROPERTY DOCUMENTS

U.S. Army Corps of Engineers, 1964a. Real Property Voucher. Site D-32 (USACE Tract FD-200).

______, 1964bb. Real Property Voucher. Site A-10 (USACE Tract FA-1001).

______, 1964cc. Real Property Voucher. Site B-17 (USACE Tract FB-700).

______, 1964dd. Real Property Voucher. Site D-0 (USACE Tract FD-1100).

______, 1964ee. Real Property Voucher. Site D-37 (USACE Tract FD-700).

______, 1965b. Real Property Voucher. Site A-0 (USACE Tract FA-1100).

______, 1965c. Real Property Voucher. Site A-2 (USACE Tract FA-200).

______, 1965d. Real Property Voucher. Site A-3 (USACE Tract FA-300).

______, 1965f. Real Property Voucher. Site A-5 (USACE Tract FA-500).

______, 1965g . Real Property Voucher. Site A-6 (USACE Tract FA-600).

______, 1965h. Real Property Voucher. Site A-7 (USACE Tract FA-700).

______, 1965i. Real Property Voucher. Site A-8 (USACE Tract FA-800).

______, 1965j. Real Property Voucher. Site A-9 (USACE Tract FA-900).

______, 1965k. Real Property Voucher. Site B-0 (USACE Tract FB-1100).

______, 1965l. Real Property Voucher. Site B-11 (USACE Tract FB-100).

______, 1965m. Real Property Voucher. Site B-12 (USACE Tract FB-200).

______, 1965n. Real Property Voucher. Site B-13 (USACE Tract FB-300).

______, 1965o. Real Property Voucher. Site B-14 (USACE Tract FB-400).

______, 1965p. Real Property Voucher. Site B-15 (USACE Tract FB-500).

______, 1965q. Real Property Voucher. Site B-16 (USACE Tract FB-600).

______, 1965r. Real Property Voucher. Site B-18 (USACE Tract FB-800).

______, 1965s. Real Property Voucher. Site B-19 (USACE Tract FB-900).

______, 1965t. Real Property Voucher. Site B-20 (USACE Tract FB-1000).

______, 1965u. Real Property Voucher. Site C-0 (USACE Tract FC-1100).

______, 1965v. Real Property Voucher. Site C-21 (USACE Tract FC-100).

______, 1965w. Real Property Voucher. Site C-22 (USACE Tract FC-200).

______, 1965x. Real Property Voucher. Site C-23 (USACE Tract FC-300).

______, 1965y. Real Property Voucher. Site C-24 (USACE Tract FC-400).

______, 1965z. Real Property Voucher. Site C-25 (USACE Tract FC-500).

______, 1965aa. Real Property Voucher. Site C-26 (USACE Tract FC-600).

______, 1965bb. Real Property Voucher. Site C-27 (USACE Tract FC-700).

______, 1965cc. Real Property Voucher. Site C-28 (USACE Tract FC-800).

______, 1965dd. Real Property Voucher. Site C-29 (USACE Tract FC-900).

______, 1965ee. Real Property Voucher. Site C-30 (USACE Tract FC-1000).

______, 1965ff. Real Property Voucher. Site D-31 (USACE Tract FD-100).

______, 1965gg. Real Property Voucher. Site D-33 (USACE Tract FD-300).

______, 1965hh. Real Property Voucher. Site D-34 (USACE Tract FD-400).

______, 1965ii. Real Property Voucher. Site D-35 (USACE Tract FD-500).

______, 1965jj. Real Property Voucher. Site D-36 (USACE Tract FD-600).

______, 1965kk. Real Property Voucher. Site D-39 (USACE Tract FD-900).

______, 1965ll. Real Property Voucher. Site D-40 (USACE Tract FD-1000).

______, 1965mm. Real Property Voucher. Site E-0 (USACE Tract FE-1100).

______, 1965nn. Real Property Voucher. Site E-41 (USACE Tract FE-100).

_____, 1965oo. Real Property Voucher. Site E-42 (USACE Tract FE-200).

_____, 1965pp. Real Property Voucher. Site E-43 (USACE Tract FE-300).

_____, 1965qq. Real Property Voucher. Site E-44 (USACE Tract FE-400).

_____, 1965rr. Real Property Voucher. Site E-45 (USACE Tract FE-500).

_____, 1965ss. Real Property Voucher. Site E-46 (USACE Tract FE-600).

_____, 1965tt. Real Property Voucher. Site E-47 (USACE Tract FE-700).

_____, 1965uu. Real Property Voucher. Site E-48 (USACE Tract FE-800).

_____, 1965vv. Real Property Voucher. Site E-49 (USACE Tract FE-900).

_____, 1965ww. Real Property Voucher. Site E-50 (USACE Tract FE-1000).

_____, 1966. Real Property Voucher. Site A-1 (USACE Tract FA-100).

_____, 1966a. Real Property Voucher. Site D-38 (USACE Tract FD-800).

_____, 1966e. Real Property Voucher. Site A-4 (USACE Tract FA-400).

9.4 U.S. GEOLOGICAL SURVEY TOPOGRAPHIC MAPS AND STUDIES

U.S. Geological Survey, 1963a. *7.5 Minute Topographical Quadrangle, Gardar, North Dakota.*

_____, 1963b. *7.5 Minute Topographical Quadrangle, Park River, North Dakota.*

_____, 1964. *7.5 Minute Topographical Quadrangle, Concrete, North Dakota.*

_____, 1966a. *Geology and Ground Water Resources, Barnes County, North Dakota, Part III Ground Water Resources.*

_____, 1966b. *Geology and Ground Water Resources of Cass County, North Dakota, Part II Ground Water Basic Data.*

_____, 1967. *Geology and Ground Water Resources, Barnes County, North Dakota, Part I Geology*.

_____, 1967a. *7.5 Minute Topographical Quadrangle, Langdon East, North Dakota.*

_____, 1967b. *7.5 Minute Topographical Quadrangle, Maida, North Dakota.*

_____, 1968a. *Geology and Ground Water Resources of Cass County, North Dakota, Part III Hydrology*.

_____, 1968b. *Geology and Ground Water Resources of Grand Forks County, North Dakota, Part II Ground Water Basic Data.*

_____, 1970a. 7.5 Minute Topographical Quadrangle, Alsen Southeast, *North Dakota*.

_____, 1970a. *Geology and Ground Water Resources of Grand Forks County, North Dakota, County Ground Water Studies 17—Part II.*

_____, 1970b. *7.5 Minute Topographical Quadrangle, Hampden, North Dakota.*

_____, 1970b. *Geology and Ground Water Resources of Grand Forks County, North*

Dakota, Part III Ground Water Resources.

______, 1970c. *7.5 Minute Topographical Quadrangle, Hannah, North Dakota.*

______, 1970d. *7.5 Minute Topographical Quadrangle, Hannah Southeast, North Dakota.*

______, 1970e. *7.5 Minute Topographical Quadrangle, Langdon West, North Dakota.*

______, 1970f. *7.5 Minute Topographical Quadrangle, Loma, North Dakota.*

______, 1970g. *7.5 Minute Topographical Quadrangle, Mount Carmel, North Dakota.*

______, 1970h. *7.5 Minute Topographical Quadrangle, Wales, North Dakota.*

______, 1971. *Ground Water Resources for Nelson and Walsh Counties, North Dakota, County Ground Water Studies 17—Part II*.

______, 1971a. *7.5 Minute Topographical Quadrangle, Munich Southeast, North Dakota.*

______, 1971b. *7.5 Minute Topographical Quadrangle, Munich Southwest, North Dakota.*

______, 1972a. *7.5 Minute Topographical Quadrangle, Adams, North Dakota.*

______, 1972b. *7.5 Minute Topographical Quadrangle, Billings Lake, North Dakota.*

______, 1972c. *7.5 Minute Topographical Quadrangle, Derrick, North Dakota.*

______, 1972d. *7.5 Minute Topographical Quadrangle, Easby, North Dakota.*

______, 1972e. *7.5 Minute Topographical Quadrangle, Edinburg Northwest, North Dakota.*

______, 1972f. *7.5 Minute Topographical Quadrangle, Edmore, North Dakota.*

______, 1972g. *7.5 Minute Topographical Quadrangle, Edmore Northeast, North Dakota.*

______, 1972h. *7.5 Minute Topographical Quadrangle, Fairdale, North Dakota.*

______, 1972i. *7.5 Minute Topographical Quadrangle, Milton, North Dakota.*

______, 1972j. *7.5 Minute Topographical Quadrangle, Nekoma, North Dakota.*

______, 1972k. *7.5 Minute Topographical Quadrangle, Nekoma Northwest, North Dakota.*

______, 1972l. *7.5 Minute Topographical Quadrangle, Olga, North Dakota.*

______, 1972m. *7.5 Minute Topographical Quadrangle, Osnabrock, North Dakota.*

______, 1972n. *7.5 Minute Topographical Quadrangle, Osnabrock Southwest, North Dakota*.

______, 1972o. *7.5 Minute Topographical Quadrangle, Union, North Dakota.*

______, 1972p. *7.5 Minute Topographical Quadrangle, Waterloo Lake, North Dakota.*

______, 1973a. *Groundwater Resources for Nelson and Walsh Counties, North Dakota, County Ground Water Studies 17—Part III*.

______, 1973b. *Geology of Nelson and Walsh Counties, North Dakota, County Ground Water Studies 17—Part 1*.

______, 1973c. *Groundwater Basic Data of Cavalier and Pembina Counties, North Dakota, County Ground Water Studies 20—Part II1*.

_____, 1975a. *Geology of Cavalier and Pembina Counties, North Dakota, County Ground Water Studies 20—Part 1*.

_____, 1975b. *Geology of Griggs and Steele Counties, North Dakota, County Ground Water Studies 21—Part 1*.

_____, 1977a. *Ground Water Resources of Cavalier and Pembina Counties, North Dakota, County Ground Water Studies 20—Part III*.

_____, 1977b. *Ground Water Resources of Griggs and Steele Counties, North Dakota, County Ground Water Studies 21—Part III*.

_____, 1977c. *Ground Water Basic Data of Ramsey County, North Dakota, County Ground Water Studies 26—Part II.*

_____, 1980. *Ground Water Resources of Ramsey County, North Dakota, County Ground Water Studies 26—Part III.*

_____, 1987a. *Boundary Descriptions and Names of Regions, Subregions, Accounting Units, and Cataloging Units.* USGS Water Supply Paper 2294. Text and geographic information system data.

_____, 1987b. *Geology of Ramsey County, North Dakota, County Ground Water Studies 26—Part I.*

_____, 1994a. *7.5 Minute Topographical Quadrangle, Derrick Northwest, North Dakota.*

_____, 1994b. *7.5 Minute Topographical Quadrangle, Starkweather, North Dakota.*

_____, 1994c. *7.5 Minute Topographical Quadrangle, Starkweather Northeast, North Dakota.*

10. LIST OF PREPARERS AND CONTRIBUTORS

The Environmental Baseline Survey for the HICS has been prepared by the Air Force Center for Environmental Excellence (AFCEE), Headquarters Air Force Space Command (HQ AFSCP), and the 319th Civil Engineer Squadron (319 CES) at Grand Forks AFB, with contractual assistance from LABAT-ANDERSON INCORPORATED (LABAT). The following personnel were involved in the preparation or review of this report:

Kristin L. Sutherlin, LABAT, Delivery Order Manager; Senior Environmental Analyst and Senior Reviewer
B.A., 1986, Economics, Louisiana State University in Shreveport
M.A., 1988, Urban Studies (Planning), University of Maryland, College Park
Years of Experience: 18

Randall G. McCart, LABAT, Project Manager; Senior Environmental Analyst
B.S., 1981, Geography, University of Nebraska at Omaha
M.A., 1984, Geography, University of Nebraska at Omaha
B.S., 1987, Education, University of Nebraska at Omaha
Years of Experience: 17

Wesley R. Adkins, LABAT, Environmental Analyst
B.S., 2000, Forestry, Iowa State University, Ames
Years of Experience: 3

Dean P. Converse, LABAT, Environmental Analyst
B.S., 1998, Geography-Environmental Studies, University of Nebraska at Lincoln
Years of Experience: 5

Quinn V. Damgaard, LABAT, Environmental Analyst
B.A., 2000, Biology (Ecological Studies), Augustana College, Sioux Falls, SD
Years of Experience: 3

Heidi L. Durako, 319 CES/CEVA, Environmental Engineer
B.S., 1995, Chemical Engineering, University of North Dakota, Grand Forks
M.S., 1996, Chemical Engineering, University of North Dakota, Grand Forks
Years of Experience: 7

George H. Gauger, HQ AFCEE/ECA, Community Planner, Contracting Officer's Deputy Representative
B.A., 1964, Business Management, Northeastern University, Boston, Massachusetts
M.R.P., 1972, Regional Planning, University of Massachusetts, Amherst
Years of Experience: 32

Carmen L. Hansen, LABAT, Executive Administrator
Years of Experience: 14

Lisa King, LABAT, Administrative Assistant
Years of Experience: 6

Wayne A. Koop, 319 CES/CEV, Environmental Engineer, Technical Reviewer
B.S., 1976, Industrial Engineer, University of North Dakota, Grand Forks
M.S., 1980, Systems Mgmt, University of Southern California, Los Angeles
Years of Experience: 27

JoAnn M. Leonard, LABAT, Administrative Assistant
Years of Experience: 20

Robert L. Lopez, HQ AFCEE/TDG, Contracting Officer's Representative
B.S., 1976, Biology, Texas A&M University, Corpus Christi
M.S., 1998, Environmental Science, University of Texas at San Antonio
Years of Experience: 17

David J. Mitchell, HQ AFSPC/CEVP, Environmental Engineer
B.Arch., 1977, University of Arizona, Tucson
Years of experience: 24

William K. Ohlmeyer, LABAT, Senior Reviewer
B.S., 1970, Construction Management, Texas A&M University, College Station
M.Arch., 1971, Construction Management, Texas A&M University, College Station
Years of Experience: 33

Sheri A. Rivera, LABAT, Senior Environmental Analyst
B.S., 1989, Geography, University of Nebraska at Omaha
M.S., 1995, Urban Studies, University of Nebraska at Omaha
Years of Experience: 14

Scott A. Rudolf, 319 CES/CEM, Chief, Missile Engineering
B.S., 1984, Civil Engineering, University of North Dakota, Grand Forks
Years of Experience: 18

Larry A. Vetter, 319 CES/CEM Grand Forks AFB, Construction Representative
A.A.S., 1979, Business Administration, Lafayette College, Fayetteville, NC
B.A., 1981, Business Administration/Marketing, Campbell College, NC
Years of Experience: 24

APPENDIX A. APPLICABLE REGULATIONS AND GUIDELINES

This section lists applicable public laws, Department of Defense directives, Air Force directives and instructions, and American Society for Testing and Materials standards.

A.1. PUBLIC LAW

Public Law 106-65, *National Defense Authorization Act for Fiscal Year 2000*, and subsequent similar laws, authorize appropriations for each fiscal year for DoD activities and military construction, and prescribe personnel strengths of the Armed Forces.

Public Law 100-180, Section 2325 (10 *United States Code* (U.S.C.) § 9781), covers the disposal process, in which first priority of consideration is to current adjacent landowners, who must pay fair market value.

A.2. PUBLIC HEALTH AND SAFETY / HAZARDOUS MATERIALS / HAZARDOUS AND SOLID WASTES

The *Comprehensive Environmental Response, Compensation, and Liability Act* of 1980, as amended by the *Superfund Amendments and Reauthorization Act* (42 U.S.C. Sec. 9601, et seq.), provides USEPA with the authority to inventory, investigate, and clean up uncontrolled or abandoned hazardous waste sites. The USEPA has established a series of programs to clean up hazardous waste disposal and spill sites nationwide. This Act provides for funding, enforcement, response, and liability for the release or threatened release of hazardous substances into the environment.

The *Resource Conservation and Recovery Act* of 1976 (42 U.S.C. Sec. 6961), as amended by the *Hazardous and Solid Waste Amendments* of 1984 (PL 98-616), is a comprehensive program for regulating and managing hazardous wastes (Subtitle C), nonhazardous solid wastes (Subtitle D), Federal procurement of reclaimed products (Subtitle F), and underground storage tanks (Subtitle I). The Act requires Federal agencies to comply with all Federal, state, interstate, and local regulations respecting control and abatement of solid waste or hazardous waste disposal. The USEPA's most comprehensive regulations have been developed under the Subtitle C program, which governs the generation, transportation, treatment, storage, and disposal of hazardous wastes.

The *Toxic Substances Control Act* of 1976 (15 U.S.C. Sec. 2601, et seq.) requires USEPA to regulate the use, storage, and disposal of industrial chemicals, including PCBs, production of which was prohibited after January 1979.

The *Occupational Safety and Health Act* of 1971 created the Occupational Safety and Health Administration under the Department of Labor. The Act grants the Secretary of Labor the authority to promulgate, modify, and revoke safety and health standards; to conduct inspections and investigations and to issue citations, including penalties; to require employers to keep records of safety and health data; to petition the courts to restrain imminent danger situations; and to approve or reject state plans for programs under the act. The act also established the National Institute for Occupational Safety and Health (NIOSH), the principal Federal agency engaged in research to eliminate on-the-job hazards. The

NIOSH is primarily responsible for identifying occupational safety and health hazards and determining necessary changes to the encompassing regulations.

The *Defense Environmental Restoration Program* (10 U.S.C. Sec. 2701), is the legal mandate for the DoD Installation Restoration Program, designed to identify, confirm, quantify, and remediate suspected problems associated with past hazardous waste disposal sites on DoD installations.

A.3. DEPARTMENT OF DEFENSE DIRECTIVES

Department of Defense Directive (DoDD) 4165.6, *Real Property Acquisition, Management, and Disposal*, September 1, 1987, directs that the military departments and defense agencies determine which real property is needed to satisfy military requirements both in peacetime and time of war. The directive prescribes that the departments and agencies will ensure that the necessary property is obtained and will dispose of only the real property having no foreseeable military requirement.

DoDD 5160.63, *Delegations of Authority Vested in The Secretary of Defense to Take Certain Real Property Actions*, June 3, 1986, delegates additional authority and responsibility to lower organization levels. The policy allows installation commanders the freedom to obtain goods and services that best satisfy their requirements whenever they can successfully achieve quality, responsiveness, and lower cost. The policy also allows commanders to retain and decide on the use of money they have saved.

A.4. AIR FORCE POLICY DIRECTIVES

Air Force Policy Directive (AFPD) 32-70, *Environmental Quality*, July 20, 1994, establishes policies to carry out the Air Force's commitment to achieving and maintaining environmental quality by cleaning up environmental damage resulting from past activities; meeting all environmental standards applicable to present operations; planning its future activities to minimize environmental impacts; responsibly managing the irreplaceable natural and cultural resources it holds in public trust; and eliminating pollution from its activities wherever possible.

AFPD 32-90, *Real Property Management*, September 10, 1993, governs the management of real property, throughout the history of the property, to ensure that the Air Force acquires and maintains only the minimum property necessary to meet peacetime and mobilization requirements.

A.5. AIR FORCE INSTRUCTIONS

AFI 32-7020, *The Environmental Restoration Program*, May, 1994, provides the Air Force with guidance on compliance with CERCLA, and federal, state, and local regulations.

AFI 32-7061, *The Environmental Impact Analysis Process*, January, 1995, establishes the procedures to supplement the CEQ regulations promulgated by NEPA.

AFI 32-7062, *Air Force Comprehensive Planning*, October, 1997, establishes the Air Force Comprehensive Planning Program for development of Air Force installations. The AFI contains responsibilities and requirements for comprehensive planning and describes procedures for developing, implementing, and maintaining the General Plan within the installation Comprehensive Plan.

AFI 32-7066, *Environmental Baseline Surveys in Real Estate Transactions*, April 1994, provides responsibilities and procedures for an EBS in a real property transaction. This instruction also covers additional procedures for transactions involving unremediated real property and for the termination or expiration of temporary interests in real property.

AFI 32-9004, *Disposal of Real Property*, July, 1994, provides the Air Force with guidance on the disposal of real property that the Air Force does not need to support the mission.

A.6. AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM Publication E 1527, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, July, 2000, defines good commercial and customary practice in the United States for conducting an environmental site assessment of a parcel of commercial real estate with respect to the range of contaminants within the scope of CERCLA and petroleum products. This practice, as well as Publication E 1528, is intended to permit a user to satisfy one of the requirements to qualify for the innocent landowner defense to CERCLA liability.

ASTM Publication E 1528, *Standard Practice for Environmental Site Assessments: Transaction Screen Process*, July, 2000, defines good commercial and customary practice in the United States for conducting an environmental site assessment of a parcel of commercial real estate with respect to the range of contaminants within the scope of CERCLA and petroleum products. This practice, as well as Practice E 1527, is intended to permit a user to satisfy one of the requirements to qualify for the innocent landowner defense to CERCLA liability.

ASTM Publication D 6008-96, *Standard Method for Sampling Waste Piles*, October 10, 1996, establishes appropriate safety and health practices and determines the applicability of regulatory limitations prior to use.

This page intentionally left blank.

APPENDIX B. FLIGHT MAPS, 446th MISSILE SQUADRON

The maps in this appendix show the geographic distribution of former missile facilities of the 446 MS. There are five figures, one for each of the missile flights (1 MAF and 10 LFs comprise a flight). The maps include basic geographic elements, which are used to orient the reader (e.g., highways and towns) and to identify important environmental resources (e.g., wildlife refuges and rivers).

These maps were developed using USBC Topologically Integrated Geographic Encoding and Referencing (TIGER) system files, which are Geographic Information System (GIS) files digitized from aerial photographs. These maps portray an accurate spatial representation of data elements; however, it is important to note that the original GIS files include data that were developed during different timeframes of various years. For example, surface water shown on some maps may show the situation in the spring of the year, while other maps may show surface water that is present in the fall of the year.

Contents

This page intentionally left blank.

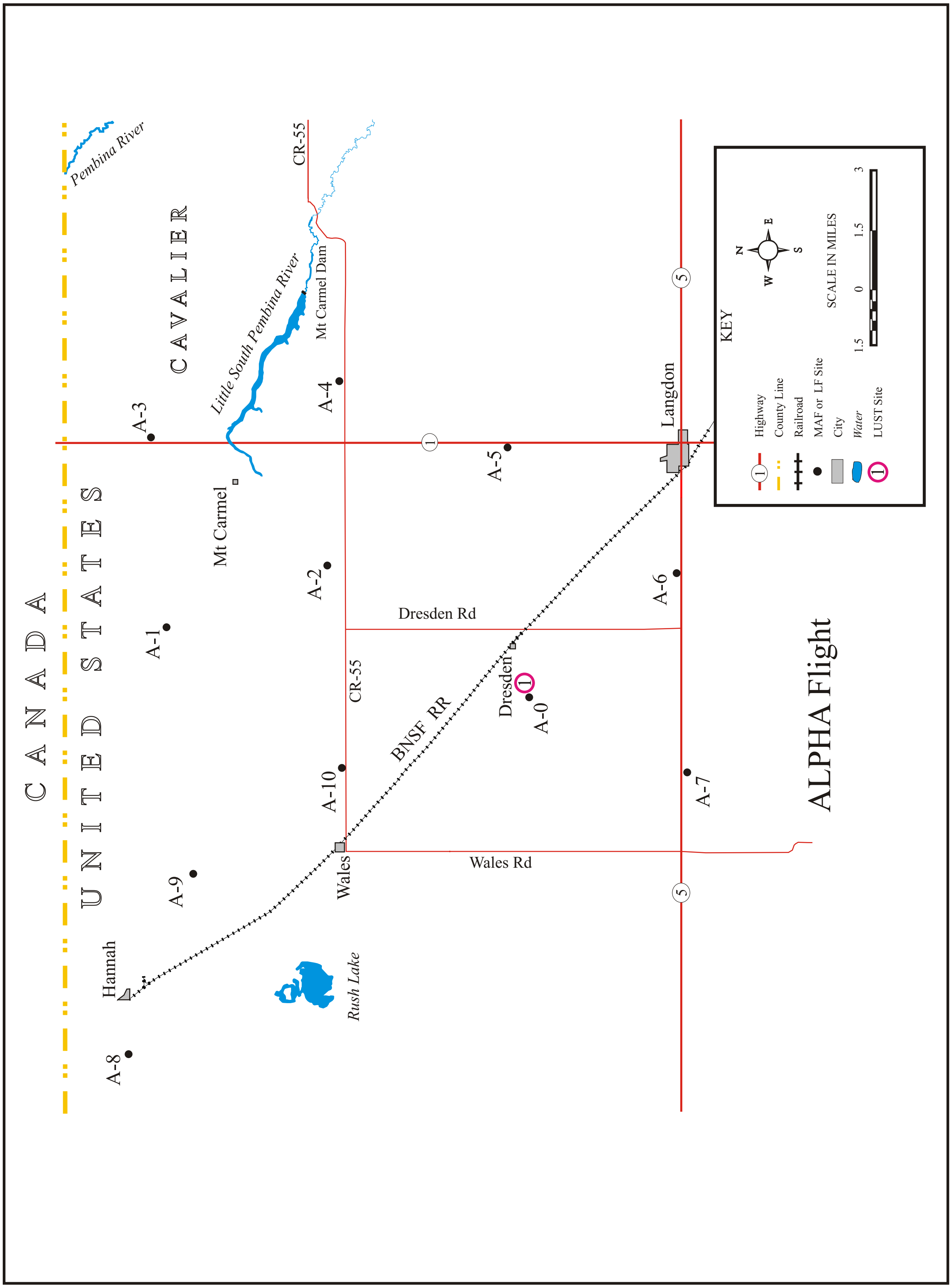

Figure B-1. Flight A

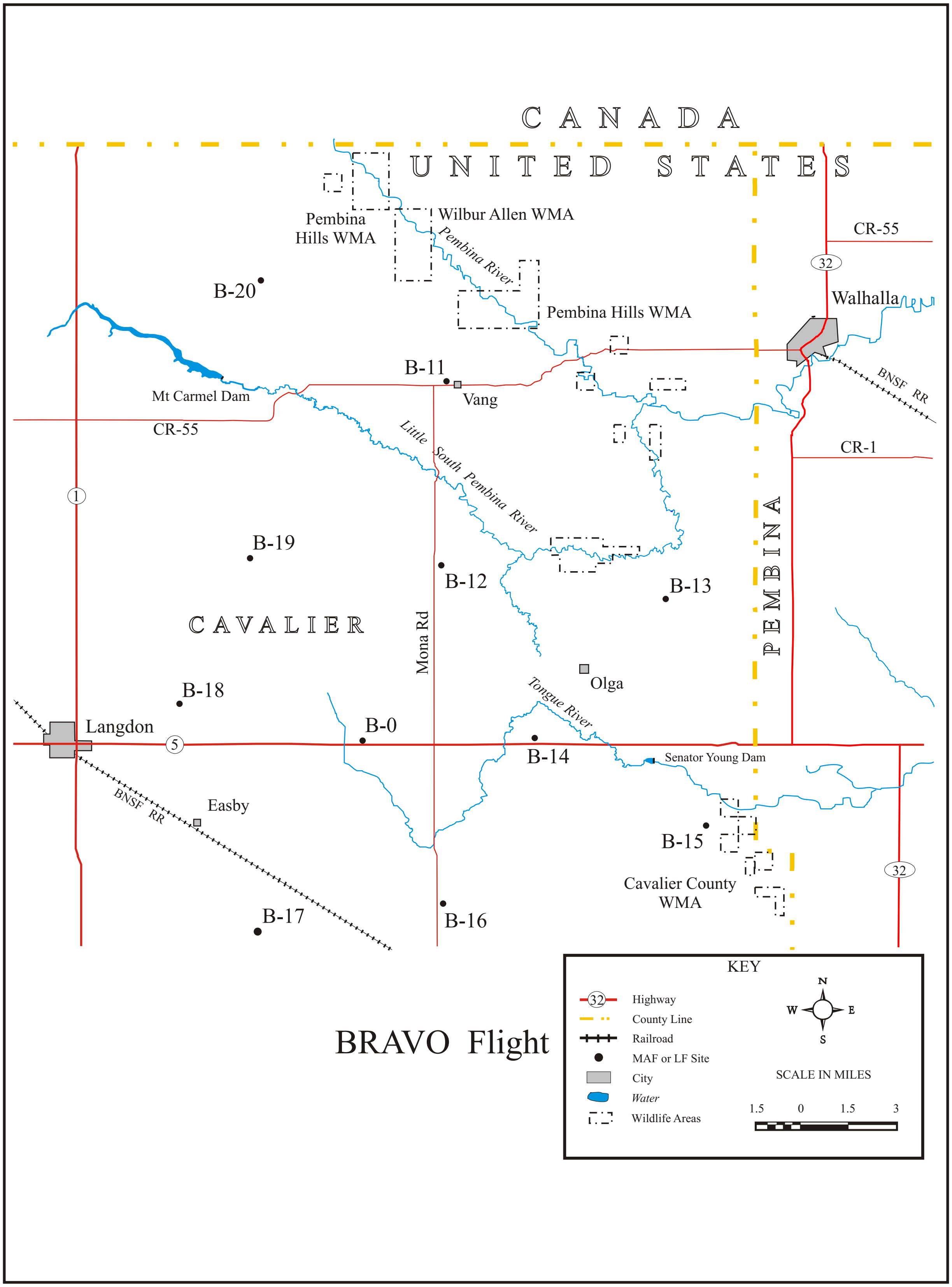

Figure B-2. Flight B

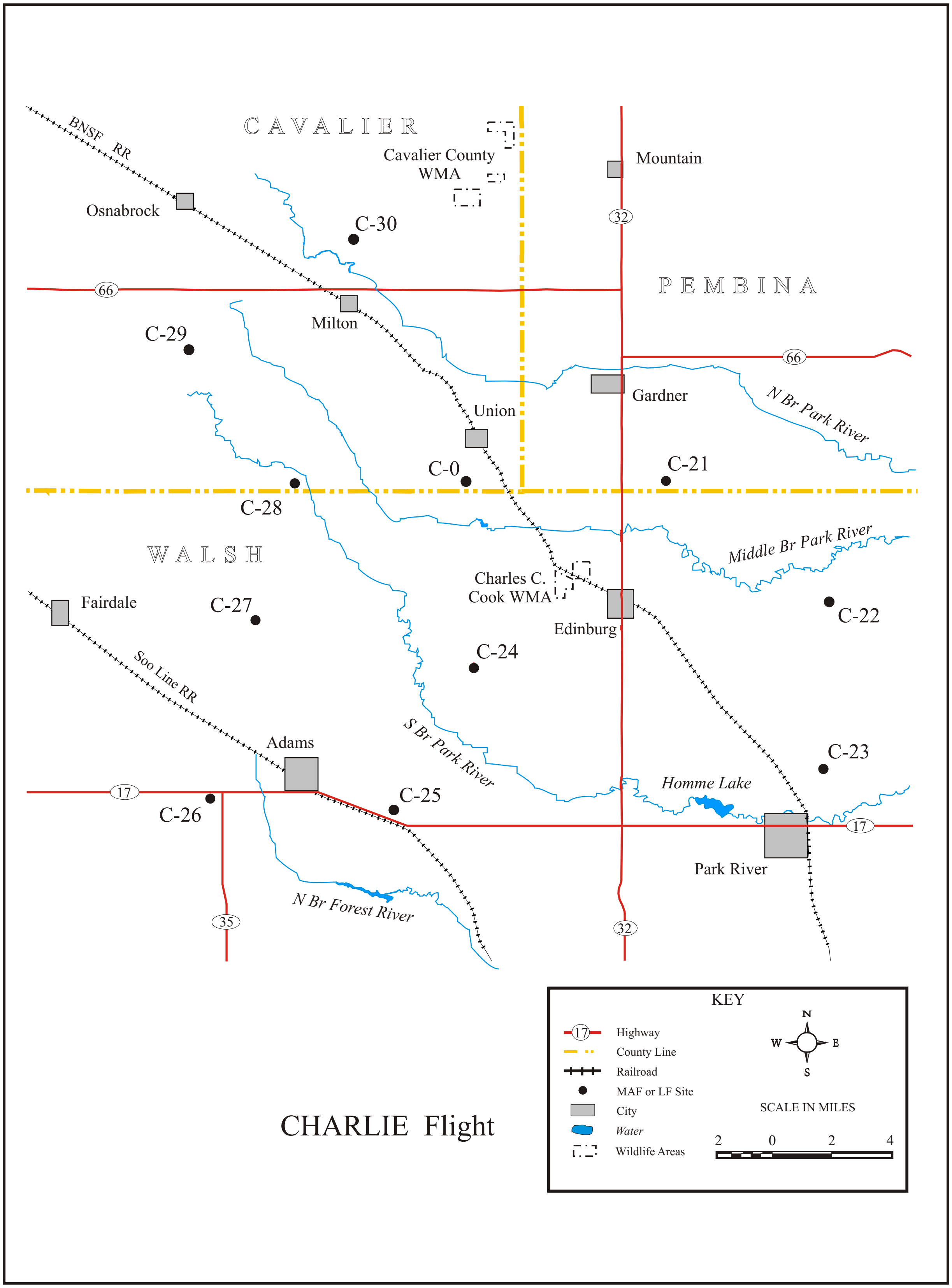

Figure B-3. Flight C

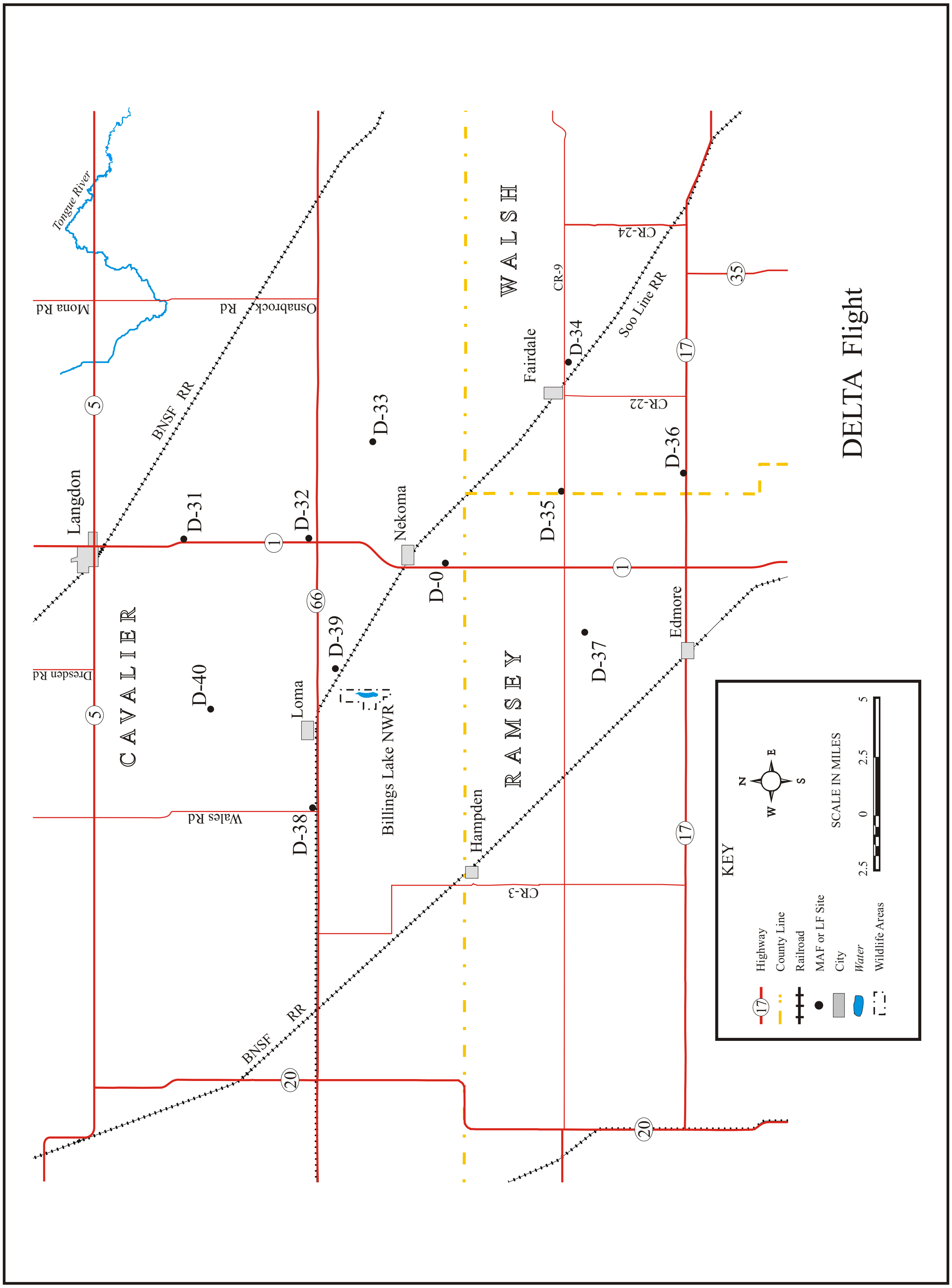

Figure B-4. Flight D

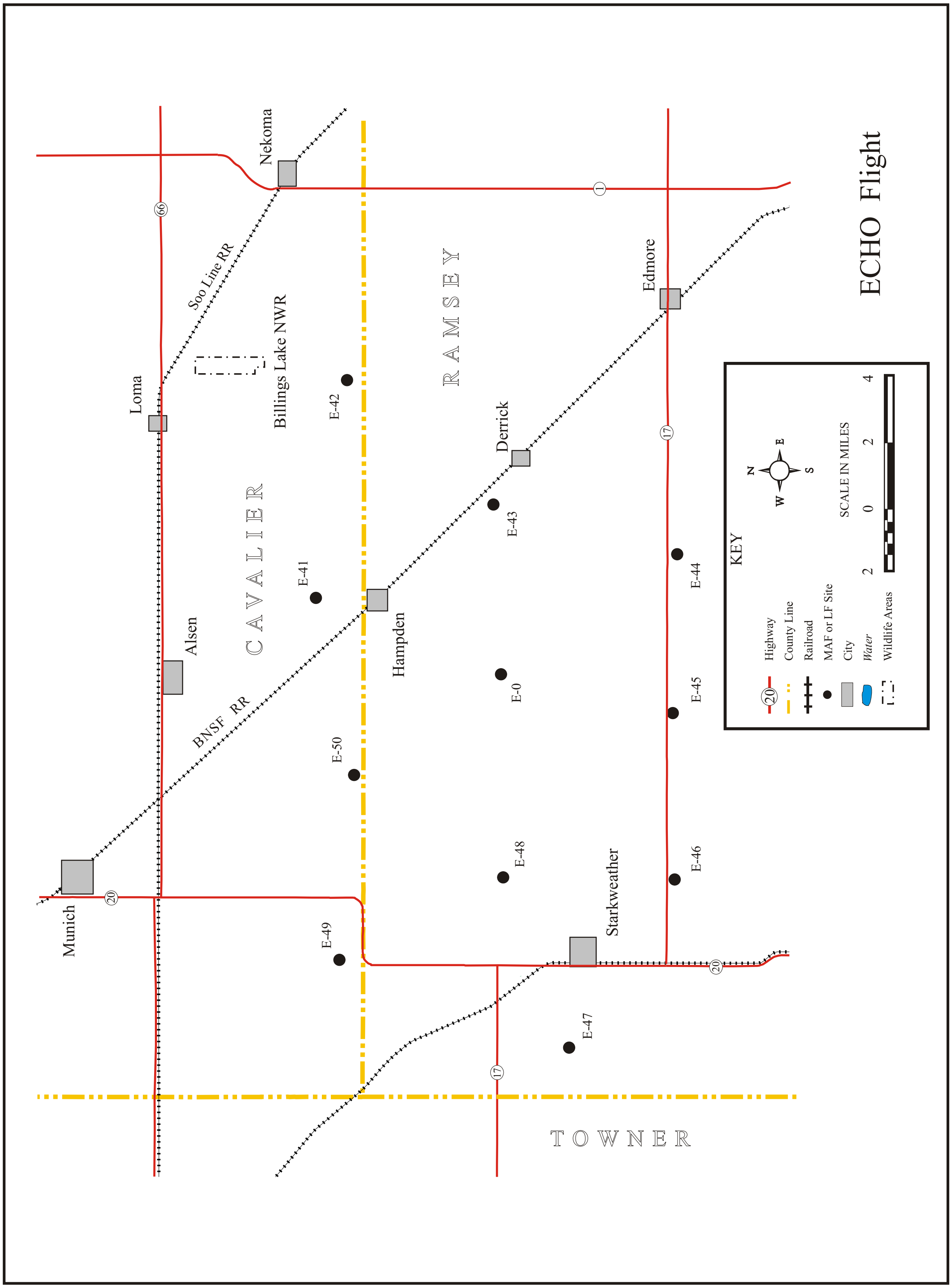

Figure B-5. Flight E

This page intentionally left blank.

APPENDIX C. SITE-SPECIFIC CHARACTERISTICS

This appendix provides detailed characteristics of each missile site.

Contents

This page intentionally left blank.

Table C-1
Soil Properties, 446th Missile Squadron

Soil Series	Wind Erosion	Hydric Soil[1]	Shrink-Swell[2]	Excavation	Fill Suitability[3]
Barnes	very slight	Inclusions	low - moderate	good	severe - piping
Binford	High	No	low	severe - cutbanks cave	good
Brantford	Slight	No	low	good	good
Buse	Moderate	Inclusions	low - moderate	good	severe - piping
Cavour	very slight	Inclusions	moderate - high	moderate - wetness	good
Cresbard	very slight	Inclusions	low - high	moderate - wetness	good
Divide	Moderate	Inclusions	low	severe - cutbanks cave	good
Easby	Moderate	Yes – saturation	moderate	severe - wetness	severe - piping
Gilby	Moderate	Inclusions	low - moderate	severe - wetness	severe - wetness
Glyndon	Moderate	Inclusions	low	severe - cutbanks cave	severe - piping
Hamerly	Moderate	Inclusions	moderate	severe - wetness	severe - piping
Lamoure	Moderate	Yes – saturation	low - moderate	severe - wetness	severe - wetness
Parnell	very slight	Yes - saturation, ponding	low - high	severe - ponding	severe - ponding
Renshaw	Slight	No	low	severe - cutbanks cave	good
Svea	Slight-moderate	Inclusions	low - moderate	moderate - wetness	severe - piping
Tiffany	High	Yes - saturation, ponding	low	severe - cutbanks cave	severe - ponding
Tonka	Slight	Yes - saturation, ponding	low - high	severe - ponding	severe - ponding
Vallers	Moderate	Yes – saturation	low	severe - wetness	severe - piping
Vang	Slight	No	low	severe - cutbanks cave	good
Walsh	Slight	No	moderate	severe - cutbanks cave	severe - piping
Waukon	very slight	No	low - moderate	good	severe - piping
Wyard	very slight	Inclusions	moderate	severe - wetness	severe - piping

[1] Hydric soils are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil (see text above). Inclusions are small areas within a soil series that are hydric.

[2] Shrink-swell is the change in volume in a soil when soil moisture changes markedly (the tendency to swell when wet and shrink when dry).

[3] A major consideration for soil used as fill is the tendency for piping (formation of subsurface tunnels or pipe-like cavities by water moving through soil), which can cause severe erosion.

Sources: USDA, 1972; USDA, 1977a, USDA, 1981; USDA, 1990a (See Section 3.2.2.)

Table C-2 Wetlands Near Missile Sites, 446th Missile Squadron [1]		
Site	**Type**	**Location**
A-0	NWI Wetland	approx. 47' SE
A-01	NWI Wetland	approx. 664' NW, 530', 724' SW
A-01	Ephemeral Wetland	approx. 896' E
A-03	NWI Wetland	approx. 765', 746' NE, 978', 727' SE
A-03	Ephemeral Wetland	approx. 727' SW, 914' SE
A-04	NWI Wetland	approx. 55', 954' S
A-04	Ephemeral Wetland	approx. 797' W
A-05	NWI Wetland	approx. 890' W
A-05	Ephemeral Wetland	approx. 570' SE
A-06	NWI Wetland	approx. 332', 794' S, 659' E
A-07	NWI Wetland	approx. 390' NE
A-08	NWI Wetland	approx. 873' S
A-09	NWI Wetland	approx. 886' E, 572', 393', 703', 648' SW, 715' W
A-10	NWI Wetland	approx. 622' SE, 597' NE
B-0	NWI Wetland	on property SE; approx. 238' S
B-14	NWI Wetland	approx. 50' N, 227' W
B-15	NWI Wetland	approx. 147' SE, 575' S, 570', 422', 848', 999' NE, 716', 830' E
B-17	NWI Wetland	on property NW
B-19	NWI Wetland	approx. 392' SE
B-20	NWI Wetland	on SW property boundary; approx. 980' NW
B-20	Ephemeral Wetland	approx. 260' SE
C-0	NWI Wetland	on NE property; approx. 208' SE
C-21	NWI Wetland	approx. 50' E, 437' SE
C-22	NWI Wetland	on fenced property SE
C-24	NWI Wetland	approx. 394' W, 407' SE, 830' NW
C-25	NWI Wetland	approx. 597' N
C-26	NWI Wetland	on property NE; approx. 40' N, 400' NW, 240', 385' W, 74', 633', 892' S, 446', 967' E
C-27	NWI Wetland	approx. 622', 682', 902' N
C-29	NWI Wetland	on property S; approx. 256' NW, 70' SE, 397' NE
C-30	NWI Wetland	approx. 620', 740' E, 450' SE
D-0	NWI Wetland	approx. 400' E
D-31	NWI Wetland	approx. 230', 300', 450', 800' W, 300', 800' NW
D-32	NWI Wetland	approx. 670' NE, 800', 870' SW
D-33	NWI Wetland	approx. 40', 900', 960' N, 230' NE
D-34	NWI Wetland	on E property boundary; approx. 300' N, 380', 670' NE, 300' E, 600' SE, 760' SW, 480' W
D-35	NWI Wetland	approx. 500', 860' NE, 800' SW
D-36	NWI Wetland	approx. 300' SE
D-37	NWI Wetland	approx. 700' SE, 400', 1,000' SW, 1,000' W
D-38	NWI Wetland	approx. 150', 500', 600', 900' N, 260', 900', 1,000' E, 180', 450' SE, 160', 400' S, 440', 550' SW

Table C-2
Wetlands Near Missile Sites, 446th Missile Squadron [1]

Site	Type	Location
E-0	NWI Wetland	approx. 760', 800' E, 500' SE, 350', 400' SW, 180', 800' W, 360', 1,000' NW, 200', 740' NE
E-0	Ephemeral Wetland	approx. 300', 600', 1,000' NE, 750' E, 500', 700' SE, 400' SW, 150', 750', W, 1,000' NW
E-41	NWI Wetland	approx. 400' NW, 900' NE, 900'
E-41	Ephemeral Wetland	approx. 600', 1,000' N, 400' NW
E-42	NWI Wetland	approx. 700', 1,000' NE, 900' S
E-43	NWI Wetland	approx. 800' W, 640', 700' SW, 700' S, 500', 940' SE, 60' E, 500' N
E-44	NWI Wetland	approx. 40', 350' W, 500' SW, 650' S, 400', 700' SE, 1,000' NE
E-45	NWI Wetland	approx. 1,000' N, 250', 300', 900' NE, 860' SE, 270', 300', 530' S, 360' NW
E-46	NWI Wetland	approx. 650', 700', 900' E, 400' S, 300', 550' W, 840' NW, 750' NE
E-46	Ephemeral Wetland	approx. 1,000' NW, 800' NE
E-47	NWI Wetland	approx. 50', 800' N, 200' SE
E-48	NWI Wetland	approx. 200', 700' N, 240' NE, 600' E, 400' S, 200' SW, 350' W, 800', 900' NW
E-48	Ephemeral Wetland	approx. 400', 800' NE, 400' SW
E-49	NWI Wetland	on N, W, property boundary; approx. 600', 700', 850' N, 170', 800', 840' E, 85', 460', 800', 820' SE, 300', 700' S, 950' SW, 100', 150', 300' W, 650', 970' NW
E-50	NWI Wetland	approx. 600' NE, 630' E, 70', 150' SE
E-50	Ephemeral Wetland	on property NE; approx. 550', 650' NE

[1] Wetlands located within 1,000 feet of property boundary.

Source: USFWS NWI Maps, 1996; USGS Topographic Maps, various dates. (See EBS Section 3.2.4.)

Table C-3
Summary of Sites with Soil Sample Diesel and Gasoline Range Organics Levels above North Dakota Standard[1],446th Missile Squadron

Site	*DRO Level*	*GRO Level*
C-23[2]	100	NA
C-24[2]	230	NA
C-26[2]	370	NA
C-27[2]	560	NA
E-44[3]	24,000	200

All concentrations in mg/kg (parts per million)
[1] NDDH (North Dakota Department of Health) Standard is 100 ppm.
[2] Soil samples taken from sump pump outfall.
[3] Discretionary soil sample taken north of LEB.

NA = not applicable; site did not exceed NDDH standard (100 ppm) for noted contaminant

Source: USAF, 1999b. (See Section 3.3.1.)

Table C-4
Groundwater Sampling for PCBs at 446 Missile Squadron LFs (μg/L)

Sample Data	B-13	C-21	C-22	C-28	D-34
MW-1	ND	ND	1.0[1]	ND	ND
MW-2	ND	ND	ND	ND	ND
MW-3	ND	ND	ND	ND	ND
MW-4	ND	ND	ND	ND	ND
MW-5	ND	NA	ND	ND	ND
MW-6	ND	NA	ND	NA	ND
MW-7	ND	NA	NA	NA	ND

ND = not detected; NA = Not applicable
[1] One sample was 1.0, duplicate was ND. Sample was unfiltered.
All samples were analyzed for PCBs by USEPA SW-846 Method 8082. The samples were both filtered and unfiltered (included sediment). Samples are in micrograms per liter.
Source: USAF, 2005 (See Section 3.3.3)

Table C-5
PCB Sampling Results from Waterproof Coatings and Adjacent Soils

Ventilation Shaft Coating			Access Shaft Coating		
Site and type[1]	Waterproof coating concentration [2]	Adjacent soil concentration [2]	Site and type[1]	Waterproof coating concentration [2]	Adjacent soil concentration [2]
A-3 (1254)	19,000[3]	1.50	B-11	ND	ND
C-25 (1254)	74,000[4]	0.59	C-21 (1260)	0.38	NC
D-32 (1254)	6,100	0.95	C-23	ND	ND
E-48 (1254)	38,000	7.90	E-46 (1254)	0.30	0.096

Notes
[1] Various types of PCBs were sampled. Aroclor 1242, 1254, and 1260 were detected in locations as noted.
[2] Concentrations in mg/kg (parts per million)
[3] Re-analysis of this sample indicated 8,300 mg/kg
[4] Re-analysis of this sample indicated 22,000 mg/kg
ND = not detected; NC = not collected
Source: USAF, 1999b.

Table C-6
Summary of UST Soil Contamination in the 446th Missile Squadron

Site	*TPH*	*4,000-gallon Heating Oil Tank (TK-106)*				*500-gallon Diesel Tank*		*1,000-gallon Heating Oil Tank (GAR)*		
		SS-1	SS-2	SS-3	SS-4	SS-1	SS-2	SS-1	SS-2	SS-3
MAF B-0	GRO	490	NA	2,100	NA	NA	1,200	210	710	NC
	DRO	2,900	NA	9,600	NA	NA	6,400	930	3,600	NC
MAF D-0	GRO	NC	NC	NC	NC	NA	NA	430	NA	560
	DRO	NC	NC	NC	NC	NA	NA	2,600	200	3,500

All concentrations in mg/kg (parts per million)
NA = not applicable; site did not exceed NDDH standard (100 ppm) for noted contaminant
NC = not collected; SS = soil sample
GRO = gasoline range organic; DRO = diesel range organic
Source: USAF, 2001d (See Section 3.5.)

Table C-7 Prime Farmland by Site, 446th Missile Squadron[1]							
Site	*None*	*Some*	*All*	*Site*	*None*	*Some*	*All*
A Flight							
MAF A-0			√	LF A-06		√	
LF A-01			√	LF A-07			√
LF A-02		√		LF A-08			√
LF A-03		√		LF A-09			√
LF A-04	√			LF A-10		√	
LF A-05		√		*Subtotal for Flight:*	1	5	5
B Flight							
MAF B-0			√	LF B-16		√	
LF B-11			√	LF B-17			√
LF B-12			√	LF B-18			√
LF B-13			√	LF B-19	√		
LF B-14			√	LF B-20			√
LF B-15	√			*Subtotal for Flight:*	2	1	8
C Flight							
MAF C-0			√	LF C-26			√
LF C-21			√	LF C-27			√
LF C-22		√		LF C-28			√
LF C-23		√		LF C-29			√
LF C-24		√		LF C-30	√		
LF C-25			√	*Subtotal for Flight:*	1	3	7
D Flight							
MAF D-0			√	LF D-36	√		
LF D-31			√	LF D-37	√		
LF D-32		√		LF D-38			√
LF D-33			√	LF D-39			√
LF D-34			√	LF D-40		√	
LF D-35			√	*Subtotal for Flight:*	2	2	7
E Flight							
MAF E-0		√		LF E-46		√	
LF E-41			√	LF E-47			√
LF E-42		√		LF E-48			√
LF E-43		√		LF E-49		√	
LF E-44			√	LF E-50			√
LF E-45			√	*Subtotal for Flight:*	0	5	6
446 MS							
Total for 446 MS					**6**	**16**	**33**

[1]"None" means that no prime farmland soils are found within the site; "some" means part of the site contains prime farmland soils; and "all" means the entire site is considered prime farmland.

Source: USDA, 1972, 1977a, 1986, and 1990a (see Section 5.1.8).

APPENDIX D. SAMPLING RESULTS

This appendix provides detailed sampling results from the *Final Site Investigation Report, 446th Missile Squadron, Grand Forks Air Force Base, North Dakota*, May 1999 (USAF, 1999d). The sampling data have been scanned into electronic files directly from that *Report*, so the original table numbering is used in this Appendix.

The following tables are included for each Flight:

1. MAF Sludge Sample Bacteriological Results
2. MAF Sludge and Soil Sample Nutrient Results
3. MAF Sludge Sample Analytical Results
4. MAF Surface Water Sample Analytical Results
5. MAF and LF Soil Sample Field Measurements and Analytical Results

Contents

446th MISSILE SQUADRON, Flight A

Contents

This page intentionally left blank

Table 5-1. Flight A: MAF Sludge Bacteriological Results

Sample I.D.	Fecal Coliform		*Regulatory Limit*[1]
	(MPN/kg)	(MPN/gram)	*(MPN/gram)*
Sludge Sample #1	0	0	
Sludge Sample #2	0	0	
Sludge Sample #3	0	0	
Sludge Sample #4	0	0	
Sludge Sample #5	7,070	7.07	
Sludge Sample #6	25,200	25.2	
Sludge Sample #7	0	0	
Sludge Sample Duplicate	0	0	
Geometric Mean (MPN/gram)		13.3	*1,000*

[1] Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = most probable number per kilogram

Notes: Samples were collected 9/10/98.
Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.
Analytical Reports are included in Appendix D.

Table 5-2. Flight A: MAF Sludge Analytical Results

Analyte	Sample I.D. and Date Sampled				Regulatory Limit[3] (mg/kg)
	A-0SD-01 (9/10/98)		A-0SD-02 (9/10/98)		
	Result	Q	Result	Q	
Ammonia as N	48		11		
Nitrate as N	5.4		*NA*		
Nitrite as N	ND*(2.9)*	U	*NA*		
Total Kjeldahl N[1]	0.08		0.08		
Percent Moisture[2]	82.9		75.4		
Percent Solids[2]	17.1		24.6		
Antimony	ND*(29)*	U	ND*(20)*	U	
Arsenic	8.3		11		*41*
Beryllium	1.2		1.3		
Cadmium	ND*(2.9)*	U	ND*(2.0)*	U	*39*
Chromium	20		27		
Copper	43		43		*1,500*
Lead	16		14		*300*
Mercury	ND*(0.58)*	U	ND*(0.41)*	U	*17*
Molybdenum	ND*(2.9)*	U	ND*(2.0)*	U	
Nickel	32		41		*420*
Phosphorus	2.2		3.4		
Potassium	3,800		5,100		
Selenium	ND*(5.8)*	UJ	ND*(4.1)*	UJ	*100*
Silver	ND*(2.9)*	U	ND*(2.0)*	U	
Thallium	ND*(0.58)*	UJ	ND*(0.41)*	UJ	
Zinc	160		170		*2,800*
Total Nitrogen	2,800		*NA*		
Total Phosphorus	1,300		*NA*		
Total Potassium	10,000		*NA*		
Percent Moisture	79.6		*NA*		

[1] Total Kjeldahl Nitrogen units: percent nitrogen (%N)
[2] Percent Moisture and Percent Solids are by weight
[3] Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

mg/kg = milligrams per kilogram
J = estimated concentration
N = nitrogen
NA = not analyzed or not applicable
ND = not detected
Q = data qualifier
U = compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., *(0.58)*] indicates the laboratory detection limit in mg/kg.
Total nitrogen, total phosphorus, total potassium, and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 5-3. Flight A: MAF Surface Water and Soil Field Measurements and Analytical Results

Analyte	Wastewater Sample I.D. and Date Sampled: A-0SW-01 (9/10/98) (Secondary Lagoon) Result	Q	A-0SW-02 (9/10/98) (Primary Lagoon) Result	Q	SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled: A-0SS-01 (9/10/98) Result	Q	EPA RBCs (mg/kg)
Field Temperature (°C)	21.9		19.2			*NA*		
Field pH	9.99		10.62			*NA*		
Available Nitrogen[1]	*NA*		*NA*			3		
Available Phosphorus[2]	*NA*		*NA*			6		
Available Potassium[2]	*NA*		*NA*			290		
Laboratory pH	10		10			7.9		
Electrical Conductivty[3]	*NA*		*NA*			0.62		
Percent Moisture[4]	*NA*		*NA*			4.30		
TSS	ND*(5.0)*	U	ND*(5.0)*	U		*NA*		
BOD	ND*(1.0)*	U	ND*(1.0)*	U		*NA*		
O/G	2.2		2.4			*NA*		
Antimony	ND*(0.05)*	U	ND*(0.05)*	U	***0.006***	ND*(5.2)*	U	***31***
Arsenic	0.0038	J	0.0077		***0.05***	3.1		***23***
Beryllium	ND*(0.002)*	U	ND*(0.002)*	U	***0.004***	0.54		***0.15***
Cadmium	ND*(0.005)*	U	ND*(0.005)*	U	***0.005***	ND*(0.52)*	U	***39***
Chromium	ND*(0.01)*	U	ND*(0.01)*	U	***0.1***	11		***390***
Copper	ND*(0.005)*	U	ND*(0.005)*	U	***1.3***	12		***3,100***
Lead	ND*(0.005)*	U	ND*(0.005)*	U	***0.015***	7.4		***400***
Mercury	ND*(0.0002)*	U	ND*(0.0002)*	U	***0.002***	ND*(0.1)*	U	***23***
Molybdenum	ND*(0.005)*	U	ND*(0.005)*	U	***0.18***	ND*(0.52)*	U	***390***
Nickel	ND*(0.01)*	U	ND*(0.01)*	U	***0.1***	19		***1,600***
Phosphorus	0.22		0.12			1.3	UJ<	
Potassium	6.8		4.6			1,600		
Selenium	ND*(0.002)*	UJ	ND*(0.002)*	UJ	***0.05***	ND*(1.0)*	UJ	***390***
Silver	ND*(0.005)*	U	ND*(0.005)*	U	***0.1***	ND*(0.52)*	U	***390***
Thallium	ND*(0.005)*	UJ	ND*(0.005)*	UJ	***0.002***	0.10	J	
Zinc	ND*(0.005)*	U	ND*(0.005)*	U	***5***	45		***23,000***

[1] Available nitrogen (N): NO_3 as N , pounds per acre per depth (lbs/acre/depth)
[2] Available Phosphorus (P) and Potassium (K): parts per million (ppm)
[3] Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)
[4] Percent Moisture is by weight

°C = degrees Celsius
BOD = biochemical oxygen demand
J = estimated concentration
J< = estimated concentration with a low bias
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
MCL = maximum contaminant level
NA = not analyzed or not applicable
ND = not detected
O/G = oil and grease
Q = data qualifier
RBC = risk based concentration for soil established by EPA Region III
SDWA = Safe Drinking Water Act
TSS = total suspended solids
U = compound was analyzed but not detected

Notes: pH values are in standard units.
All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated.
All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., *(1.0)*] indicates the laboratory detection limit in mg/l or mg/kg.
Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 5-4. Flight A: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled																			
	A-1SS-01 (9/16/98)		A-1SS-D3 (9/16/98)		A-2SS-01 (9/17/98)		A-3SS-01 (9/17/98)		A-3SS-01 (12/3/98)		A-3SS-02[1] (12/3/98)		A-3WP-01 (12/3/98)		A-3WP-02[1] (12/3/98)		A-3AS-01 (12/3/98)		A-4SS-01 (9/17/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	8.1		*NA*		17.4		64.5		*NA*		*NA*		*NA*		*NA*		*NA*		102.4	
Percent Moisture	10.0		23.3		16.4		18.9		20.3		21.4		*NA*		*NA*		18.4		19.8	
DRO	ND*(11)*	U	ND*(13)*	U	ND*(12)*	UJ<	ND*(12)*	U	*NA*		*NA*		*NA*		*NA*		*NA*		45	
GRO	ND*(0.11)*	U	ND*(0.13)*	U	ND*(0.12)*	U	ND*(0.12)*	U	*NA*		*NA*		*NA*		*NA*		*NA*		ND*(0.12)*	U
PCB-1221	ND*(0.037)*	U	ND*(0.043)*	U	ND*(0.040)*	U	ND*(0.041)*	U	*NA*		*NA*		ND*(19,000)*	U	ND*(3,800)*	U	ND*(0.41)*	U	ND*(0.042)*	U
PCB-1232	ND*(0.018)*	U	ND*(0.022)*	U	ND*(0.020)*	U	ND*(0.021)*	U	*NA*		*NA*		ND*(9,500)*	U	ND*(1,900)*	U	ND*(0.20)*	U	ND*(0.021)*	U
PCB-1242	ND*(0.018)*	U	ND*(0.022)*	U	ND*(0.020)*	U	ND*(0.021)*	U	*NA*		*NA*		ND*(9,500)*	U	ND*(1,900)*	U	ND*(0.20)*	U	ND*(0.021)*	U
PCB-1248	ND*(0.018)*	U	ND*(0.022)*	U	ND*(0.020)*	U	ND*(0.021)*	U	*NA*		*NA*		ND*(9,500)*	U	ND*(1,900)*	U	ND*(0.20)*	U	ND*(0.021)*	U
PCB-1254	0.022		ND*(0.022)*	U	ND*(0.020)*	U	ND*(0.021)*	U	*NA*		*NA*		19,000	J<	8,300	J<	1.5		ND*(0.021)*	U
PCB-1260	ND*(0.018)*	U	ND*(0.022)*	U	ND*(0.020)*	U	ND*(0.021)*	U	*NA*		*NA*		ND*(9,500)*	U	ND*(1,900)*	U	ND*(0.20)*	U	ND*(0.021)*	U
PCB-1016	ND*(0.018)*	U	ND*(0.022)*	U	ND*(0.020)*	U	ND*(0.021)*	U	*NA*		*NA*		ND*(9,500)*	U	ND*(1,900)*	U	ND*(0.20)*	U	ND*(0.021)*	U
Antimony	ND*(5.6)*	U	ND*(6.5)*	UJ<	ND*(6.0)*	U	ND*(6.2)*	U	ND*(6.3)*	UJ<	ND*(6.4)*	U	*NA*		*NA*		*NA*		ND*(6.2)*	U
Arsenic	3.6		5.6		4.2		4.0		ND*(6.3)*	U	ND*(6.4)*	U	*NA*		*NA*		*NA*		4.1	
Beryllium	0.44		0.43		0.51		0.49		0.29		0.32		*NA*		*NA*		*NA*		0.56	
Cadmium	ND*(0.56)*	U	0.69		ND*(0.6)*	U	ND*(0.62)*	U	0.79		ND*(0.64)*	U	*NA*		*NA*		*NA*		ND*(0.62)*	U
Chromium	9.0		9.4		15		13		10		9.2		*NA*		*NA*		*NA*		14	
Copper	11		36		13		14		10		11		*NA*		*NA*		*NA*		12	
Lead	60	J	8.2	J<	10		37		40		34		*NA*		*NA*		*NA*		9.8	
Mercury	ND*(0.11)*	U	ND*(0.13)*	U	ND*(0.12)*	U	ND*(0.12)*	U	*NA*		*NA*		*NA*		*NA*		*NA*		ND*(0.12)*	U
Molybdenum	1.0		0.68		ND*(0.6)*	U	1.1		*NA*		*NA*		*NA*		*NA*		*NA*		ND*(0.62)*	U
Nickel	15		18		20		19		15		19		*NA*		*NA*		*NA*		19	
Phosphorus	2.7		2.1		20		19		*NA*		*NA*		*NA*		*NA*		*NA*		22	
Potassium	1,100		1,400		1,900		1,800		*NA*		*NA*		*NA*		*NA*		*NA*		1,900	
Selenium	ND*(0.11)*	UJ	ND*(1.3)*	UJ	ND*(1.2)*	U	ND*(1.2)*	U	ND*(13)*	U	ND*(13)*	U	*NA*		*NA*		*NA*		ND*(1.2)*	U
Silver	ND*(0.56)*	U	ND*(0.65)*	U	ND*(0.6)*	U	ND*(0.62)*	U	ND*(0.63)*	U	ND*(0.64)*	U	*NA*		*NA*		*NA*		ND*(0.62)*	U
Thallium	ND*(0.11)*	UJ	ND*(0.13)*	UJ<	ND*(0.12)*	UJ	ND*(0.12)*	UJ	ND*(13)*	U	ND*(13)*	U	*NA*		*NA*		*NA*		ND*(0.12)*	UJ
Zinc	35		62		49		51		60		63		*NA*		*NA*		*NA*		47	

Table 5-4. Flight A: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																			
	A-5SS-01 (9/16/98)		AF-5SS[1] (9/16/98)		A-6SS-01 (9/16/98)		A-7SS-01 (9/16/98)		A-8SS-01 (9/16/98)		A-8SS-D2 (9/16/98)		A-9SS-01 (9/16/98)		A-9SS-D1 (9/16/98)		A-10SS-01 (9/16/98)		A-10SS-R[1] (9/16/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	8.0		*NA*		14.1		13.0		167.2		*NA*		230		*NA*		126.1		*NA*	
Percent Moisture	18.1		18.0		13.1		10.2		14.6		15.6		16.7		14.2		14.1		14.1	
DRO	ND*(12)*	U	ND*(12)*	U	ND*(11)*	U	28		ND*(12)*	U	ND*(12)*	U	ND*(12)*	U	28		ND*(12)*	U	*NA*	
GRO	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.12)*	UJ<	ND*(0.12)*	U	*NA*	
PCB-1221	ND*(0.042)*	U	ND*(0.0410)*	U	ND*(0.038)*	U	ND*(0.037)*	U	ND*(0.039)*	U	ND*(0.039)*	U	ND*(0.040)*	U	ND*(0.039)*	U	ND*(0.039)*	U	*NA*	
PCB-1232	ND*(0.021)*	U	ND*(0.20)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	*NA*	
PCB-1242	ND*(0.021)*	U	ND*(0.20)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	*NA*	
PCB-1248	ND*(0.021)*	U	ND*(0.20)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	*NA*	
PCB-1254	ND*(0.021)*	U	0.87		ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U	0.045		ND*(0.019)*	U	ND*(0.019)*	U	*NA*	
PCB-1260	ND*(0.021)*	U	ND*(0.20)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	*NA*	
PCB-1016	ND*(0.021)*	U	ND*(0.20)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	*NA*	
Antimony	ND*(6.1)*	U	0.17		ND*(0.05)*	U	ND*(5.6)*	U	ND*(5.9)*	U	30		2.0		1.1		ND*(5.8)*	U	ND*(0.05)*	U
Arsenic	4.6		4.0		4.6		3.0		3.7		3.1		6.2		5.8		5.1		4.4	
Beryllium	0.38		0.39		0.47		ND*(0.22)*	U	0.36		0.59		0.49		0.31		0.37		0.44	
Cadmium	ND*(0.62)*	U	0.35		0.26		ND*(0.56)*	U	ND*(0.59)*	U	0.76		0.41		0.10		ND*(0.58)*	U	0.093	
Chromium	6.8		7.7		9.3		10		6.6		4.7		11		6.3		8.6		10	
Copper	12		12		15		13		11		19		17		11		14		14	
Lead	9.9		8.8		13		12		19		10		11		9.0		9.0	J	11	
Mercury	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.12)*	U	ND*(0.12)*	U
Molybdenum	ND*(0.62)*	U	0.82		0.51		2.2		ND*(0.59)*	U	3.1		1.3		0.54		1.2		0.77	
Nickel	17		18		18		11		16		39		23		12		18		18	
Phosphorus	4.7		9.3		9.7		7.6		19		ND*(0.59)*	U	3.1		27		19		11	
Potassium	1,200		1,300		1,500		790		1,200		1,300		1,800		1,300		1,400		1,500	
Selenium	ND*(1.2)*	UJ	ND*(1.2)*	UJ	ND*(1.2)*	UJ	ND*(1.1)*	UJ	ND*(1.2)*	UJ	ND*(1.2)*	UJ	ND*(1.2)*	UJ	ND*(1.2)*	UJ	ND*(1.2)*	UJ	ND*(1.2)*	UJ
Silver	ND*(0.62)*	U	0.098		0.046		ND*(0.56)*	U	ND*(0.59)*	U	3.0		ND*(0.005)*	U	ND*(0.005)*	U	ND*(0.58)*	U	ND*(0.005)*	U
Thallium	ND*(0.12)*	UJ	ND*(0.12)*	UJ	ND*(0.12)*	UJ	0.12	J	0.13	J	0.17	J	0.12	J	0.12	J	ND*(0.12)*	UJ	ND*(0.12)*	UJ
Zinc	42		45		43		25		58		120		54		37		42		46	

[1] This sample is a duplicate of the previous investigative sample.

D1, D2 = discretionary samples
DRO = diesel range organics
GRO = gasoline range organics
J = estimated concentration
J< = estimated concentration with low bias
NA = not analyzed or not applicable
ND = not detected
PCB = polychlorinated biphenyls
PID = photoionization detector
Q = data qualifier
R = duplicate sample
U = compound was analyzed but not detected

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Percent Moisture is by weight.
Number in parentheses [i.e., *(0.021)*] indicates the laboratory detection limit in mg/kg
All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

This page intentionally left blank.

446th MISSILE SQUADRON, Flight B

Contents

This page intentionally left blank

Table 6-1. Flight B: MAF Sludge Bacteriological Results

Sample I.D.	Fecal Coliform		*Regulatory Limit[1]*
	(MPN/kg)	(MPN/gram)	*(MPN/gram)*
Sludge Sample #1	2,940	2.94	
Sludge Sample #2	0	0	
Sludge Sample #3	0	0	
Sludge Sample #4	2,300	2.3	
Sludge Sample #5	0	0	
Sludge Sample #6	0	0	
Sludge Sample #7	19,300	19.3	
Geometric Mean (MPN/gram)		5.07	*1,000*

[1] Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = most probable number per kilogram

Notes: Samples were collected 9/09/98.
Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.
Analytical Reports are included in Appendix D.

Table 6-2. Flight B: MAF Sludge Analytical Results

Analyte	Sample I.D. and Date Sampled B-0SD-01 (9/09/98)		*Regulatory Limit[3] (mg/kg)*
	Result	Q	
Ammonia as N	66		
Nitrate as N	3.1		
Nitrite as N	ND*(2.0)*	U	
Total Kjeldahl N[1]	0.18		
Percent Moisture[2]	75.5		
Percent Solids[2]	24.5		
Antimony	ND*(20)*	U	*41*
Arsenic	4.4		
Beryllium	ND*(0.82)*	U	*39*
Cadmium	ND*(2.0)*	U	
Chromium	6.5		*1,500*
Copper	21		*300*
Lead	9.6		*17*
Mercury	ND*(0.41)*	U	
Molybdenum	ND*(2.0)*	U	*420*
Nickel	14		
Phosphorus	4.6		
Potassium	1,800		*100*
Selenium	ND*(0.82)*	UJ	
Silver	ND*(2.0)*	U	
Thallium	ND*(0.41)*	UJ	*2,800*
Zinc	94		
Total Nitrogen	2,300		
Total Phosphorus	600		
Total Potassium	10,000		
Percent Moisture	72.2		

[1] Total Kjeldahl Nitrogen units: percent Nitrogen (% N)
[2] Percent Moisture and Percent Solids are by weight
[3] Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

J = estimated concentration
mg/kg = milligrams per kilogram
N = nitrogen
ND = not detected
Q = data qualifier
U = compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., (2.0)] indicates the laboratory detection limit in mg/kg.
Total nitrogen, total phosphorus, total potassium and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 6-3. Flight B: MAF Surface Water and Soil Field Measurements and Analytical Results

Analyte	Wastewater Sample I.D. and Date Sampled				SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled		EPA RBCs (mg/kg)
	B-0SW-01 (9/09/98) (Secondary Lagoon)		B-0SW-02 (9/09/98) (Primary Lagoon)			B-0SS-01 (9/09/98)		
	Result	Q	Result	Q		Result	Q	
Field Temperature (°C)	16.6		16.6			*NA*		
Field pH	7.97		7.92			*NA*		
Available Nitrogen[1]	*NA*		*NA*			39		
Available Phosphorus[2]	*NA*		*NA*			9		
Available Potassium[2]	*NA*		*NA*			635		
Laboratory pH	8.8		7.8			7.6		
Electrical Conductivty[3]	*NA*		*NA*			0.60		
Percent Moisture[4]	*NA*		*NA*			8.4		
TSS	22		24			*NA*		
BOD	4.8		8.99			*NA*		
O/G	1.4		1.8			*NA*		
Antimony	ND*(0.05)*	U	ND*(0.05)*	U	***0.006***	ND*(5.5)*	U	***31***
Arsenic	0.0054	J	0.0024	J	***0.05***	3.5		***23***
Beryllium	ND*(0.002)*	U	ND*(0.002)*	U	***0.004***	0.40		***0.15***
Cadmium	ND*(0.005)*	U	ND*(0.005)*	U	***0.005***	0.55		***39***
Chromium	ND*(0.01)*	U	ND*(0.01)*	U	***0.1***	6.8		***390***
Copper	ND*(0.005)*	U	ND*(0.005)*	U	***1.3***	13		***3,100***
Lead	ND*(0.001)*	UJ	ND*(0.005)*	U	***0.015***	6.9		***400***
Mercury	ND*(0.0002)*	U	ND*(0.0002)*	U	***0.002***	ND*(0.11)*	U	***23***
Molybdenum	0.0052		ND*(0.005)*	U	***0.18***	ND*(0.55)*	U	***390***
Nickel	0.012		ND*(0.01)*	U	***0.1***	15		***1,600***
Phosphorus	1.7		4.0			1.3		
Potassium	17		16			2,100		
Selenium	ND*(0.002)*	UJ	ND*(0.002)*	UJ	***0.05***	ND*(1.1)*	UJ	***390***
Silver	ND*(0.005)*	U	ND*(0.005)*	U	***0.1***	ND*(0.55)*	U	***390***
Thallium	ND*(0.001)*	U	ND*(0.001)*	U	***0.002***	ND*(0.11)*	UJ	
Zinc	ND*(0.005)*	U	ND*(0.005)*	U	***5***	67		***23,000***

[1] Available nitrogen (N): NO_3 as N , pounds per acre per depth (lbs/acre/depth)
[2] Available Phosphorus (P) and Potassium (K): parts per million (ppm)
[3] Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)
[4] Percent Moisture is by weight

°C	=	degrees Celsius	ND	=	not detected
BOD	=	biological oxygen demand	O/G	=	oil and grease
J	=	estimated concentration	Q	=	data qualifier
MCL	=	maximum contaminant level	RBC	=	risk based concentrations (EPA Region III)
mg/kg	=	milligrams per kilogram	SDWA	=	Safe Drinking Water Act
mg/l	=	milligrams per liter	TSS	=	total suspended solids
NA	=	not analyzed or not applicable	U	=	compound was analyzed but not detected

Notes: pH values are in standard units.
All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated.
Number in parentheses [i.e., (0.01)] indicates the laboratory detection limit in mg/l or mg/kg.
All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 6-4. Flight B: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled															
	B-11SS-01 (9/17/98)		B-11SS-B (9/17/98)		B-11WP-01 (9/17/98)		B-11SS-02 (9/17/98)		B-12SS-01 (9/17/98)		B-12SS-D1 (9/17/98)		B-13SS-01 (9/17/98)		B-13SS-R (9/17/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	8.6		NA		NA		NA		167		8.7		13.2		7.7	
Percent Moisture	10.0		19.9		27.6		14.7		11.6		10.2		17.3		17.8	
DRO	ND(11)	U	NA		NA		NA		ND(11)	U	ND(11)	U	ND(12)	U	NA	
GRO	ND(0.11)	UJ<	NA		NA		NA		ND(0.11)	U	ND(0.11)	U	ND(0.12)	UJ<	NA	
PCB-1221	ND(0.037)	U	NA		ND(0.046)	U	ND(0.039)	U	ND(0.038)	U	ND(0.037)	U	ND(0.040)	U	NA	
PCB-1232	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1242	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1248	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1254	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1260	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1016	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
Antimony	ND(5.6)	U	ND(6.2)	U	NA		NA		ND(5.7)	U	ND(5.6)	U	ND(6.0)	U	ND(6.1)	U
Arsenic	2.4		4.4		NA		NA		3.4		3.9		4.8		5.4	
Beryllium	0.48		0.45		NA		NA		0.64		0.50		0.51		0.36	
Cadmium	ND(0.56)	U	ND(0.62)	U	NA		NA		ND(0.57)	U	ND(0.56)	U	ND(0.6)	U	0.69	
Chromium	12		10		NA		NA		12		13		12		6.4	
Copper	10		11		NA		NA		12		13		11		11	
Lead	6.5		7.6		NA		NA		9.0		8.2		9.8		8.8	
Mercury	ND(0.11)	U	ND(0.12)	U	NA		NA		ND(0.11)	U	ND(0.11)	U	ND(0.12)	U	0.16	
Molybdenum	0.64		1.2		NA		NA		1.7		1.4		0.93		1.5	
Nickel	16		20		NA		NA		20		20		21		21	
Phosphorus	14		6.6		NA		NA		16		3.5		1.8		1.3	
Potassium	1,500		1,700		NA		NA		1,700		1,800		1,700		1,100	
Selenium	ND(1.1)	U	ND(1.2)	U	NA		NA		ND(1.1)	U	ND(1.1)	U	ND(1.2)	U	ND(1.2)	U
Silver	ND(0.56)	U	ND(0.62)	U	NA		NA		ND(0.57)	U	ND(0.56)	U	ND(0.6)	U	ND(0.61)	U
Thallium	ND(0.11)	U	0.14		NA		NA		ND(0.11)	U	0.11		0.12		0.17	
Zinc	40		40		NA		NA		50		47		42		37	

Table 6-4. Flight B: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled											
	B-14SS-01 (9/17/98)		B-14SS-D3 (9/17/98)		B-15SS-01 (9/17/98)		BF-15SS[1] (9/17/98)		B-16SS-01 (9/17/98)		B-16SS-D2 (9/17/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	551		*NA*		196		*NA*		14.1		*NA*	
Percent Moisture	18.5		21.5		10.8		13.0		17.0		18.2	
DRO	ND*(12)*	U	ND*(13)*	U	ND*(11)*	U	ND*(11)*	U	ND*(11)*	UJ<	ND*(12)*	U
GRO	ND*(0.12)*	U	ND*(0.13)*	U	ND*(0.11)*	U	ND*(0.11)*	U	ND*(0.11)*	U	ND*(0.12)*	U
PCB-1221	ND*(0.041)*	U	ND*(0.042)*	U	ND*(0.037)*	U	ND*(0.038)*	U	ND*(0.040)*	U	ND*(0.041)*	U
PCB-1232	ND*(0.020)*	U	ND*(0.021)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U
PCB-1242	ND*(0.020)*	U	ND*(0.021)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U
PCB-1248	ND*(0.020)*	U	ND*(0.021)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U
PCB-1254	ND*(0.020)*	U	ND*(0.021)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U
PCB-1260	ND*(0.020)*	U	ND*(0.021)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U
PCB-1016	ND*(0.020)*	U	ND*(0.021)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.020)*	U
Antimony	ND*(6.1)*	U	ND*(6.4)*	U	ND*(5.6)*	U	ND*(5.7)*	UJ<	ND*(6.0)*	U	ND*(6.1)*	U
Arsenic	4.5		3.7		3.7		3.6		4.5		5.6	
Beryllium	0.63		0.64		0.41		0.37		0.60		0.76	
Cadmium	ND*(0.61)*	U	ND*(0.64)*	U	0.58		0.57		ND*(0.6)*	U	ND*(0.61)*	U
Chromium	16		17		11		8.6		13		17	
Copper	14		13		9.3		9.2		14		13	
Lead	8.1	J	7.8	J	11		10		12		8.3	J
Mercury	ND*(0.12)*	U	ND*(0.13)*	U	ND*(0.11)*	U	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.12)*	U
Molybdenum	0.64		ND*(0.64)*	U	0.61		ND*(0.57)*	U	1.0		0.80	
Nickel	22		20		16		16		26		26	
Phosphorus	9.8		1.2		ND*(0.56)*	U	0.58		13		ND*(0.61)*	U
Potassium	2,100		2,200		1,300		1,100	J<	2,100		2,400	
Selenium	ND*(1.2)*	UJ	ND*(1.3)*	U	ND*(1.1)*	UJ	ND*(1.1)*	U	ND*(1.2)*	U	ND*(1.2)*	U
Silver	ND*(0.61)*	U	ND*(0.64)*	U	ND*(0.56)*	U	ND*(0.57)*	U	ND*(0.6)*	U	ND*(0.61)*	U
Thallium	0.17	J	0.41	J	0.15	J	ND*(0.11)*	UJ	0.14	J	ND*(0.12)*	UJ
Zinc	57		63		38		36		65		95	

Table 6-4. Flight B: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled													
	B-17SS-01 (9/17/98)		B-17SS-RA (9/17/98)		B-18SS-01 (9/17/98)		B-19SS-01 (9/17/98)		B-19SS-02 (9/17/98)		B-20SS-01 (9/17/98)		B-20SS-R (9/17/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	108.6		*NA*		4.0		6.7		*NA*		24.8		*NA*	
Percent Moisture	5.80		17.4		11.9		13.3		10.4		24.7		20.5	
DRO	ND*(11)*	UJ<	*NA*		28		ND*(12)*	U	ND*(11)*	U	ND*(13)*	U	*NA*	
GRO	ND*(0.11)*	U	*NA*		ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.13)*	U	*NA*	
PCB-1221	ND*(0.035)*	U	*NA*		ND*(0.038)*	U	ND*(0.77)*	U	ND*(0.037)*	U	ND*(0.044)*	U	*NA*	
PCB-1232	ND*(0.018)*	U	*NA*		ND*(0.019)*	U	ND*(0.38)*	U	ND*(0.019)*	U	ND*(0.022)*	U	*NA*	
PCB-1242	ND*(0.018)*	U	*NA*		ND*(0.019)*	U	ND*(0.38)*	U	ND*(0.019)*	U	ND*(0.022)*	U	*NA*	
PCB-1248	ND*(0.018)*	U	*NA*		ND*(0.019)*	U	ND*(0.38)*	U	ND*(0.019)*	U	ND*(0.022)*	U	*NA*	
PCB-1254	0.15		*NA*		0.021		3.8		ND*(0.019)*	U	ND*(0.022)*	U	*NA*	
PCB-1260	ND*(0.018)*	U	*NA*		ND*(0.019)*	U	ND*(0.38)*	U	ND*(0.019)*	U	ND*(0.022)*	U	*NA*	
PCB-1016	ND*(0.018)*	U	*NA*		ND*(0.019)*	U	ND*(0.38)*	U	ND*(0.019)*	U	ND*(0.022)*	U	*NA*	
Antimony	9.5		ND*(6.1)*	U	ND*(5.7)*	U	ND*(5.8)*	UJ<	ND*(5.6)*	U	ND*(6.6)*	U	ND*(6.3)*	U
Arsenic	3.3		3.7		3.1		3.2	J<	3.6		3.1		3.8	
Beryllium	0.35		0.52		0.42		0.48		0.33		0.45		0.64	
Cadmium	ND*(0.53)*	U	0.73		0.66		ND*(0.58)*	U	ND*(0.56)*	U	ND*(0.66)*	U	ND*(0.63)*	U
Chromium	5.2		13		9.2		12		8.6		12		18	
Copper	6.8		12		11		11		7.0		15		15	
Lead	13		260	J	23		8.2		9.8		27		19	
Mercury	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.13)*	U	ND*(0.13)*	U
Molybdenum	ND*(0.53)*	U	1.0		ND*(0.57)*	U	1.3		0.57		ND*(0.66)*	U	0.65	
Nickel	7.8		15		17		18		12		16		20	
Phosphorus	4.3		4.0		ND*(0.57)*	U	14		11		0.67		3.6	
Potassium	850		1,800		1,700		1,600		1,200		2,000		2,200	
Selenium	ND*(1.1)*	UJ	ND*(1.2)*	U	ND*(1.1)*	U	ND*(1.2)*	U	ND*(1.1)*	U	ND*(1.3)*	U	ND*(1.3)*	U
Silver	0.70		ND*(0.61)*	U	ND*(0.57)*	U	ND*(0.58)*	U	ND*(0.56)*	U	ND*(0.66)*	U	ND*(0.63)*	U
Thallium	0.12	J	0.15	J	ND*(0.11)*	UJ	0.12	J<	ND*(0.11)*	U	ND*(0.13)*	U	0.19	
Zinc	26		56		57		41		27		52		63	

[1] This sample is a duplicate of the previous investigative sample

B = background sample
D1, D2, D3 = discretionary sample
DRO = diesel range organics
GRO = gasoline range organics
J = estimated concentration
J< = estimated concentration with low bias
NA = not analyzed or not applicable
ND = not detected
PCB = polychlorinated biphenyls
PID = photoionization detector
Q = data qualifier
U = compound was analyzed but not detected
R, RA = random sample

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Percent moisture is by weight.
Number in parentheses [i.e., *(0.11)*] indicates the laboratory detection limit in mg/kg.
All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

446th MISSILE SQUADRON, Flight C

Contents

This page intentionally left blank

Table 7-1. Flight C: MAF Sludge Bacteriological Results

Sample I.D.	Fecal Coliform		Regulatory Limit[1] (MPN/gram)
	(MPN/kg)	(MPN/gram)	
Sludge Sample #1	0	0	
Sludge Sample #2	0	0	
Sludge Sample #3	0	0	
Sludge Sample #4	0	0	
Sludge Sample #5	2,270	2.27	
Sludge Sample #6	0	0	
Sludge Sample #7	0	0	
Sludge Sample Duplicate	0	0	
Geometric Mean (MPN/gram)		2.27	*1,000*

[1] Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = most probable Number per kilogram

Notes: Samples were collected 9/15/98.
Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.
Analytical Reports are included in Appendix D.

Table 7-2. Flight C: MAF Sludge Analytical Results

Analyte	Sample I.D. and Date Sampled				Regulatory Limit[4] (mg/kg)
	C-0SD-01 (9/15/98)		CF-0SD-01[1] (9/15/98)		
	Result	Q	Result	Q	
Ammonia as N	43		280		
Nitrate as N	ND*(1.7)*	U	ND*(2.3)*	U	
Nitrite as N	ND*(3.4)*	U	ND*(4.5)*	U	
Total Kjeldahl N[2]	0.08		0.11		
Percent Moisture[3]	70.9		78.0		
Percent Solids[3]	29.1		22.0		
Antimony	ND*(17)*	U	ND*(23)*	U	
Arsenic	7.1		7.2		*41*
Beryllium	1.3		1.1		
Cadmium	ND*(1.7)*	U	ND*(2.3)*	U	*39*
Chromium	27		25		
Copper	26		29		*1,500*
Lead	16		18	U	*300*
Mercury	ND*(0.34)*	U	ND*(0.45)*	U	*17*
Molybdenum	2.6		ND*(2.3)*		
Nickel	29		36		*420*
Phosphorus	ND*(1.7)*	U	4.1		
Potassium	3,900		4,100		
Selenium	ND*(3.4)*	U	ND*(4.5)*	U	*100*
Silver	ND*(1.7)*	U	ND*(2.3)*	U	
Thallium	ND*(0.34)*	U	ND*(0.45)*	U	
Zinc	96		110		*2,800*
Total Nitrogen	2,400		*NA*		
Total Phosphorus	600		*NA*		
Total Potassium	13,500		*NA*		
Percent Moisture	36.5		*NA*		

[1] This sample is a duplicate of the previous investigative sample.
[2] Total Kjeldahl Nitrogen units: percent Nitrogen (% N)
[3] Percent Moisture and Percent Solids are by weight
[4] Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

mg/kg = milligrams per kilogram
N = nitrogen
NA = not analyzed or not applicable
ND = not detected
Q = data qualifier
U = Compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., *(2.3)*] indicates the laboratory detection limit in mg/kg.
Total nitrogen, total phosphorus, total potassium and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 7-3. Flight C: MAF Surface Water and Soil Field Measurements and Analytical Results

Analyte	Wastewater Sample I.D. and Date Sampled						SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled				EPA RBCs (mg/kg)
	C-0SW-01 (9/12/98) (Primary Lagoon)		C-0SW-02 (9/12/98) (Secondary Lagoon)		CF-0SW-02[5] (9/12/98)			C-0SS-01 (9/12/98)		CF-0SS-01[5] (9/12/98)		
	Result	Q	Result	Q	Result	Q		Result	Q	Result	Q	
Field Temperature (°C)	19.3		18.9		*NA*			*NA*		*NA*		
Field pH	9.67		9.90		*NA*			*NA*		*NA*		
Available Nitrogen[1]	*NA*		*NA*		*NA*			4		*NA*		
Available Phosphorus[2]	*NA*		*NA*		*NA*			5		*NA*		
Available Potassium[2]	*NA*		*NA*		*NA*			250		*NA*		
Laboratory pH	9.60		9.74		9.69			7.7		*NA*		
Electrical Conductivty[3]	*NA*		*NA*		*NA*			0.35		*NA*		
Percent Moisture[4]	*NA*		*NA*		*NA*			12.3		11.7		
TSS	ND*(5.0)*	U	33		ND*(5.0)*	U		*NA*		*NA*		
BOD	ND*(1.0)*	U	1.0		1.4			*NA*		*NA*		
O/G	1.7		1.5		7.3			*NA*		*NA*		
Antimony	ND*(0.05)*	U	ND*(0.05)*	U	ND*(0.05)*	U	*0.006*	ND*(5.7)*	U	ND*(5.7)*	U	*31*
Arsenic	0.0052	J	0.012		0.012		*0.05*	2.5		2.5		*23*
Beryllium	ND*(0.002)*	U	ND*(0.002)*	U	ND*(0.002)*	U	*0.004*	0.55		0.52		*0.15*
Cadmium	ND*(0.005)*	U	ND*(0.005)*	U	ND*(0.005)*	U	*0.005*	ND*(0.57)*	U	ND*(0.57)*	U	*39*
Chromium	ND*(0.01)*	U	ND*(0.01)*	U	ND*(0.01)*	U	*0.1*	9.4		9.1		*390*
Copper	ND*(0.005)*	U	ND*(0.005)*	U	ND*(0.005)*	U	*1.3*	7.5		7.8		*3,100*
Lead	ND*(0.005)*	U	ND*(0.001)*	UJ	ND*(0.001)*	UJ	*0.015*	8.9		6.9		*400*
Mercury	ND*(0.0002)*	U	ND*(0.0002)*	U	ND*(0.0002)*	U	*0.002*	ND*(0.11)*	U	ND*(0.11)*	U	*23*
Molybdenum	ND*(0.005)*	U	ND*(0.005)*	U	ND*(0.005)*	U	*0.18*	ND*(0.57)*	U	ND*(0.57)*	U	*390*
Nickel	ND*(0.01)*	U	ND*(0.01)*	U	ND*(0.01)*	U	*0.1*	17		15		*1,600*
Phosphorus	0.32		0.34		0.38			ND*(0.57)*	U	ND*(0.57)*	U	
Potassium	5.5		6.3		6.4			1,400		1,400		
Selenium	ND*(0.002)*	UJ	ND*(0.002)*	UJ	ND*(0.002)*	UJ	*0.05*	ND*(1.1)*	UJ	ND*(1.1)*	UJ	*390*
Silver	ND*(0.005)*	U	ND*(0.005)*	U	ND*(0.005)*	U	*0.1*	ND*(0.57)*	U	ND*(0.57)*	U	*390*
Thallium	ND*(0.001)*	UJ	ND*(0.001)*	UJ	ND*(0.001)*	UJ	*0.002*	ND*(0.57)*	UJ	ND*(0.57)*	UJ	
Zinc	0.0061		0.0074		0.0053		*5*	36		36		*23,000*

[1] Available nitrogen (N): NO_3 as N , pounds per acre per depth (lbs/acre/depth)
[2] Available Phosphorus (P) and Potassium (K): parts per million (ppm)
[3] Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)
[4] Percent Moisture is by weight
[5] This sample is a duplicate of the previous investigative sample.

°C = degrees Celsius
BOD = biological oxygen demand
J = estimated concentration
MCL = maximum contaminant level
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
NA = not analyzed or not applicable
ND = not detected
O/G = oil and grease
Q = data qualifier
RBC = risk based concentrations (EPA Region III)
SAP = sampling and analysis plan
SDWA = Safe Drinking Water Act
TSS = total suspended solids
U = compound analyzed but not detected

Notes: All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated; pH values are in standard units.
All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., *(1.0)*] indicates the laboratory detection limit in mg/l or mg/kg.
Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota. All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 7-4. Flight C: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled																	
	C-21SS-01 (9/11/98)		C-21SS-B (9/11/98)		C-21WP-01 (9/11/98)		C-22SS-01 (9/11/98)		C-23SS-01 (9/11/98)		C-23WP-01 (9/11/98)		C-24SS-01 (9/11/98)		C-25SS-01 (9/14/98)		C-25SS-D3 (9/14/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	40.7		NA		NA		9.1		NA		NA		50.4		86.3		15.9	
Percent Moisture	7.40		8.3		16.6		15.8		12.9		27.0		9.30		15.2		15.6	
DRO	ND(11)	U	NA		NA		ND(12)	U	100		NA		230		ND(12)	U	16	
GRO	ND(0.11)	U	NA		NA		ND(0.12)	U	ND(0.11)	U	NA		ND(0.11)	UJ<	ND(0.12)	U	ND(0.12)	U
PCB-1221	ND(0.036)	U	NA		ND(0.28)	U	ND(0.040)	U	ND(0.038)	U	ND(0.140)	UJ<	ND(0.037)	U	ND(0.039)	U	ND(0.039)	U
PCB-1232	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
PCB-1242	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
PCB-1248	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
PCB-1254	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	0.064		0.07	
PCB-1260	ND(0.018)	U	NA		0.38	J<	0.029		0.033		ND(0.068)	UJ<	0.13		ND(0.020)	U	ND(0.020)	U
PCB-1016	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
Antimony	ND(5.4)	U	ND(5.5)	U	NA		ND(5.9)	U	ND(5.7)	U	NA		21		ND(5.9)	U	ND(5.9)	UJ<
Arsenic	3.1		3.3		NA		5.5		4.8		NA		4.1		4.6		2.7	J<
Beryllium	0.31		0.29		NA		0.31		0.34		NA		0.35		0.34		0.57	
Cadmium	ND(0.54)	U	ND(0.55)	U	NA		0.65		ND(0.57)	U	NA		1.1		ND(0.59)	U	ND(0.59)	U
Chromium	5.3		6.4		NA		5.5		6.8		NA		9.1		6.9		13	
Copper	9.1		13		NA		11		14		NA		30		12		9.0	
Lead	3.7		7.9		NA		8.8		7.0		NA		49		20		7.5	J<
Mercury	ND(0.11)	U	ND(0.11)	U	NA		ND(0.12)	U	ND(0.11)	U	NA		ND(0.11)	U	ND(0.12)	U	ND(0.12)	U
Molybdenum	0.98		ND(0.55)	U	NA		1.7		2.6		NA		2.7		7.0		ND(0.59)	U
Nickel	15		14		NA		15		19		NA		22		15		20	
Phosphorus	3.5		4.4		NA		6.2		1.4		NA		65	UJ<	10		ND(0.59)	UJ<
Potassium	850		810		NA		880		1,200		NA		860		830		1,300	
Selenium	ND(1.1)	UJ	ND(1.1)	UJ	NA		ND(1.2)	UJ	ND(1.1)	UJ	NA		ND(1.1)	UJ	ND(1.2)	UJ	X	
Silver	ND(0.54)	U	ND(0.55)	U	NA		ND(0.59)	U	ND(0.57)	U	NA		2.6		ND(0.59)	U	ND(0.59)	U
Thallium	ND(0.54)	UJ	0.65		NA		0.65		ND(0.57)	UJ	NA		ND(0.55)	UJ	ND(0.59)	UJ	0.24	J
Zinc	32		31		NA		36		45		NA		57		33		37	

Table 7-4. Flight C: LF Soil Field Measurements and Analytical Results (continued)

/AST -ok

Analyte	Sample I.D. and Date Sampled																			
	C-25WP (9/14/98)		C-25SS-02 (9/14/98)		C-26SS-01 (9/11/98)		C-26SS-D3/D1 (9/11,18/98)		C-27SS-01 (9/11/98)		C-28SS-01 (9/11/98)		C-29SS-01 (9/11/98)		C-30SS-01 (9/11/98)		C-30SS-D1/D2 (9/11,18/98)		C-30SS-R (9/11/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	NA		NA		24		NA		28.3		8.9		14.6		28.9		NA		NA	
Percent Moisture	6.30		13.3		14.1		18.0		13.9		9.80		11.1		17.0		9.20		22.9	
DRO	NA		NA		370		ND(11)	U	560	J>	ND(11)	U	ND(11)	U	ND(12)	U	ND(11)	U	NA	
GRO	NA		NA		ND(0.12)	U	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	NA	
PCB-1221	ND(18,000)	UJ<	ND(0.077)	U	ND(0.039)	U	ND(0.36)	U	ND(0.039)	U	ND(0.037)	U	ND(0.037)	U	ND(0.040)	U	NA		NA	
PCB-1232	ND(8,900)	UJ<	ND(0.038)	U	ND(0.019)	U	ND(0.18)	U	ND(0.019)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
PCB-1242	ND(8,900)	UJ<	ND(0.038)	U	ND(0.019)	U	ND(0.18)	U	ND(0.019)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
PCB-1248	ND(8,900)	UJ<	ND(0.038)	U	ND(0.019)	U	ND(0.18)	U	ND(0.019)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
PCB-1254	74,000	UJ<	0.59		ND(0.019)	U	3.5		ND(0.019)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
PCB-1260	ND(8,900)	UJ<	ND(0.038)	U	0.02		ND(0.18)	U	0.046		ND(0.018)	U	0.087		0.026		NA		NA	
PCB-1016	ND(8,900)	UJ<	ND(0.038)	U	ND(0.019)	U	ND(0.18)	U	ND(0.019)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
Antimony	NA		NA		ND(5.8)	U	ND(6.1)	U	ND(5.8)	U	ND(5.5)		ND(5.6)	U	ND(6.0)	U	ND(5.5)	U	ND(6.5)	U
Arsenic	NA		NA		4.3		5.0		3.6		2.4		2.3		3.1		2.7		2.8	
Beryllium	NA		NA		0.45		0.41		0.30		0.33		0.24		0.41		0.43		0.52	
Cadmium	NA		NA		ND(0.58)	U	ND(0.61)	U	0.71		ND(0.55)	U	ND(0.56)	U	ND(0.6)	U	0.65		ND(0.65)	U
Chromium	NA		NA		11		8.9		5.4		6.3		5.0		7.4		7.9		9.9	
Copper	NA		NA		15		11		12		8.7		8.0		12		11		14	
Lead	NA		NA		8.5		11		17		15		5.5		6.5		14		9.6	
Mercury	NA		NA		ND(0.12)	U	ND(0.12)	U	ND(0.12)	U	ND(0.11)	U	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.13)	U
Molybdenum	NA		NA		ND(0.58)	U	0.99		ND(0.58)	U	0.60		0.98		0.95		1.0		0.73	
Nickel	NA		NA		19		14		12		15		10		20		21		22	
Phosphorus	NA		NA		9.3		29		3.3		ND(0.55)	U	3.2		ND(0.6)	U	0.64		0.52	J1
Potassium	NA		NA		1,400		1,100		1,100		890		820		1,100		1,300		1,300	
Selenium	NA		NA		ND(1.2)	UJ	ND(1.2)	UJ	ND(1.2)	UJ	ND(1.1)	UJ	ND(1.1)	UJ	ND(1.2)	UJ	ND(1.1)	UJ	ND(1.3)	UJ
Silver	NA		NA		ND(0.58)	U	ND(0.58)	U	ND(0.58)	U	ND(0.55)	U	ND(0.56)	U	ND(0.6)	U	ND(0.55)	U	ND(0.65)	U
Thallium	NA		NA		0.58		0.73		ND(0.58)	UJ	0.61		ND(0.56)	UJ	ND(0.6)	UJ	0.12	J	0.17	J
Zinc	NA		NA		48		36		42		38		23		51		51		58	

B = background sample
D1/D2 = discretionary sample
D3/D1 = discretionary sample
DRO = diesel range organics
GRO = gasoline range organics
J = estimated concentration
J> = estimated concentration with high bias
J< = estimated concentration with low bias
NA = not analyzed or not applicable
ND = not detected
PID = photoionization detector
PCB = polychlorinated biphenyls
Q = data qualifier
R = random sample
U = compound was analyzed but not detected
X = laboratory analytical data rejected during validation

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Percent Moisture is by weight.
Number in parentheses [i.e., *(0.11)*] indicates the laboratory detection limit in mg/kg.
All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

This page intentionally left blank.

446th MISSILE SQUADRON, Flight D

Contents

This page intentionally left blank

Table 8-1. Flight D: MAF Sludge Bacteriological Results

Sample I.D.	Fecal Coliform		*Regulatory Limit*[1] *(MPN/gram)*
	(MPN/kg)	(MPN/gram)	
Sludge Sample #1	16,600	16.6	
Sludge Sample #2	27,200	27.2	
Sludge Sample #3	11,600	11.6	
Sludge Sample #4	0	0	
Sludge Sample #5	2,630	2.63	
Sludge Sample #6	84,000	84	
Sludge Sample #7	0	0	
Geometric Mean (MPN/gram)		16.3	*1,000*

[1] Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = most probable number per kilogram

Notes: Samples were collected 9/10/98.
Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.
Analytical Reports are included in Appendix D.

Table 8-2. Flight D: MAF Sludge Analytical Results

Analyte	Sample I.D. and Date Sampled						Regulatory Limit[4] (mg/kg)
	D-0SD-01 (9/10/98)		DF-0SD-01[1] (9/10/98)		D-0SD-02 (9/10/98)		
	Result	Q	Result	Q	Result	Q	
Ammonia as N	100		120		97		
Nitrate as N	6.6		ND*(3.4)*	U	ND*(2.9)*	U	
Nitrite as N	ND*(2.9)*	U	ND*(3.4)*	U	ND*(2.9)*	U	
Total Kjeldahl N[2]	0.09		0.07		0.08		
Percent Moisture[3]	82.7		85.4		82.8		
Percent Solids[3]	17.3		14.6		17.2		
Antimony	ND*(29)*	U	ND*(34)*	U	ND*(29)*	U	*41*
Arsenic	2.7	J	3.4	J	2.3	J	
Beryllium	ND*(1.2)*	U	ND*(1.4)*	U	ND*(1.2)*	U	*39*
Cadmium	ND*(2.9)*	U	ND*(3.4)*	U	ND*(2.9)*	U	
Chromium	14		15		7.6		*1,500*
Copper	26		36		19		*300*
Lead	15		23		10		*17*
Mercury	ND*(0.58)*	U	ND*(0.68)*	U	ND*(0.58)*	U	
Molybdenum	ND*(2.9)*	U	ND*(3.4)*	U	ND*(2.9)*	U	*420*
Nickel	16		22		15		
Phosphorus	18		11		3.5		
Potassium	2,600		3,600		2,200		*100*
Selenium	ND*(5.8)*	UJ	ND*(6.8)*	UJ	ND*(1.2)*	UJ	
Silver	ND*(2.9)*	U	ND*(3.4)*	U	ND*(2.9)*	U	
Thallium	ND*(0.58)*	UJ	ND*(0.68)*	UJ	ND*(0.58)*	U	*2,800*
Zinc	98		130		72		
Total Nitrogen	4,100		*NA*		*NA*		
Total Phosphorus	800		*NA*		*NA*		
Total Potassium	8,100		*NA*		*NA*		
Percent Moisture	85.0		*NA*		*NA*		

[1] This sample is a duplicate of the previous investigative sample.
[2] Total Kjeldahl Nitrogen units: percent Nitrogen (% N)
[3] Percent Moisture and Percent Solids are by weight
[4] Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

J = estimated concentration
mg/kg = milligrams per kilogram
N = nitrogen
NA = not analyzed or not applicable
ND = not detected
Q = data qualifier
U = compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., *(2.9)*] indicates the laboratory detection limit in mg/kg.
Total nitrogen, total phosphorus, total potassium and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 8-3. Flight D MAF: Surface Water and Soil Field Measurements and Analytical Results

Analyte	Wastewater Sample I.D. and Date Sampled				SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled				EPA RBCs (mg/kg)
	D-0SW-01 (9/12/98) (Primary Lagoon)		D-0SW-02 (9/12/98) (Secondary Lagoon)			D-0SS-01 (9/10/98)		DF-0SS-01[5] (9/10/98)		
	Result	Q	Result	Q		Result	Q	Result	Q	
Field Temperature (°C)	18.2		17.5			NA		NA		
Field pH	8.11		8.91			NA		NA		
Available Nitrogen[1]	NA		NA			4		NA		
Available Phosphorus[2]	NA		NA			4		NA		
Available Potassium[2]	NA		NA			320		NA		
Laboratory pH	7.70		8.71			8.1		NA		
Electrical Conductivty[3]	NA		NA			0.54		NA		
Percent Moisture[4]	NA		NA			5.0		5.8		
TSS	140		330			NA		NA		
BOD	5.3		ND(1.0)	U		NA		NA		
O/G	3.7		2.0			NA		NA		
Antimony	ND(0.05)	U	ND(0.05)	U	0.006	ND(5.3)	U	ND(5.3)	U	31
Arsenic	ND(0.002)	UJ	0.0029	J	0.05	3.9		4.2		23
Beryllium	ND(0.002)	U	ND(0.002)	U	0.004	0.44		0.47		0.15
Cadmium	ND(0.005)	U	ND(0.005)	U	0.005	ND(0.53)	U	ND(0.53)	U	39
Chromium	ND(0.01)	U	ND(0.01)	U	0.1	9.0		11		390
Copper	ND(0.005)	U	0.0053		1.3	12		12		3,100
Lead	ND(0.005)	UJ	0.009		0.015	6.4		6.2		400
Mercury	ND(0.0002)	U	ND(0.0002)	U	0.002	ND(0.11)	U	ND(0.11)	U	23
Molybdenum	ND(0.005)	U	ND(0.005)	U	0.18	ND(0.53)	U	ND(0.53)	U	390
Nickel	ND(0.01)	U	ND(0.01)	U	0.1	17		18		1,600
Phosphorus	3.1		1.2			2.2		1.8		
Potassium	8.5		19			1,600		1,700		
Selenium	ND(0.002)	UJ	ND(0.002)	UJ	0.05	ND(1.1)	UJ	ND(1.1)	UJ	390
Silver	ND(0.005)	U	ND(0.005)	U	0.1	ND(0.53)	U	ND(0.53)	U	390
Thallium	ND(0.001)	UJ	ND(0.001)	UJ	0.002	0.14	J	0.12	J	
Zinc	0.014		0.026		5	42		45		23,000

1 Available nitrogen (N): NO_3 as N , pounds per acre per depth (lbs/acre/depth)
2 Available Phosphorus (P) and Potassium (K): parts per million (ppm)
3 Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)
4 Percent Moisture is by weight
5 This sample is a duplicate of the previous investigative sample.

°C = degrees Celsius
BOD = biological oxygen demand
J = estimated concentration
MCL = maximum contaminant level
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
NA = not analyzed or not applicable
ND = not detected
O/G = oil and grease
Q = data qualifier
RBC = risk based concentrations (EPA Region III)
SDWA = Safe Drinking Water Act
TSS = total suspended solids
U = compound analyzed but not detected

Notes: pH values are in standard units.
All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated.
All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., (1.1)] indicates the laboratory detection limit in mg/l or mg/kg.
Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 8-4. Flight D: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled															
	D-31SS-01 (9/14/98)		D-32SS-01 (9/14/98)		D-32SS-01 (12/2/98)		D-32WP-01 (12/2/98)		D-32AS-01 (12/2/98)		D-32AS-02[1] (12/2/98)		D-33SS-01 (9/14/98)		D-34SS-01 (9/14/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	63.7		23.6		NA		NA		NA		NA		20.8		14.1	
Percent Moisture	12.2		10.0		15.7		21.6		20.7		20.3		15.0		7.50	
DRO	ND(11)	U	ND(11)	UJ<	NA		NA		NA		NA		ND(12)	UJ<	ND(100)	UJ<
GRO	ND(0.11)	U	ND(0.11)	U	NA		NA		NA		NA		ND(0.12)	U	ND(0.11)	U
PCB-1221	ND(0.038)	U	ND(0.038)	U	NA		ND(4,300)	U	ND(0.21)	UJ<	ND(0.21)		ND(0.039)	U	ND(0.036)	U
PCB-1232	ND(0.019)	U	ND(0.018)	U	NA		ND(2,100)	U	ND(0.11)	UJ<	ND(0.10)		ND(0.020)	U	ND(0.018)	U
PCB-1242	ND(0.019)	U	ND(0.018)	U	NA		ND(2,100)	U	ND(0.11)	UJ<	ND(0.10)		ND(0.020)	U	ND(0.018)	U
PCB-1248	ND(0.019)	U	ND(0.018)	U	NA		ND(2,100)	U	ND(0.11)	UJ<	ND(0.10)		ND(0.020)	U	ND(0.018)	U
PCB-1254	ND(0.019)	U	ND(0.018)	U	NA		6,100		0.95	UJ<	0.81		ND(0.020)	U	0.037	
PCB-1260	ND(0.019)	U	ND(0.018)	U	NA		ND(2,100)	U	ND(0.11)	UJ<	ND(0.10)		ND(0.020)	U	ND(0.018)	U
PCB-1016	ND(0.019)	U	ND(0.018)	U	NA		ND(2,100)	U	ND(0.11)	UJ<	ND(0.10)		ND(0.020)	U	ND(0.018)	U
Antimony	ND(5.7)	U	ND(5.6)	U	ND(5.9)	U	NA		NA		NA		ND(5.9)	U	ND(5.4)	U
Arsenic	3.7		2.1		ND(5.9)	U	NA		NA		NA		3.0		4.2	
Beryllium	0.46		0.34		0.25		NA		NA		NA		0.31		0.24	
Cadmium	ND(0.57)	U	0.83		ND(0.59)	U	NA		NA		NA		ND(0.59)	U	ND(0.54)	U
Chromium	8.2		6.1		8.0		NA		NA		NA		13		9.2	
Copper	12		10		7.1		NA		NA		NA		23		23	
Lead	8.8		9.3		44		NA		NA		NA		6.5		30	
Mercury	ND(0.11)	U	ND(0.11)	U	NA		NA		NA		NA		ND(0.12)	U	ND(0.11)	U
Molybdenum	0.84		0.98		NA		NA		NA		NA		2.0		0.69	
Nickel	18		16		13		NA		NA		NA		18		11	
Phosphorus	2.9		5.6		NA		NA		NA		NA		2.7		5.1	
Potassium	1,300		860		NA		NA		NA		NA		830		1,100	
Selenium	1.1		ND(1.1)	U	ND(12)	U	NA		NA		NA		ND(1.2)	U	ND(1.1)	U
Silver	ND(0.57)	U	ND(0.56)	U	ND(0.59)	U	NA		NA		NA		ND(0.59)	U	ND(0.54)	U
Thallium	0.11		ND(0.56)	U	ND(12)	U	NA		NA		NA		ND(0.59)	U	0.13	
Zinc	42		33		32		NA		NA		NA		44		37	

Table 8-4. Flight D: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																	
	D-35SS-01 (9/14/98)		D-35SS-D2 (9/14/98)		D-36SS-01 (9/14/98)		D-37SS-01 (9/14/98)		D-38SS-01 (9/14/98)		D-39SS-01 (9/14/98)		D-39SS-D3 (9/14/98)		D-40SS-01 (9/14/98)		D-40SS-R (9/14/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	82.8		*NA*		6.0		7.5		7.0		8.1		*NA*		6.0		*NA*	
Percent Moisture	12.1		14.8		11.4		12.6		10.4		15.3		10.5		16.2		5.90	
DRO	ND*(11)*	UJ<	ND*(12)*	UJ<	ND*(11)*	UJ<	ND*(11)*	UJ<	ND*(11)*	U	ND*(12)*	U	ND*(11)*	U	ND*(12)*	UJ<	*NA*	
GRO	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.11)*	U	ND*(37)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.12)*	U	*NA*	
PCB-1221	ND*(0.038)*	U	ND*(0.039)*	U	ND*(0.038)*	U	ND*(0.038)*	U	ND*(0.019)*	U	ND*(0.037)*	U	ND*(0.037)*	U	ND*(0.040)*	U	*NA*	
PCB-1232	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	*NA*	
PCB-1242	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	*NA*	
PCB-1248	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	*NA*	
PCB-1254	ND*(0.019)*	U	ND*(0.020)*	U	0.120		ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	0.370		*NA*	
PCB-1260	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	*NA*	
PCB-1016	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.019)*	U	ND*(0.020)*	U	*NA*	
Antimony	ND*(5.7)*	U	ND*(5.9)*	U	ND*(5.6)*	U	ND*(5.7)*	U	ND*(5.6)*	U	0.68		ND*(0.05)*	U	ND*(6.0)*	U	0.23	
Arsenic	4.0		2.6		2.6		3.7		4.4		4.8		3.1		3.6		3.8	
Beryllium	0.33		0.43		0.30		0.34		0.37		0.33		0.37		0.50		0.44	
Cadmium	ND*(0.57)*	U	ND*(0.59)*	U	ND*(0.56)*	U	ND*(0.57)*	U	ND*(0.56)*	U	0.58		ND*(0.005)*	U	ND*(0.6)*	U	0.30	
Chromium	7.5		6.8		7.5		8.6		8.9		7.8		7.9		7.7		10	
Copper	8.9		11		9.0		11		13		11		10		13		12	
Lead	7.8		13		5.2		5.2		7.3		8.0		7.6		17		6.8	
Mercury	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.11)*	U	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.11)*	U	ND*(0.12)*	U	ND*(0.11)*	U
Molybdenum	0.78		ND*(0.59)*	U	1.7		0.96		0.83		0.59		0.078		0.67		0.95	
Nickel	14		18		13		13		14		14		15		21		17	
Phosphorus	5.0		5.8		5.2		3.5		22		3.7		2.8		9.3		3.4	
Potassium	870		1,400		960		1,000		1,200		1,100		1,200		1,500		1,300	
Selenium	ND*(1.1)*	U	ND*(1.2)*	U	ND*(1.1)*	U	ND*(1.1)*	U	ND*(1.1)*	U	ND*(1.2)*	U	ND*(1.1)*	U	ND*(1.2)*	U	ND*(1.1)*	U
Silver	ND*(0.57)*	U	ND*(0.59)*	U	ND*(0.56)*	U	ND*(0.57)*	U	ND*(0.56)*	U	ND*(0.005)*	U	ND*(0.005)*	U	ND*(0.6)*	U	ND*(0.005)*	U
Thallium	ND*(0.57)*	U	ND*(0.12)*	U	ND*(0.56)*	U	ND*(0.57)*	U	ND*(0.11)*	U	0.15		ND*(0.11)*	U	ND*(0.6)*	U	ND*(0.11)*	U
Zinc	27		64		30		32		38		36		38		74		40	

[1] This sample is a duplicate of the previous investigative sample.

D2, D3 = discretionary samples
DRO = diesel range organics
GRO = gasoline range organics
J = estimated concentration
J< = estimated concentration with low bias
PCB = polychlorinated biphenyls
PID = photoionization detector
NA = not analyzed or not applicable
ND = not detected
Q = data qualifier
R = random sample
U = compound was analyzed but not detected

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., *(1.1)*] indicates the laboratory detection limit in mg/kg.
Percent Moisture is by weight.
All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

This page intentionally left blank.

446th MISSILE SQUADRON, Flight E

Contents

Table 9-1. Flight E: MAF Sludge Bacteriological Results

Sample I.D.	Fecal Coliform		*Regulatory Limit[1]*
	(MPN/kg)	(MPN/gram)	*(MPN/gram)*
Sludge Sample #1	0	0	
Sludge Sample #2	170,000	170	
Sludge Sample #3	68,400	68.4	
Sludge Sample #4	1,330	1.33	
Sludge Sample #5	19,400	19.4	
Sludge Sample #6	0	0	
Sludge Sample #7	15,200	15.2	
Geometric Mean (MPN/gram)		21.5	*1,000*

[1] Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = Most Probable Number per kilogram

Notes: Samples were collected 9/15/98.
Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.
Analytical Reports are included in Appendix D.

Table 9-2. Flight E: MAF Sludge Analytical Results

Analyte	Sample I.D. and Date Sampled E-0SD-01 (9/15/98)		Regulatory Limit[3] (mg/kg)
	Result	Q	
Ammonia as N	5.8		
Nitrate as N	ND*(0.77)*	U	
Nitrite as N	ND*(0.77)*	U	
Total Kjeldahl N[1]	0.11		
Percent Moisture[2]	34.8		
Percent Solids[2]	65.2		
Antimony	ND*(7.7)*	U	*41*
Arsenic	3.8		
Beryllium	ND*(0.31)*	U	*39*
Cadmium	ND*(0.77)*	U	
Chromium	9.3		*1,500*
Copper	14		*300*
Lead	7.2		*17*
Mercury	ND*(0.15)*	U	
Molybdenum	0.84		*420*
Nickel	14		
Phosphorus	1.3		
Potassium	1,400		*100*
Selenium	ND*(1.5)*	U	
Silver	ND*(0.77)*	U	
Thallium	ND*(0.15)*	U	*2,800*
Zinc	46		
Total Nitrogen	900		
Total Phosphorus	600		
Total Potassium	7,600		
Percent Moisture	68.1		

[1] Total Kjeldahl Nitrogen units: percent Nitrogen (% N)
[2] Percent Moisture and Percent Solids are by weight
[3] Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

mg/kg = milligrams per kilogram
N = nitrogen
NA = not analyzed
ND = not detected
Q = Data Qualifier
U = Compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., *(0.15)*] indicates the laboratory detection limit in mg/kg.
Total nitrogen, total phosphorus, total potassium and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 9-3. Flight E: MAF Surface Water and Soil Field Measurements and Analytical Results

Analyte	Wastewater Sample I.D. and Date Sampled				SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled				EPA RBCs (mg/kg)
	E-0SW-01 (9/12/98) (Primary Lagoon)		EF-0SW-01[5] (9/12/98)			E-0SS-01 (9/12/98)		EF-0SS-01[5] (9/12/98)		
	Result	Q	Result	Q		Result	Q	Result	Q	
Field Temperature (°C)	19.5		*NA*			*NA*		*NA*		
Field pH	9.20		*NA*			*NA*		*NA*		
Available Nitrogen[1]	*NA*		*NA*			7		7		
Available Phosphorus[2]	*NA*		*NA*			17		23		
Available Potassium[2]	*NA*		*NA*			410		440		
Laboratory pH	9.26		*NA*			8.1		8.1		
Electrical Conductivty[3]	*NA*		*NA*			4.00		4.50		
Percent Moisture[4]	*NA*		*NA*			11.0		11.8		
TSS	ND*(5.0)*	U	5.0			*NA*		*NA*		
BOD	ND*(1.0)*	U	ND*(1.0)*	U		*NA*		*NA*		
O/G	2.4		ND*(1.0)*	U		*NA*		*NA*		
Antimony	ND*(0.05)*	U	ND*(0.05)*	U	***0.006***	0.93		ND*(5.7)*	UJ<	***31***
Arsenic	0.015	UJ<	0.011		***0.05***	2.7		2.3	UJ<	***23***
Beryllium	ND*(0.002)*	U	ND*(0.002)*	U	***0.004***	0.44		0.35		***0.15***
Cadmium	ND*(0.005)*	U	ND*(0.005)*	U	***0.005***	0.48		ND*(0.57)*	U	***39***
Chromium	ND*(0.01)*	U	ND*(0.01)*	U	***0.1***	8.7		6.9		***390***
Copper	ND*(0.005)*	U	ND*(0.005)*	U	***1.3***	13		9.8		***3,100***
Lead	ND*(0.005)*	UJ	ND*(0.005)*	UJ	***0.015***	4.5		5.9		***400***
Mercury	ND*(0.0002)*	U	ND*(0.0002)*	U	***0.002***	ND*(0.11)*	U	ND*(0.11)*	U	***23***
Molybdenum	0.024		0.021		***0.18***	0.38		ND*(0.57)*	U	***390***
Nickel	ND*(0.01)*	U	ND*(0.01)*	U	***0.1***	19		12		***1,600***
Phosphorus	0.20		0.21			45		28		
Potassium	15		15			1,600		1,300		
Selenium	ND*(0.002)*	UJ<	ND*(0.002)*	UJ	***0.05***	ND*(1.1)*	UJ	[1.1]	X	***390***
Silver	ND*(0.005)*	U	ND*(0.005)*	U	***0.1***	0.13		ND*(0.57)*	U	***390***
Thallium	ND*(0.005)*	UJ<	ND*(0.005)*	UJ	***0.002***	ND*(0.56)*	UJ	ND*(0.57)*	UJ	
Zinc	ND*(0.005)*	U	ND*(0.005)*	U	***5***	42		34		***23,000***

[1] Available nitrogen (N): NO_3 as N , pounds per acre per depth (lbs/acre/depth)
[2] Available Phosphorus (P) and Potassium (K): parts per million (ppm)
[3] Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)
[4] Percent Moisture is by weight
[5] This sample is a duplicate of the previous investigative sample.

BOD = biological oxygen demand
J = estimated concentration
J< = estimated concentration with a low bias
MCL = maximum contaminant level
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
NA = not analyzed or not applicable
ND = not detected
O/G = oil and grease
Q = data Qualifier
R = laboratory analytical data rejected during data validation
RBC = risk based concentrations (EPA Region III)
SDWA = Safe Drinking Water Act
TSS = total suspended solids
U = compound was analyzed but not detected
X = laboratory analytical data rejected during data validation

Notes: pH values are in standard units.
All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated.
All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., *(0.05)*] indicates the laboratory detection limit in mg/l or mg/kg.
Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.
All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

Table 9-4. Flight E: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled															
	E-41SS-01 (9/18/98)		E-41SS-02[1] (9/18/98)		E-41SS-B (9/18/98)		E-42SS-01 (9/18/98)		E-43SS-01 (9/18/98)		E-43SS-D1 (9/18/98)		E-44SS-01 (9/18/98)		E-44SS-D2 (9/18/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	4.0		*NA*		*NA*		5.8		5.1		*NA*		8.3		*NA*	
Percent Moisture	13.0		15.8		10.6		9.30		8.60		6.70		12.6		3.30	
DRO	ND(*12*)	U	ND(*12*)	U	*NA*		ND(*11*)	U	ND(*11*)	U	ND(*11*)	U	ND(*11*)	U	24,000	
GRO	ND(*0.11*)	U	ND(*0.12*)	U	*NA*		ND(*0.11*)	U	ND(*0.11*)	U	ND(*0.11*)	U	ND(*0.11*)	U	200	J>
PCB-1221	ND(*0.038*)	U	ND(*0.040*)	U	*NA*		ND(*0.037*)	U	ND(*0.036*)	U	ND(*0.036*)	U	ND(*0.038*)	U	ND(*0.034*)	U
PCB-1232	ND(*0.019*)	U	ND(*0.020*)	U	*NA*		ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.019*)	U	ND(*0.017*)	U
PCB-1242	ND(*0.019*)	U	ND(*0.020*)	U	*NA*		ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.019*)	U	ND(*0.017*)	U
PCB-1248	ND(*0.019*)	U	ND(*0.020*)	U	*NA*		ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.019*)	U	ND(*0.017*)	U
PCB-1254	0.17		ND(*0.020*)	U	*NA*		ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.018*)	U	0.031		ND(*0.017*)	U
PCB-1260	ND(*0.019*)	U	ND(*0.020*)	U	*NA*		ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.019*)	U	ND(*0.017*)	U
PCB-1016	ND(*0.019*)	U	ND(*0.020*)	U	*NA*		ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.018*)	U	ND(*0.019*)	U	ND(*0.017*)	U
Antimony	ND(*5.7*)	U	ND(*5.9*)	U	ND(*5.6*)	U	ND(*5.5*)	U	ND(*5.5*)	U	ND(*5.4*)	U	ND(*5.7*)	U	9.9	
Arsenic	5.6		5.3		4.8		4.1		4.6		3.9		4.4		6.8	
Beryllium	0.33		0.34		0.31		0.31		0.33		ND(*0.21*)	U	0.35		0.21	
Cadmium	ND(*0.57*)		ND(*0.59*)	U	ND(*0.56*)	U	ND(*0.55*)	U	ND(*0.55*)	U	ND(*0.54*)	U	ND(*0.57*)	U	ND(*0.52*)	U
Chromium	9.9		9.6		8.8		8.4		8.7		5.1		11		4.7	
Copper	11		13		11		11		10		5.3		14		9.6	
Lead	8.7		8.3		6.2		6.4		15		28		7.5		5.2	
Mercury	ND(*0.11*)	U	ND(*0.12*)	U	ND(*0.11*)	U	ND(*0.11*)	U	ND(*0.11*)	U	ND(*0.11*)	U	ND(*0.11*)	U	ND(*0.1*)	U
Molybdenum	1.4		1.2		1.3		1.5		1.0		1.1		1.2		1.6	
Nickel	14		15		13		15		10		9.5		15		16	
Phosphorus	8.8		15		8.2		14		16		30		12		1.1	U B
Potassium	1,300		1,300		1,200		1,200		1,200		750		1,700		740	
Selenium	ND(*1.1*)	U	ND(*1.2*)	U	ND(*1.1*)	U	ND(*1.1*)	U	ND(*1.1*)	U	ND(*1.1*)	UJ	ND(*1.1*)	U	ND(*1.0*)	U
Silver	ND(*0.57*)	U	ND(*0.59*)	U	ND(*0.56*)	U	ND(*0.55*)	U	ND(*0.55*)	U	ND(*0.54*)	U	ND(*0.57*)	U	1.0	
Thallium	ND(*0.11*)	UJ	0.20	J	0.11	J	0.20	J	0.16	J	ND(*0.11*)	UJ	ND(*0.11*)	UJ	0.11	J
Zinc	40		44		31		35		26		16		42		25	

Table 9-4. Flight E: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																	
	E-45SS-01 (9/18/98)		EF-45SS[1] (9/18/98)		E-46SS-01 (9/18/98)		E-46WP-01 (9/18/98)		E-51WP-01[1] (9/18/98)		E-46SS-02 (9/18/98)		E-51SS-02[1] (9/18/98)		E-47SS-01 (9/18/98)		E-47SS-D4 (9/18/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	5.8		*NA*		290.6		*NA*		*NA*		*NA*		*NA*		343		*NA*	
Percent Moisture	8.50		9.90		11.0		16.6		16.6		4.40		5.2		12.2		14.9	
DRO	ND*(11)*	U	13		ND*(11)*	U	*NA*		*NA*		*NA*		*NA*		ND*(11)*	U	ND*(12)*	U
GRO	ND*(0.11)*	U	ND*(0.11)*	U	ND*(0.11)*	U	*NA*		*NA*		*NA*		*NA*		ND*(0.11)*	U	ND*(0.12)*	U
PCB-1221	ND*(0.036)*	U	ND*(0.037)*	U	ND*(0.037)*	U	ND*(0.040)*	U	ND*(0.038)*	U	ND*(0.035)*	U	ND*(0.035)*	U	ND*(0.038)*	U	ND*(0.039)*	U
PCB-1232	ND*(0.018)*	U	ND*(0.018)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.017)*	U	ND*(0.018)*	U	ND*(0.019)*	U	ND*(0.020)*	U
PCB-1242	ND*(0.018)*	U	ND*(0.018)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.017)*	U	ND*(0.018)*	U	ND*(0.019)*	U	ND*(0.020)*	U
PCB-1248	ND*(0.018)*	U	ND*(0.018)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.017)*	U	ND*(0.018)*	U	ND*(0.019)*	U	ND*(0.020)*	U
PCB-1254	ND*(0.018)*	U	ND*(0.018)*	U	ND*(0.019)*	U	0.30		0.37		ND*(0.017)*	U	0.096		ND*(0.019)*	U	ND*(0.020)*	U
PCB-1260	ND*(0.018)*	U	ND*(0.018)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.017)*	U	ND*(0.018)*		ND*(0.019)*	U	ND*(0.020)*	U
PCB-1016	ND*(0.018)*	U	ND*(0.018)*	U	ND*(0.019)*	U	ND*(0.020)*	U	ND*(0.019)*	U	ND*(0.017)*	U	ND*(0.018)*		ND*(0.019)*	U	ND*(0.020)*	U
Antimony	ND*(5.5)*	U	ND*(5.5)*	U	ND*(5.6)*	U	*NA*		*NA*		*NA*		*NA*		ND*(5.7)*	UJ<	ND*(5.9)*	U
Arsenic	5.1		5.0		4.2		*NA*		*NA*		*NA*		*NA*		4.8		4.6	
Beryllium	0.34		0.36		0.55		*NA*		*NA*		*NA*		*NA*		0.56		0.55	
Cadmium	ND*(0.57)*	U	ND*(0.55)*	U	ND*(0.56)*	U	*NA*		*NA*		*NA*		*NA*		ND*(0.57)*	U	ND*(0.59)*	U
Chromium	10		23		14		*NA*		*NA*		*NA*		*NA*		14		13	
Copper	14		13		13		*NA*		*NA*		*NA*		*NA*		14		15	
Lead	6.2		7.8		7.6		*NA*		*NA*		*NA*		*NA*		11		12	
Mercury	ND*(0.11)*	U	ND*(0.11)*	U	ND*(0.11)*	U	*NA*		*NA*		*NA*		*NA*		ND*(0.11)*	U	ND*(0.12)*	U
Molybdenum	1.6		2.1		ND*(0.56)*	U	*NA*		*NA*		*NA*		*NA*		1.3		ND*(0.59)*	U
Nickel	15		14		14		*NA*		*NA*		*NA*		*NA*		18		16	
Phosphorus	3.6		3.1		16		*NA*		*NA*		*NA*		*NA*		16		ND*(0.59)*	U
Potassium	1,400		1,300		2,000		*NA*		*NA*		*NA*		*NA*		1,800		1,800	
Selenium	ND*(1.1)*	U	ND*(1.1)*	U	ND*(1.1)*	U	*NA*		*NA*		*NA*		*NA*		ND*(1.1)*	U	ND*(1.2)*	U
Silver	ND*(0.55)*	U	ND*(0.55)*	U	ND*(0.56)*	U	*NA*		*NA*		*NA*		*NA*		ND*(0.57)*	U	ND*(0.59)*	U
Thallium	0.14	J	0.11	J	0.12	J	*NA*		*NA*		*NA*		*NA*		ND*(0.11)*	UJ	0.21	J
Zinc	37		38		38		*NA*		*NA*		*NA*		*NA*		51	UJ<	56	

Table 9-4. Flight E: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																	
	E-48SS-01 (9/18/98)		E-48SS-02[1] (9/18/98)		E-48SS-01 (12/4/98)		E-48WP-01 (12/4/98)		E-48AS-01 (12/4/98)		E-49SS-01 (9/18/98)		E-49SS-B (9/18/98)		E-50SS-01 (9/18/98)		E-50SS-D3 (9/18/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	142.5		NA		NA		NA		NA		50.3		9.1		23.6		7.4	
Percent Moisture	13.9		12.0		17.1		22.2		10.6		8.10		20.7		8.40		11.1	
DRO	ND(12)	U	ND(11)	U	NA		NA		NA		ND(11)	U	NA		ND(11)	U	ND(11)	U
GRO	ND(0.12)	U	ND(0.11)	U	NA		NA		NA		ND(0.11)	U	NA		ND(0.11)	U	ND(0.11)	UJ<
PCB-1221	ND(0.039)	U	ND(0.038)	U	NA		ND(4,300)		ND(3.7)		ND(0.036)	U	NA		ND(0.036)	U	ND(0.037)	U
PCB-1232	ND(0.019)	U	ND(0.019)	U	NA		ND(2,100)		ND(1.9)		ND(0.018)	U	NA		ND(0.018)	U	ND(0.018)	U
PCB-1242	ND(0.019)	U	ND(0.019)	U	NA		ND(2,100)		ND(1.9)		ND(0.018)	U	NA		ND(0.018)	U	ND(0.018)	U
PCB-1248	ND(0.019)	U	ND(0.019)	U	NA		ND(2,100)		ND(1.9)		ND(0.018)	U	NA		ND(0.018)	U	ND(0.018)	U
PCB-1254	ND(0.019)	U	ND(0.019)	U	NA		38,000	J<	7.9		ND(0.018)	U	NA		0.051		ND(0.018)	U
PCB-1260	ND(0.019)	U	ND(0.019)	U	NA		ND(2,100)		ND(1.9)		ND(0.018)	U	NA		ND(0.018)	U	ND(0.018)	U
PCB-1016	ND(0.019)	U	ND(0.019)	U	NA		ND(2,100)		ND(1.9)		ND(0.018)	U	NA		ND(0.018)	U	ND(0.018)	U
Antimony	ND(5.8)	U	ND(5.7)	U	ND(6.0)		NA		NA		ND(5.4)	U	ND(6.3)	U	ND(5.5)	U	ND(5.6)	U
Arsenic	5.9		5.0		ND(6.0)		NA		NA		3.9		6.9		4.5		4.6	
Beryllium	0.43		0.43		0.29		NA		NA		0.36		0.48		0.38		0.47	
Cadmium	ND(0.58)	U	ND(0.57)	U	0.71		NA		NA		ND(0.54)	U	ND(0.63)	U	ND(0.55)	U	ND(0.56)	U
Chromium	11		12		9.2		NA		NA		9.4		13		11		14	
Copper	13		14		12		NA		NA		12		11		11		13	
Lead	7.8		7.5		11		NA		NA		12		5.5		9.4		40	
Mercury	ND(0.12)	U	ND(0.11)	U	NA		NA		NA		ND(0.11)	U	ND(0.13)	U	ND(0.11)	U	ND(0.11)	U
Molybdenum	0.74		0.73		NA		NA		NA		ND(0.54)	U	ND(0.63)	U	0.70		ND(0.56)	U
Nickel	14		15		14		NA		NA		13		12		14		14	
Phosphorus	21		2.8		NA		NA		NA		7.7		3.8		15	J>	5.2	
Potassium	1,500		1,600		NA		NA		NA		1,400		2,000		1,300		1,700	
Selenium	ND(1.2)	U	ND(1.1)	U	ND(12)		NA		NA		ND(1.1)	U	ND(1.3)	U	ND(1.1)	U	ND(1.1)	U
Silver	ND(0.58)	U	ND(0.57)	U	ND(0.60)		NA		NA		ND(0.54)	U	ND(0.63)	U	ND(0.55)	U	ND(0.56)	U
Thallium	0.13	J	0.12	J	ND(12)		NA		NA		0.16	J	ND(0.13)	UJ	ND(0.11)	UJ	0.16	J
Zinc	39		40		385		NA		NA		36		34		34		58	

[1] This sample is a duplicate of the previous investigative sample.

D1, D2, D3, D4 = discretionary samples
DRO = diesel range organics
GRO = gasoline range organics
J = estimated concentration
J< = estimated concentration with low bias
PCB = polychlorinated biphenyls
PID = photoionization detector
NA = not analyzed or not applicable
ND = not detected
Q = data qualifier
R = random sample
U = compound was analyzed but not detected

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.
Number in parentheses [i.e., (1.1)] indicates the laboratory detection limit in mg/kg.
Percent Moisture is by weight.
All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.
Analytical Reports are included in Appendix D.

APPENDIX E. TERMS, ACRONYMS, AND ABBREVIATIONS

This appendix contains a glossary of terms, a list of acronyms and abbreviations (including organizational designations), and the phonetic alphabet, which is used in some documents to designate missile flights.

E.1 GLOSSARY OF TERMS

Aquifer. The water-bearing portion of subsurface earth material that yields or is capable of yielding useful quantities of water to wells.

Air Force Space Command (AFSPC). The U.S. Air Force command that controls (among other things) the former missile deployment area at Grand Forks AFB, ND.

American Society for Testing and Materials (ASTM). Organized in 1898, ASTM is one of the largest voluntary standards development organizations in the world. ASTM develops standard test methods, specifications, practices, guides, classifications, and terminology in 130 subject areas. An ASTM standard is a document that has been developed and established within the consensus principles of the Society and that meets the approval requirements of ASTM procedures and regulations.

CAS [Chemical Abstracts Service] Number. A unique number assigned to every chemical.

***Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA)**. A law passed in 1980, and amended by the *Superfund Amendments and Reauthorization Act* (SARA) to authorize investigation and cleanup of contamination resulting from previous releases of hazardous substances, pollutants, or contaminants.

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS). Created by Congress in 1986, this system is the official repository for site and non-site specific Superfund data in support of CERCLA. It contains information on hazardous waste site assessment and remediation from 1983 to the present. The system tracks information of all Superfund sites — both the most hazardous (the NPL) and those where cleanup is easier or less urgent. CERCLIS contains the names of all sites that USEPA is currently investigating or has investigated for a release of potential hazardous substances and possible inclusion on the NPL. A listing in the CERCLIS means that USEPA will examine the site and determine if there is cause for a Superfund cleanup or for further investigation; it does not mean that the site has been marked for cleanup by the Superfund program or that a hazardous substance has in fact been released there.

Deployment Area. The area within which missiles are placed in launch facilities.

Diesel Range Organics (DRO). The range of hydrocarbons comprising diesel fuel. Diesel fuel can evaporate or leach into groundwater. Inhalation or ingestion of diesel fuel can cause nausea, dizziness, headaches, eye irritation, difficulty in concentrating, and increased blood pressure. The NDDH has established a cleanup level of 100 ppm for soil.

Dismantlement. The irreversible process of demolishing the headworks and destroying the launch facility support building.

Environmental Baseline Survey (EBS). A document prepared for a property to be transferred, purchased, or leased. An EBS is based on all available environmental information related to storage, release, treatment or disposal of hazardous substances or petroleum products on the property to determine the presence or likely presence of a release or threatened release of any hazardous substance or petroleum product.

Environmental Response Notification System (ERNS). USEPA's emergency response notification system list of reported CERCLA hazardous substance releases or spills in reportable quantities, as maintained at the National Response Center.

Erosion. The wearing away of soil and rock by the action of wind and water.

***Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA).** A 1947 law regulating the distribution, use and sale of pesticides within the United States. The 1972 *Federal Pesticide Control Act* amended FIFRA.

Gasoline Range Organics (GRO). The range of hydrocarbons comprising gasoline. Gasoline can evaporate or leach into groundwater. Inhalation or ingestion of gasoline can cause irritation to lungs, dizziness, headaches, difficulty in concentrating, and increased blood pressure. Gasoline commonly contains other toxic substances, such as benzene. The NDDH has established a cleanup level of 100 ppm for soil.

Groundwater. Subsurface water that saturates pore spaces of rock, sediment, or soil, and that may supply wells and springs.

Hardened Intersite Cable System (HICS). A network of hardened cables between LFs and MAFs that enabled the launch control centers to control the launch of missiles.

Hazardous Substance. A substance defined as hazardous pursuant to CERCLA 42 U.S.C. Sec. 9601(14), as interpreted by USEPA regulations and the courts.

Hazardous Waste. Any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the *Solid Waste Disposal Act* (SWDA) (42 U.S.C. Sec. 6921) (but excluding any waste whose regulation under SWDA has been suspended by Act of Congress). The *Solid Waste Act* of 1980 amended RCRA. RCRA defines a hazardous waste in 42 U.S.C. Sec. 6903 as "a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitation reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."

Launch Facility (LF). A fenced and secured facility composed of a missile launcher and launch support building.

Leaking Underground Storage Tank (LUST). A UST that has had a confirmed release of a petroleum product or hazardous substance. Section 9003(h) of Subtitle I of RCRA gives USEPA, and states having cooperative agreements with USEPA, authority to clean up releases from a UST system or require owners and operators to do so.

Maximum Contaminant Level (MCL). Legally enforceable limits of chemical contamination regulated by the National Primary Drinking Water Standards (40 CFR 141 *et seq*) for public water supplies.

Missile Alert Facility (MAF). A fenced and secured site composed of a launch control center, launch control support building, and communications equipment. Formerly known as launch control center (LCC).

National Priorities List (NPL). USEPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund. The list is based primarily on the score a site receives from the Hazard Ranking System. USEPA is required to update the NPL at least once a year. A site must be on the NPL to receive money from the Trust Fund for remedial action.

Pesticides. Substances intended for preventing, destroying, repelling, or mitigating any pest, or for use as a plant regulator, defoliant, or desiccant. Pests are defined as insects, rodents, worms, fungus, weeds, plants, viruses, bacteria, microorganisms and other animal life. Pesticides include herbicides, insecticides, fungicides, and rodenticides, and their application is regulated under FIFRA.

Polychlorinated Biphenyls (PCB). Mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties, ranging from oily liquids to waxy solids. Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products; in pigments and dyes; and in many other applications. PCBs were used in the United States from 1929 to 1979 and are regulated by the *Toxic Substances Control Act* (15 U.S.C. Sec. 2601, *et seq*).

- **PCB items.** Equipment containing a PCB concentration of up to 49 parts per million, as regulated by the USEPA.
- **PCB-contaminated equipment.** Equipment containing a PCB concentration of 50 to 499 parts per million, as regulated by the USEPA.
- **PCB equipment.** Equipment containing a PCB concentration of 500 parts per million or greater, as regulated by the USEPA.

pH. A measurement of the acidity or alkalinity of a solution. A value of 7 indicates neutral, while lower values indicate higher acidity, and values above 7 indicate alkalinity.

***Resource Conservation and Recovery Act* (RCRA)**. A law passed in 1976 establishing a regulatory system to track hazardous substances from their generation to disposal. The law requires safe and secure procedures to be used for treating, transporting, storing, and disposing of hazardous substances. The law also requires federal agencies to comply with all federal, state, interstate, and local regulations respecting control and abatement of solid waste or hazardous waste disposal.

Resource Conservation and Recovery Information System (RCRIS). The system used by the EPA to support its implementation of RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA). The system is primarily used to track handler permit or closure status, compliance with Federal and State regulations, and cleanup activities. Other uses of the data include program management, regulation development, waste handler inventory, corrective action tracking, regulation enforcement, facility management planning, and environmental program progress assessment.

RCRA Treatment, Storage, and Disposal (TSD) Facilities. Facilities where treatment, storage, or disposal of hazardous wastes take place, as defined and regulated by RCRA.

***Superfund Amendments and Reauthorization Act* (SARA).** A 1986 law to reauthorize and enhance CERCLA and the Superfund program. Among other provisions, it increased State involvement, increased the focus on human health problems posed by hazardous waste sites, and encouraged greater citizen participation in decisionmaking on site cleanup.

Soil series. A group of soils having similar parent materials, genetic horizons, and arrangement in the soil profile.

Target Analyte List (TAL). A USEPA list of chemical compounds (metals, pesticides, volatile and semi-volatile compounds, and PCBs and other chlorinated compounds) targeted for analysis in soil, water, and air. This list was originally derived from the USEPA Priority Pollutant List, with additions based on the needs of the Superfund program. Most of these substances are toxic. Water quality standards (maximum contaminant levels) have been established for most of these chemicals, but standards have not been set for soil levels.

Total Dissolved Solids (TDS). The amount of dissolved mineral constituents in water, measured in milligrams per liter (mg/L). The U.S. Public Health Service has set a standard of 500 mg/L TDS for drinking water. Depending on the dissolved minerals present, higher levels can cause health problems, and objectionable odors and tastes.

Toxic. A substance that can cause death, disease, behavioral abnormalities, physiological or reproductive malfunctions, or physical deformities over a short or long time period.

***Toxic Substances Control Act* (TSCA)**. A law enacted in 1976 to give USEPA the ability to track industrial chemicals currently produced in or imported into the United States. The USEPA repeatedly screens these chemicals and can require reporting or testing of those that may pose an environmental or human-health hazard, or can ban the manufacture and import of those chemicals that pose an unreasonable risk.

Toxics Release Inventory (TRI). A publicly available USEPA database containing information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the *Emergency Planning and Community Right-to-Know Act* (EPCRA) of 1986 and expanded by the *Pollution Prevention Act* of 1990.

Underground Storage Tank (UST). Any tank, including underground piping connected to the tank, currently or formerly used to contain hazardous substances or petroleum products the volume of which is ten percent or more beneath the surface of the ground.

Wetlands. Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

E.2 ACRONYMS / ABBREVIATIONS

Selected Measurements

°C	degrees Celsius
°F	degrees Fahrenheit
cm	centimeter
km	kilometer
mph	miles per hour
psi	pounds per square inch
g	gram
kg	kilogram (1,000 grams; used for dry measurements)
L	liter (1,000 grams; used for liquid measurements)
lb	pound
mg	milligrams (1/1,000th or 0.001 gram)
µg	microgram (1/1,000,000th or 0.000001 gram
pCi/l	picocuries per liter (used in this document for radon)
ppb	parts per billion
ppm	parts per million
1 mg/kg	approximately equivalent to 1 ppm
1 mg/L	approximately equivalent to 1 ppm
1 µg/kg	approximately equivalent to 1 ppb
1 µg/L	approximately equivalent to 1 ppb

Organizations

319 CES	319th Civil Engineer Squadron (based at Grand Forks AFB, ND)
319 CES/CEV	Grand Forks AFB Environmental Flight
319 CES/CEM	Grand Forks AFB Missile Engineering
319 CES/CERR	Grand Forks AFB Real Estate Office
319 MDG/SGPB	Grand Forks AFB Medical Group, Bioenvironmental Engineering Office
446 MS	446th Missile Squadron
447 MS	447th Missile Squadron
448 MS	448th Missile Squadron
AFCEE	Air Force Center for Environmental Excellence
AFSPC	U.S. Air Force Space Command
HQ AFSCP/CEM	Headquarters Air Force Space Command, Missile Engineering
HQ USAF/ILEV	Headquarters Air Force, Environmental Office

Acronyms and Abbreviations

AFB	Air Force Base
AFI	Air Force Instruction
AFPD	Air Force Policy Directive
AST	aboveground storage tank
ASTM	American Standards for Testing Materials

CAS	Chemical Abstracts Service
CERCLA	*Comprehensive Environmental Response, Compensation and Liability Act*
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	*Code of Federal Regulations*
CWA	*Clean Water Act*
DEU	diesel electric unit
DoD	Department of Defense
DoDD	Department of Defense Directive
DRO	diesel range organics
EBS	environmental baseline survey
EIS	environmental impact statement
EO	executive order
EPCRA	*Emergency Planning and Community Right-to-Know Act*
ERNS	Emergency Response Notification System
FEMA	Federal Emergency Management Agency
FFCA	Federal Facility Compliance Agreement
FIFRA	*Federal Insecticide, Fungicide, and Rodenticide Act*
GIS	geographic information system
GLEAMS	Groundwater Loading Effects on Agricultural Management Systems
GMW	groundwater monitoring well
GRO	gasoline range organics
HICS	Hardened Intersite Cable System
HPRCC	High Plains Regional Climate Center
HQ	headquarters
HUC	hydrologic unit catalog
ICBM	Intercontinental Ballistic Missile
IRP	Installation Restoration Program
LBP	lead-based paint
LCC	launch control center
LCEB	launch control equipment building
LCSB	launch control support building
LEB	launcher equipment building
LER	launcher equipment room
LF	launch facility
LUST	leaking underground storage tank
MAF	missile alert facility
MCL	maximum contaminant level
MILE	Minuteman integrated life extension
MM	Minuteman
MOGAS	motor gasoline
MS	missile squadron
MSL	mean sea level
NCRP	National Council on Radiation Protection and Measurements
NIOSH	National Institute for Occupational Safety and Health
ND	North Dakota

NDCC	North Dakota Century Code
NDDH	North Dakota Department of Health
NDDOT	North Dakota Department of Transportation
NDGS	North Dakota Geological Survey
NDSWC	North Dakota State Water Commission
NPL	National Priority List
NDSU	North Dakota State University
NRC	National Response Center
NRCS	Natural Resources Conservation Service
PCB	polychlorinated biphenyl
PPM	priority pollutant metals
POL	petroleum, oils, and lubricants
RCRA	*Resource Conservation and Recovery Act*
RCRIS	Resource Conservation and Recovery Information System
ROD	record of decision
RS	reentry system
SARA	*Superfund Amendments and Reauthorization Act*
SCS	Soil Conservation Service (now Natural Resources Conservation Service)
SD	South Dakota
SHSND	State Historical Society of North Dakota
START	Strategic Arms Reduction Treaty
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TIGER	Topologically Integrated Geographic Encoding and Referencing system
TPH	total petroleum hydrocarbons
TRI	Toxic Release Inventory
TSCA	*Toxic Substances Control Act*
TSD	Treatment, Storage, and Disposal
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USAFETAC	U.S. Air Force Environmental Technical Applications Center (now the Combat Climatology Center at Asheville, NC)
USBC	U.S. Bureau of the Census
U.S.C.	*United States Code*
USDA	U.S. Department of Agriculture
USDHHS	U.S. Department of Health and Human Services
USDI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service (USDI)
USGS	U.S. Geological Survey (USDI)
USPHS	U.S. Public Health Service (USDHHS)
UST	underground storage tank
WSO	weather service office

North Atlantic Treaty Organization (NATO) Phonetic Alphabet

A	Alpha	J	Juliet	S	Sierra
B	Bravo	K	Kilo	T	Tango
C	Charlie	L	Lima	U	Uniform
D	Delta	M	Mike	V	Victor
E	Echo	N	November	W	Whiskey
F	Foxtrot	O	Oscar	X	X-Ray
G	Golf	P	Papa	Y	Yankee
H	Hotel	Q	Quebec	Z	Zulu
I	India	R	Romeo		

APPENDIX C

HAZARDOUS MATERIALS STORAGE

APPENDIX C

HAZARDOUS MATERIALS STORAGE

Table C-1. An inventory of hazardous materials stored in industrial workplaces based on information maintained by the Bioenvironmental Engineering Services office is presented in Table C-1. Specifically, this inventory reflects information tabulated on Air Force Form 2761, Hazardous Materials Data. The quantity and quality of data on the Hazardous Materials Data forms varies considerably over the period of available records. For some workplaces, records were available back to 1972; for others, records were only available since the mid-1980s. The most complete records are available for the last 5 years (i.e., 1987 to 1992). Since 1990, most of the data have been recorded on a computer-generated version of Air Force Form 2761.

The "Quantity Stored" entry is as it was listed on the original forms. If a quantity was not specified on the form, "unknown" has been listed in the Quantity Stored column. It should also be noted that only the amount of product usage per unit time was recorded on the Hazardous Materials Data forms; product storage per unit time was not recorded on the forms. A major assumption made for this appendix is that usage data was the only available data for storage.

The units of measure vary for different classes of products listed on the Hazardous Materials Data forms. The "Quantity Stored" for many products is given in conventional quantitative units of ounces, pounds, tons, pints, quarts, gallons, liters, and grams. Other products, however, are listed in terms of non-quantified units such as cans, boxes, rolls, tubes, kits, packs, drums, and cylinders. For these products, the conversion factors listed below were used.

1 bag	= 25 lb	1 ball	= 1 lb	1 bar	= 1 lb
1 barrel	= 350 lb	1 box	= 100 lb	1 can	= 50 lb
1 canister	= 50 lb	1 caplet	= 1 lb	1 cartridge	= 1 lb
1 case	= 50 lb	1 cycle	= 1 lb	1 cylinder	= 100 lb
1 disk	= 1 lb	1 dozen	= 1 lb	1 drop	= 1 lb
1 drum	= 417 lb	1 each	= 1 lb	1 jar	= 1 lb
1 keg	= 100 lb	1 kit	= 1 lb	1 mon	= 1 lb
1 pack	= 1 lb	1 package	= 1 lb	1 pad	= 1 lb
1 pail	= 50 lb	1 pellet	= 1 lb	1 pillow	= 1 lb
1 roll	= 1 lb	1 spool	= 1 lb	1 stick	= 1 lb
1 tablet	= 1 lb	1 tub	= 1 lb	1 tube	= 1 lb

For products listed using volumetric measures, such as pints, quarts, gallons, and liters, knowledge of the density or specific gravity of each product would be required to calculate the respective total weights of product usage per unit time. Given the fact that such data are not recorded on Hazardous Materials Data forms, the weight of an equivalent volume of water (1 U.S. gallon weighs 8.3453 pounds or 3.7854 kilograms) was used to calculate an approximate total product weight. All weights recorded in the English system of ounces and pounds were converted to their metric equivalent.

Only the actual products used in each workplace are listed in Table C-1. In most cases, the product used (e.g., black spray paint) is a mixture of unique chemical constituents. For example, black spray paint consists of several chemical compounds, such as toluene, acetone, butyl acetate, butyl cellosolve, and isobutane. In addition, black spray paint manufactured by two different companies may contain different percentages of the same compounds (i.e., one may contain 5 percent toluene and the other 19 percent) or an entirely different composition of chemical compounds.

Table C-2. The list of products in Table C-1 used in quantities which are subject to reporting requirements specified under 40 CFR Part 373 is provided in Table C-2. Under Section 120(h)(1) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), whenever any agency, department, or instrumentality of the United States enters into any contract for the sale or other transfer of real property which is owned by the United States, and on which any hazardous substance was stored for 1 year or more, known to have been released, or disposed of, the contract must include notice of the type and quantity of such hazardous substance, and the time at which such storage, release, or disposal took place, to the extent such information is available based on a complete search of agency files. Requirements for such notice are outlined in 40 CFR Part 373.

The notice required by 40 CFR Part 373 for the storage of hazardous substances applies only when hazardous substances have been stored in quantities greater than or equal to 1,000 kilograms (or 2,205 pounds) or the CERCLA-reportable quantity for the substance as listed in 40 CFR Part 302.4, whichever is greater. Hazardous substances that are also listed under 40 CFR 261.30 as acutely hazardous wastes, and that are stored for 1 year or more are subject to the notice requirement when stored in quantities greater than or equal to 1 kilogram (2.205 pounds).

Constituents of products and their percentages are listed in Table C-2 when they were provided on Air Force Form 2761. Synonyms and Chemical Abstracts Services Registry Numbers (CASRN) for these constituents are also provided when listed in the Keller's Chemical Reg-A-Dex Chemical Cross Reference.

Table C-1. Hazardous Materials Storage, Facility 3

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
9 Radar Shop			
Alkyd Enamel SG	48 ounces/year	1.35/year	1990
Automotive & Artillery Grease	1 ounce/year	0.03/year	1990
Blue Gloss Paint	400 ounces/year	11.25/year	1990
Cleaning & Lubricating Compound	8 ounces/year	0.23/year	1990
Cleaning Compound Solvent	10 ounces/year	0.28/year	1990
Corrosion Preventive Compound	32 ounces/year	0.9/year	1990
Enamel	1 quart/year	0.91/year	1990
Gear Lubricating Oil	1 gallon/year	3.63/year	1990
General Purpose Detergent	50 ounces/year	1.41/year	1990
General Purpose Grease	2 gallons/year	7/year	1990
General Purpose Lubricating Oil	2 gallons/year	7/year	1990
Gray Primer	160 ounces/year	4.5/year	1990
Oil	2 gallons/year	7/year	1990
Red Enamel	50 ounces/year	1.41/year	1990
Silicone Compound	3 ounces/year	0.08/year	1990
Solder	1 pound/year	0.45/year	1990
Trichloroethane	16 ounces/year	0.45/year	1990
White Enamel	10.5 ounces/year	0.30/year	1990
T1 Radar Shop			
Aerosol Lacquer	12 ounces/year	0.33/year	1993
Aerosol Lacquer	160 ounces/year	4.67/year	1990
Air Conditioner Filter Coater	2 cans/year	45/year	1990
Air Conditioning Filter Coater	128 ounces/year	3.6/year	1993
Aliphatic Polyurethane Thinner	5 gallons/year	18/year	1993
Anti-Stat Cleaning Compound	128 ounces/year	3.6/year	1993
Antistatic & Cleaner Compound	20 bottles/year	--	1990
Antistatic & Cleaner Compound	42 ounces/year	1.18/year	1993
Automotive & Artillery Grease	2 cans/year	45/year	1993
Automotive & Artillery Grease	4 tubes/year	2/year	1990
Black Paint	24 cans/year	540/year	1990
Blue Gloss Paint	24 ounces/year	0.68/year	1993
Camouflage Lacquer	10 cans/year	225/year	1990

Table C-1. Hazardous Materials Storage, Facility 3 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Cement	16 ounces/year	0.45/year	1993
Corrosion Prevention Compound	13 ounces/year	0.37/year	1993
Denatured Alcohol	10 gallons/year	36/year	1990
Denatured Alcohol	2 gallons/year	7/year	1993
Deodorizer	56 ounces/year	1.58/year	1993
Dubble Bubble Epoxy	100 ounces/year	2.81/year	1993
Electrical Insulating Varnish	16 ounces/year	0.45/year	1990
Electrical Insulating Varnish	4 ounces/year	0.11/year	1993
Enamel	6 cans/year	135/year	1990
Epoxy Primer	1 gallon/year	3.63/year	1993
Epoxy Primer	2 ounces/year	0.06/year	1993
Ethyl Alcohol	4 gallons/year	15/year	1993
Exterior Enamel	2 quarts/year	1.82/year	1993
Flat Black Enamel	60 ounces/year	2.25/year	1993
Floor Polish Remover	2 gallons/year	7/year	1993
Floor Wax	5 gallons/year	18/year	1993
Furniture Polish	2 quarts/year	1.82/year	1993
General Purpose Cleaner	50 gallons/year	182/year	1993
Glass Cleaner	6 gallons/year	22/year	1993
Graphite	1 pound/year	0.45/year	1993
Gray Aerosol	120 cans/year	2,700/year	1990
Gray Aerosol	48 ounces/year	1.35/year	1993
Gray Enamel	24 cans/year	540/year	1990
Gray Paint	1 quart/year	0.91/year	1993
Gray Primer	36 ounces/year	1.01/year	1993
Grease	5 pounds/year	2/year	1993
Hydraulic Fluid	15 gallons/year	54/year	1990
Hydraulic Fluid	6 gallons/year	22/year	1993
Insulating Compound	1 quart/year	0.91/year	1993
Insulating Oil	50 gallons/year	182/year	1993
Isopropyl Alcohol	10 bottles/year	--	1990
Kerosine	150 gallons/year	545/year	1993
Lacquer	10 cans/year	225/year	1990
Leak Test Compound	12 bottles/year	--	1990
Leak Test Compound	6 ounces/year	0.17/year	1993
Lubricating Oil	40 ounces/year	1.13/year	1993

Table C-1. Hazardous Materials Storage, Facility 3 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Never Dull Polish	2 pounds/year	0.9/year	1993
Olive Drab Lacquer	1 gallon/year	3.63/year	1993
Olive Drab Paint	120 cans/year	2,700/year	1990
Oven Cleaner	72 ounces/year	2.03/year	1993
Pace Chem Stripper	3 ounces/year	0.08/year	1993
Poly Floor Enamel	1 gallon/year	3.63/year	1993
Pumice Soap	1 box/year	45/year	1993
Red Paint	6 cans/year	135/year	1990
RTV Compound	12 ounces/year	0.33/year	1993
Scouring Powder	12 ounces/year	0.33/year	1993
Semi-Gloss Alkyd Enamel	2 quarts/year	1.82/year	1993
Shredder Oil	32 ounces/year	0.9/year	1993
Silicone Grease	1 gallon/year	3.63/year	1993
Soldering Flux	1 gallon/year	3.63/year	1993
Soldering Flux	1 pound/year	0.45/year	1990
Tape Head Cleaner	48 ounces/year	1.35/year	1993
Thinner	1 gallon/year	3.63/year	1993
Tin Alloy Solder	1 pound/year	0.45/year	1990
Toilet Cleaner	12 ounces/year	0.34/year	1993
Trichlorotrifluoroethane	12 ounces/year	0.34/year	1993
Urinal Cakes	2 cans/year	45/year	1993
White Enamel	36 ounces/year	1.01/year	1993
T4 Radar Shop			
Epoxy Primer	2 ounces/year	0.06/year	1993
Dubble Bubble Epoxy	100 ounces/year	2.81/year	1993
Ethyl Alcohol	4 quarts/year	3.64/year	1993
Exterior Enamel	2 quarts/year	1.82/year	1993
Flat Black Enamel	60 ounces/year	1.69/year	1993
Floor Polish Remover	2 gallons/year	7/year	1993
Floor Wax	5 gallons/year	18/year	1993
Soldering Flux	1 gallon/year	3.63/year	1993
Furniture Polish	2 quarts/year	1.82/year	1993
General Purpose Cleaner	264 ounces/year	16.5/year	1993
Glass Cleaner	2 gallons/year	7/year	1993

Table C-1. Hazardous Materials Storage, Facility 3 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Graphite	Unknown	--	1993
Gray Paint	1 quart/year	0.91/year	1993
Gray Aerosol	48 ounces/year	1.35/year	1993
Gray Enamel	1 gallon/year	3.63/year	1993
Gray Paint	2 quarts/year	1.82/year	1993
Gray Primer	360 ounces/year	10.13/year	1993
Grease	80 ounces/year	2.25/year	1993
Automotive & Artillery Grease	2 cans/year	45/year	1993
Hydraulic Fluid	6 gallons/year	22/year	1993
Insulating Compound	1 quart/year	0.91/year	1993
Insulating Oil	50 gallons/year	182/year	1993
Electrical Insulating Varnish	4 ounces/year	0.11/year	1993
Kerosine	150 gallons/year	545/year	1993
Leak Test Compound	6 ounces/year	0.17/year	1993
Lubricating Oil	40 ounces/year	0.13/year	1993
Never Dull Polish	2 pounds/year	0.9/year	1993
Olive Drab Lacquer	1 gallon/year	3.63/year	1993
Oven Cleaner	72 ounces/year	2.03/year	1993
Pace Chem Stripper	3 ounces/year	0.08/year	1993
Poly Floor Enamel	1 gallon/year	3.63/year	1993
Pumice Soap	1 box/year	45/year	1993
Scouring Powder	1 box/year	45/year	1993
Shredder Oil	32 ounces/year	0.9/year	1993
Silicone Grease	1 gallon/year	3.63/year	1993
Tape Head Cleaner	48 ounces/year	1.35/year	1993
Thinner	1 gallon/year	3.63/year	1993
Aliphatic Polyurethane Thinner	5 gallons/year	18/year	1993
Toilet Cleaner	12 ounces/year	0.34/year	1993
Trichlorotrifluoroethane	32 ounces/year	0.9/year	1993
Urinal Cakes	2 cans/year	45/year	1993

Table C-1. Hazardous Materials Storage, Facility 24

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Explosive Ordnance			
Aerosol Brake Free	1 pint/year	0.45/year	1993
Alkyd Resin Varnish	Unknown	--	1992
Auto Transmission Hydraulic Fluid	Unknown	--	1992
Automatic Transmission Hydraulic Fluid	3 quarts/year	2.73/year	1993
Black Lacquer	10 pints/year	4.5/year	1993
Black Lacquer	Unknown	--	1992
Brake Free Aerosol	Unknown	--	1992
Direct Electrostatic Toner	Unknown	--	1992
Enamel	6 pints/year	2.7/year	1993
Enamel	Unknown	--	1992
Exterior Latex Paint	1 gallon/year	3.63/year	1992
Exterior Latex Paint	Unknown	--	1992
Floor Sealer	12 gallons/year	44/year	1992
Floor Wax	12 gallons/year	44/year	1992
Furniture Polish	3 pints/year	1.35/year	1993
Furniture Polish	6 quarts/year	5.46/year	1992
General Purpose Detergent	22 ounces/year	0.62/year	1992-1993
Glass Cleaner	3 pints/year	1.35/year	1993
Glass Cleaner	Unknown	--	1992
Lubricant & Preserve Cleaner	1 pint/year	0.45/year	1993
Lubricant & Preserve Cleaner	12 pints/year	5.4/year	1992
Mercury Battery	2 each/year	0.9/year	1993
Mercury Battery	Unknown	--	1992
Neatsfoot Oil	2 pints/year	0.9/year	1992-1993
Olive Drab Lacquer	10 pints/year	4.5/year	1993
Olive Drab Lacquer	48 ounces/year	1.35/year	1992
Petroleum Distillates	Unknown	--	1992
Porcelain Cleaning Compound	26 ounces/year	0.73/year	1993
Porcelain Cleaning Compound	Unknown	--	1992
Prime Neatsfoot Oil Compound	12 gallons/year	44/year	1992
Rubber Paint	1 gallon/year	3.63/year	1993
Rubber Paint	Unknown	--	1992
Seal N Place	Unknown	--	1992

Table C-1. Hazardous Materials Storage, Facility 24 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Spray And Wipe	22 ounces/year	0.62/year	1992
Spray Stencil Ink White	1 ounce/year	0.03/year	1992
Strata Blue Aerosol	3 pints/year	1.35/year	1993
Strata Blue Aerosol	30 pints/year	13.5/year	1992
Sweeping Compound	5 pounds/year	2/year	1992-1993
White Marking Ink	Unknown	--	1992
White Spraying Ink	1 pint/year	0.45/year	1992
Explosive Ordnance Disposal			
Adhesive	1 can/year	23/year	1987
Black Aerosol Enamel	24 ounces/year	0.68/year	1987
Blue Enamel	24 ounces/year	0.68/year	1987
Corrosion Preventive Compound	1 can/year	23/year	1987
Denatured Alcohol	2 gallons/year	7/year	1987
Enamel	24 ounces/year	0.68/year	1987
Epoxy Polyamide Resin	1 can/year	23/year	1987
White Spray Paint	24 ounces/year	0.68/year	1987

Table C-1. Hazardous Materials Storage, Facility 58-C

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
G C Transmitter Shop			
Battery Water	Unknown	--	1990
Cleaning Compound Solvent	Unknown	--	1990
Electrolyte Sulfuric Acid	Unknown	--	1990
Floor Wax	Unknown	--	1990
General Purpose Detergent	Unknown	--	1990
Glass Cleaner	Unknown	--	1990
Isopropyl Alcohol USP	Unknown	--	1990
Lead Alloy Solder	Unknown	--	1990
Lubrication Kit	Unknown	--	1990
Pine Oil Soap	Unknown	--	1990
Soldering Flux	Unknown	--	1990
Power Production			
Antifreeze	42 gallons/year	152/year	1990
Battery Water	5 gallons/year	18/year	1990
Diesel Fuel	850 gallons/year	3,086/year	1990
Engine Lubricating Oil	40 gallons/year	145/year	1990
Reaction Indicator Concentrate	16 ounces/year	0.45/year	1990
Electrolyte Sulfuric Acid	17 bottles/year	--	1990
Water Indicating Paste	1 ounce/year	0.03/year	1990
Global Command & Control			
Acetone	1/4 cup/month	0.11/month	1989
Aircraft Grease	1 gallon/year	3.63/year	1990
Aircraft Grease	8 ounces/month	0.23/month	1989
Alcohol	8 ounces/week	0.23/week	1989
Antifreeze/Coolant	30 gallons/year	109/year	1989
Battery Water	10 gallons/year	36/year	1990
Battery "D" Cells	1 package/year	0.45/year	1990
Blue Locktite	1 ounce/month	0.03/month	1989
Cleaning Compound Solvent	1 can/month	23/month	1985
Clear RTV	6 ounces/84 days	0.17/84 days	1989

Table C-1. Hazardous Materials Storage, Facility 58-C (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Corrosion Prevention Compound	1 can/year	23/year	1990
Creosote	20 gallons/10 years	0.56/10 years	1989
Denatured Alcohol	2 quarts/year	1.82/year	1985
Diesel Fuel	15 gallons/month	54/month	1989
Disinfectant Detergent	3 ounces/week	0.08/week	1989
Electrical Insulating Oil	1 pint/year	0.45/year	1990
Electrolyte Sulfuric Acid	1 gallon/2 years	3.63/2 years	1989
Engine Lube Oil	30 gallons/year	109/year	1989
Fluorescent Orange Paint	10 pints/year	4.5/year	1989
General Purpose Detergent	7 ounces/week	0.20/week	1989-1990
General Purpose Cleaner	1 bottle/month	--	1985
Glass Cleaner	15 gallons/year	54/year	1990
Gray Lacquer	6 pints/month	2.7/month	1989
Grease	1 pint/3 months	0.45/3 months	1989
Isopropyl Alcohol	15 gallons/year	54/year	1990
Lubricating Oil	1 can/year	23/year	1985
Lubricating Oil	2 gallons/year	7/year	1989
Neats Foot Oil	8 ounces/3 months	0.23/3 months	1989
Non Oxidized Grease	5 pints/year	2.25/year	1990
Penetrating Fluid	16 ounces/month	0.45/month	1989
Propellant	Unknown	--	1985
Rosin Core Solder	3 rolls/year	1/year	1985
Rubber Silicone	1 tube/year	0.45/year	1985
Sealing Compound	1 pint/year	0.45/year	1990
Silicone Grease	8 ounces/84 days	0.23/84 days	1989
Solder Flux	1 pint/year	0.45/year	1985
Solder	0.5 roll/year	0.23/year	1990
Solder Flux	1/4 cup/month	0.11/month	1989
Trichlorotrifluoroethane	16 ounces/week	0.45/week	1989
Water Emulsion Type Floor Wax	10 gallons/year	36/year	1990
Water Finding Paste	2.25 ounces/year	0.06/year	1990
Waterless Cream Hand Cleanser	2 cans/year	45/year	1990
Wood Preservative	5 gallons/year	18/year	1990

Table C-1. Hazardous Materials Storage, Facility 101

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Combat Arms Training			
Break Free	6 ounces/year	0.17/year	1991
Rifle Bore Cleaner	6 ounces/year	0.17/year	1991
Urea Technical	25 pounds/year	11/year	1991

Table C-1. Hazardous Materials Storage, Facility 216

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Munitions Maintenance			
1,1,1 Trichloroethane	1 gallon/month	3.63/month	1985
1,1,1 Trichloroethane	1 pint/month	0.45/month	1984
Acrylic Aerosol Lacquer	5 gallons/month	18/month	1985
Activated Desiccant	1 drum/month	188/month	1986
Adhesive	2 tubes/month	0.9/month	1988
Blue Gloss Paint	1-5 cans/month	23-113/month	1988
Blue Lusterless Paint	5 gallons/month	18/month	1985
Cellulose Nitrate Lacquer	15 gallons/month	54/month	1985
Corrosion Removing Compound	1 pint/month	0.45/month	1984-1985
Denatured Alcohol	12 quarts/year	11/year	1985
Dope & Lacquer Thinner	15 gallons/month	54/month	1984-1985
Dry Cleaning Solvent	1 quart/month	0.91/month	1984-1985
Flat Black Paint	70 pints/year	31.5/year	1985
Methyl Ethyl Ketone	10 gallons/month	36/month	1988
Molybdenum Disulfide	5 gallons/month	18/month	1988
Obliterating Paint	12 pints/month	5.4/month	1985
Olive Drab Lacquer	10 gallons/month	36/month	1984-1985
Olive Drab Lacquer	6 pints/month	2.7/month	1986
RTV 189 Adhesive	Unknown	--	1985
Rubber Base Paint	1 can/year	23/year	1985
Tamper Proof	5 each/month	2/month	1988
Trichloroethane	1 gallon/month	3.63/month	1988
White Lacquer	Unknown	--	1988
White Lacquer Spray Paint	12 pints/month	5.4/month	1985
Windshield Cleaning Compound	24 pints/6 months	10.8/6 months	1985
Yellow Enamel	1-5 gallons/month	3.63-18/month	1986,1988
Yellow Lacquer	5 gallons/month	18/month	1988
Yellow Primer	10 gallons/month	36/month	1985
Yellow Zinc Chromate	6 pints/month	2.7/month	1986,1988
Zinc Chromate Primer	10 gallons/month	36/month	1984-1985
Conventional Munitions			
1,1,1 Trichloroethane	Unknown	--	1990

Table C-1. Hazardous Materials Storage, Facility 216 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Adhesive	Unknown	--	1990
Antiseize Compound	Unknown	--	1990
Cement Adhesive	Unknown	--	1990
Cleaning Compound	Unknown	--	1990
Corrosion Preventive Compound	Unknown	--	1990
Corrosion Removing Compound	Unknown	--	1990
Dry Cleaning Solvent	Unknown	--	1990
Epoxy Polyamide Primer	16 ounces/year	0.45/year	1990
Epoxy Primer	2 gallons/year	29/year	1990
Flat Blue Paint	Unknown	--	1990
Glass Beads	50 pounds/year	23/year	1990
Mineral Spirits	Unknown	--	1990
Naphtha Aromatic	Unknown	--	1990
Olive Drab Paint	Unknown	--	1990
Paint Thinner	Unknown	--	1990
Penetrating Fluid	Unknown	--	1990
Primer Coating	Unknown	--	1990
RTV 738 Sealant	Unknown	--	1990
Rust Inhibiting Primer	Unknown	--	1990
Rust Stop	Unknown	--	1990
Sealing Compound	Unknown	--	1990
Sealing Compound	Unknown	--	1990
Thinner	Unknown	--	1990
White Lacquer	Unknown	--	1990
Zinc Chromate Primer	Unknown	--	1990
Water Treatment Plant			
Aluminum Sulfate	20,000 gallons/year	72,600/year	1988
Caustic Soda	20,000 gallons/year	72,600/year	1988
Chlorine	7,200 pounds/year	3,240/year	1988
Hydrofluorosilicic Acid	165 gallons/month	602/month	1988
Nalco Polymer	1,980 gallons/year	7,187/year	1988

Table C-1. Hazardous Materials Storage, Facility 232

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Bomber Weapons Maintenance			
Adhesive	1 pint/6 months	0.45/6 months	1985
Aluminum Pigment	Unknown	--	1985
Cleaning Compound Solvent	Unknown	--	1985
Clear Enamel	Unknown	--	1985
Clear Lacquer	Unknown	--	1985
Corrosion Preventive Compound	1 quart/6 months	0.91/6 months	1985
Corrosion Resistant Coating	Unknown	--	1985
Denatured Alcohol	50-75 gallons/year	182-272/year	1985
Dent Filler	1 quart/6 months	0.91/6 months	1985
Dope & Lacquer Thinner	1 gallon/2 months	3.63/2 months	1985
Dry Cleaning Solvent	Unknown	--	1985
Flat Black Acrylic Lacquer	Unknown	--	1985
Green Primer	Unknown	--	1985
Isopropyl Alcohol	1 gallon/year	3.63/year	1985
Lubricating Compound	Unknown	--	1985
Methyl Ethyl Ketone	20 gallons/year	73/year	1985
Molybdenum Disulfide	1 pound/6 months	0.45/6 months	1985
Naphtha Aliphatic	20 gallons/year	73/year	1985
Olive Drab Acrylic Lacquer	Unknown	--	1985
Paint Remover	Unknown	--	1985
Polyurethane Coating	1 gallon/2 months	3.63/2 months	1985
Polyvinyl Chloride	Unknown	--	1985
Red Acrylic Lacquer	Unknown	--	1985
Rubber Adhesive	Unknown	--	1985
Silver Lacquer Paint	Unknown	--	1985
Solid Film Lubricant	Unknown	--	1985
Strata Blue Enamel	Unknown	--	1985
Toluene Technical	20 gallons/year	73/year	1985
Trichloroethane	2 pints/6 months	0.9/6 months	1985
Walkway Compound	1 gallon/6 months	3.63/6 months	1985
White Acrylic Lacquer	Unknown	--	1985
Yellow Enamel	Unknown	--	1985
Yellow Lusterless Lacquer	Unknown	--	1985
Yellow Zinc Chromate	10 pints/week	4.5/week	1985

Table C-1. Hazardous Materials Storage, Facility 232 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Mine Maintenance			
Absorbent Material	26 bags/year	293/year	1992
Acetone	Unknown	--	1992
Aircraft Grease	5 pounds/year	2/year	1992
Alkyd Gloss Gold Enamel	Unknown	--	1992
Amsco Solvent 1106	Unknown	--	1992
Black Lacquer	25 pints/year	11/year	1992
Black Spray Stencil Ink	1 gallon/year	3.63/year	1992
Black Stencil	Unknown	--	1992
Black Stencil Ink	1 gallon/year	3.63/year	1992
Blue Enamel	24 cans/year	540/year	1992
Blue Spray Paint	30 pints/year	14/year	1992
Brown Coating Compound	Unknown	--	1992
Cleaning Compound Solvent	48 ounces/year	1.35/year	1992
Clear Enamel	1 pint/year	0.45/year	1992
Corrosion Preventive Compound	32 ounces/year	0.9/year	1992
Dichlorodifluoromethane Technical	Unknown	--	1992
Dishwashing Compound	12 pints/year	5.4/year	1992
Dope & Lacquer Cellulose Thinner	8 gallons/year	29/year	1992
Electrical Insulating Compound	Unknown	--	1992
Enamel	1.5 cans/year	34/year	1992
Flat White Aerosol Lacquer	12 cans/year	270/year	1992
Floor Finish	4 gallons/year	15/year	1992
Gasoline	6 gallons/year	22/year	1992
General Purpose Detergent	22 ounces/year	0.62/year	1992
Glass Cleaner	24 bottles/year	--	1992
Gray Paint	Unknown	--	1992
Gray Primer	35 pints/year	16/year	1992
Liquid Protectant	Unknown	--	1992
Lubricating Oil	24 quarts/year	22/year	1992
Methyl Ethyl Ketone	50 gallons/year	182/year	1992
Molybdenum Disulfide Lubricating Oil	3 quarts/year	3/year	1992
Never Dull	1 can/year	23/year	1992

Table C-1. Hazardous Materials Storage, Facility 232 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Olive Drab Paint	30 pints/year	13/year	1992
Pine Oil Soap	Unknown	--	1992
Red Lacquer	64 ounces/year	1.8/year	1992
Red Spray Stencil Ink	1 gallon/year	3.63/year	1992
Sanitizer Cleaner	200 packages/year	90/year	1992
Sealing Compound	Unknown	--	1992
Silicone Compound	1 tube/year	0.45/year	1992
Silicone Sealant	Unknown	--	1992
Solder	1 pound/year	0.45/year	1992
Solid Film Lubricant	Unknown	--	1992
Sweeping Compound	5 pounds/year	2/year	1992
Thinner	8 gallons/year	29/year	1992
Trichlorotrifluoroethane	52 ounces/year	1.46/year	1992
Walkway Compound	Unknown	--	1992
White Sealant	Unknown	--	1992
White Stencil	1 gallon/year	3.63/year	1992
Yellow Alkyd Enamel Gloss	1 gallon/year	3.63/year	1992
Yellow Enamel	72 pints/year	32/year	1992
Yellow Paint	Unknown	--	1992
Yellow Stencil Ink	1 gallon/year	3.63/year	1992

Table C-1. Hazardous Materials Storage, Facility 233

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Munitions Inspection			
1,1,1 Trichloroethane Technical	1 gallon/year	3.63/year	1992
Acrylic Lacquer	1 can/year	23/year	1992
Acrylic Lacquer Aerosol	1 pint/year	0.45/year	1992
Aerosol Paint	48 ounces/year	1.35/year	1992
Anti-Icing Fluid	Unknown	--	1992
Black Lacquer	1 pint/year	0.45/year	1992
Black Stencil Ink	1 gallon/year	3.63/year	1992
Blue Enamel	1 can/year	23/year	1992
Blue Gloss Enamel	1 can/year	23/year	1992
Blue Spray Paint	1 can/year	23/year	1992
Brown Obliterating Compound	1 can/year	23/year	1992
Corrosion Preventive Compound	5 pints/year	2/year	1992
Dishwashing Compound	12 pints/year	5/year	1992
Disinfectant Pine Oil	12 quarts/year	11/year	1992
Floor Finish	Unknown	--	1992
Floor Polish Remover	1 gallon/year	3.63/year	1992
Floor Polish Remover	Unknown	--	1992
Floor Wax	Unknown	--	1992
Furniture Polish	6 pints/year	3/year	1992
General Purpose Deodorant	14 ounces/year	0.39/year	1992
General Purpose Detergent	22 ounces/year	0.62/year	1992
Glass Cleaner Type II	24 pints/year	11/year	1992
Gray Primer	1 can/year	23/year	1992
GSA Adhesive	50 tubes/year	23/year	1992
Liquid Protectant	Unknown	--	1992
Lubricating Motor Oil	Unknown	--	1992
Obliterating Compound	Unknown	--	1992
Olive Drab Lacquer	1 can/year	23/year	1992
Orange Paint	2 pints/year	0.9/year	1992
Porcelain Cleaning Compound	1 quart/year	0.91/year	1992
Rally Wax	Unknown	--	1992
Red Aerosol Spray Paint	1 gallon/year	3.63/year	1992
Red Stencil Ink	1 can/year	23/year	1992
Red Stencil Marking Ink	1 gallon/year	3.63/year	1992

Table C-1. Hazardous Materials Storage, Facility 233 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Scouring Powder	1 can/year	23/year	1992
Silastic 140 RTV Adhesive	6 tubes/year	3/year	1992
Silicone Sealant	6 tubes/year	3/year	1992
Sweeping Compound	5 pounds/year	2/year	1992
Walkway Compound	Unknown	--	1992
White Acrylic Lacquer	1 pint/year	0.45/year	1992
White Aerosol	1 gallon/year	3.63/year	1992
White Lacquer	1 pint/year	0.45/year	1992
White Stencil Ink	1 gallon/year	3.63/year	1992
Windshield Cleaning Compound	1 quart/year	0.91/year	1992
Yellow Enamel Gloss	1 can/year	23/year	1992
Yellow Lacquer Spray	1 can/year	23/year	1992
Storage & Handling			
1,1,1 Trichloroethane Technical	Unknown	--	1992
All Season Motor Oil	Unknown	--	1992
Anti-Freeze Ethylene Glycol	Unknown	--	1992
Anti-Icing Fluid	Unknown	--	1992
Denatured Alcohol	12 pints/year	5/year	1992
Diesel Fuel Oil	850 gallons/year	3,086/year	1992
Diesel Fuel Pour Depressant	12 ounces/year	0.34/year	1992
Dishwashing Compound	12 pints/year	5/year	1992
Disinfectant	156 ounces/year	4.39/year	1992
Floor Finish	Unknown	--	1992
Floor Polish Remover	12 gallons/year	44/year	1992
Floor Wax	12 gallons/year	44/year	1992
Furniture Polish	Unknown	--	1992
General Purpose Detergent	22 ounces/year	0.62/year	1992
Glass Cleaner	1 gallon/year	3.63/year	1992
Hand Cleaner	7 pounds/year	3/year	1992
Jet-Start Fast Flash Fuel	Unknown	--	1992
Liquid Protectant	Unknown	--	1992
Porcelain Cleaning Compound	Unknown	--	1992
Protective Coating	Unknown	--	1992
Quick Start Diesel	18 ounces/year	0.51/year	1992

Table C-1. Hazardous Materials Storage, Facility 233 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Rally Cream Wax	Unknown	--	1992
Scouring Powder	1 can/year	23/year	1992
Windshield Cleaning Compound	2 bottles/year	--	1992
Air Launch Missile Maintenance Branch			
Adhesive	3 quarts/year	3/year	1986
Aircraft Soap	8 gallons/year	29/year	1986
Aliphatic Naptha	10 gallons/year	36/year	1986
Black Lacquer	12 cans/year	270/year	1986
Clear Lacquer	144 ounces/year	4.05/year	1986
Corrosion Preventive Compound	3 quarts/year	3/year	1986
Dry Cleaning Solvent	5 gallons/year	18/year	1986
Dry Lubricant	12 cans/year	270/year	1986
Enamel Alkyd Gloss	2 gallons/year	7/year	1986
Freon	50 gallons/year	182/year	1986
Glytol Enamel	1 quart/year	0.91/year	1986
Isopropyl Alcohol	10 gallons/year	36/year	1986
Olive Drab Paint	15 ounces/year	0.42/year	1986
Paint Remover	15 gallons/year	54/year	1986
Primer	2 pints/year	0.9/year	1986
Primer Coating	1 gallon/year	3.63/year	1986
Protective Coating	2 pints/year	0.9/year	1986
Sealant Compound	150 ounces/year	4.22/year	1986
Silicone	15 ounces/year	0.42/year	1986
Silicone Compound	100 ounces/year	2.81/year	1986
Silver Enamel Paint	36 ounces/year	1.01/year	1986
Solder Flux	1 pint/year	0.45/year	1986
Toluene	5 gallons/year	18/year	1986
White Paint	1 gallon/year	3.63/year	1986
Windshield Cleaner	5 gallons/year	18/year	1986
Yellow Enamel	10 gallons/year	36/year	1986
Zinc Chromate	6 cans/year	135/year	1986
Zinc Chromate Primer	72 ounces/year	2.03/year	1986

Table C-1. Hazardous Materials Storage, Facility 361

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Small Arms			
Break Free	2 pints/year	0.9/year	1985
Break Free	15 pints/year	7/year	1986, 1989
Corrosion Preventive	1 gallon/year	3.63/year	1983
Dry Cleaning Solvent	1 gallon/year	3.63/year	1983
Rifle Bore Cleaner	2 gallons/year	7/year	1983
Weapons Oil	24 ounces/year	0.68/year	1983

Table C-1. Hazardous Materials Storage, Facility 1300

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Water Treatment Plant			
Acrylic Spray Enamel	6 cans/year	135/year	1993
Adhesive #1	Unknown	--	1993
Aluminum Sulfate	30,112 gallons/year	109,307/year	1993
Aluver 3 Aluminum Reagent	24 pills/year	--	1993
Amino Acid Reagant	25 pills/year	--	1993
Ammonia Solution	10 drops/year	5/year	1993
Ammonium Hydroxide	1 quart/year	0.45/year	1993
Baking Soda	100 pounds/year	45/year	1993
Beige Acrylic Enamel	1 gallon/year	3.63/year	1993
Black Gloss Enamel	1 gallon/year	3.63/year	1993
Black Spray Enamel	6 cans/year	135/year	1993
Bleaching 3 Reagent	3 pills/year	--	1993
Bright Red Marine Enamel	1 gallon/year	3.63/year	1993
Bromcresol Green-Mythol Red	3 drops/year	--	1993
Brown Latex Deep Tint Base	1 gallon/year	3.63/year	1993
Brown Latex Paint	1 gallon/year	3.63/year	1993
Buffer Pillows Citrate Type	3 pills/year	--	1993
Buffer Solution Hardness 1	1,419 milliliters/year	--	1993
Buffer Solutions 3.0-5.0	1 quart/year	0.91/year	1993
Buffer Solutions 9.0-11.0	1 quart/year	0.91/year	1993
Calcium Hypochlorite	100 pounds/year	45/year	1993
Calver 2 Calcium Reagent	3 pills/year	--	1993
Caustic Soda Liquid	20,075 gallons/year	72,872/year	1993
Ceiling White Flat Latex	1 gallon/year	3.63/year	1993
Chlorine	9,125 pounds/year	4,106/year	1993
Chromaver 3	3 pills/year	--	1993
Citric Acid	25 pills/year	--	1993
Cresol Red Indicator Solution	Unknown	--	1993
Cuver 1 Copper Reagent	5 pills/year	--	1993
Diphenylcarbazone Reagent	5 pills/year	--	1993
Dissolved Oxygen 1 Reagent	5 pills/year	--	1993
Dissolved Oxygen 2	5 pills/year	--	1993
Dissolved Oxygen 3	5 pills/year	--	1993
DPD Compound For Free & Total	1,500 pills/year	--	1993

Table C-1. Hazardous Materials Storage, Facility 1300 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
DPD Free Chlorine Reagent	1,500 pills/year	--	1993
Dull Aluminum Metallic Enamel	1 gallon/year	3.63/year	1993
EDTA Tetrasodium Salt	1 gallon/year	3.63/year	1993
Ferrover Iron Reagent	25 pills/year	--	1993
Fluoride Standard Solution	473 milliliters/year	--	1993
Formazin Turbidity Standard	500 milliliters/year	--	1993
Gloss Black Spray Enamel	6 cans/year	135/year	1993
Hach One Reference Electrolyte	300 milliliters/year	--	1993
Hydrochloric Acid	Unknown	--	1993
Hydrofluorsilicic Acid	2,007 gallons/year	7,285/year	1993
Latex Deep Tint	1 gallon/year	3.63/year	1993
Magna Floc Polymer 1849A	55 gallons/year	200/year	1993
Never-Dull	1 can/year	23/year	1993
Oatey All Purpose Cement	1 can/year	23/year	1993
Oatey CPE Solvent	1 can/year	23/year	1993
Oatey PVC Solvent	1 can/year	23/year	1993
Off-White Latex Semi-Gloss	1 gallon/year	3.63/year	1993
Off-White Marine Enamel	1 gallon/year	3.63/year	1993
Paint Remover	1 gallons/year	3.63/year	1993
Polyurethane Enamel	1 gallon/year	3.63/year	1993
Rust Transformer	1 gallon/year	3.63/year	1993
Safety Green Alkyd Enamel	1 gallon/year	3.63/year	1993
Soda Ash	100 pounds/year	45/year	1993
Sodium Bisulfate	50 pounds/year	23/year	1993
Sodium Chloride	Unknown	--	1993
Sodium Hydroxide	Unknown	--	1988
Sodium Hydroxide	Unknown	--	1993
Sodium Perosidate	5 pills/year	--	1993
Sodium Thiosulfate Solution	118 milliliters/year	--	1993
Stain	1 gallon/year	3.63/year	1993
Sulfaver 4	5 pills/year	--	1993
Sulfuric Acid Standard	118 milliliters/year	--	1993
Sulfuric Acid Titration	144 milliliters/year	--	1993
Turbidity Standard	1 gallon/year	3.63/year	1993
Wide Range PH Indicator	473 milliliters/year	--	1993

Table C-1. Hazardous Materials Storage, Facility 1800

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Sewage Treatment Plant			
1,2,2 Trifluoroethane	5.2 liters/year	--	1993
Acetate Buffer Solution	2.7 liters/year	--	1993
Alcohol Prep Pads	2 pads/year	0.9/year	1993
Alkaline Iodide Azide Reagent	Unknown	--	1993
Ammonia Nitrogen	300 milliliters/year	--	1993
Ammonium Hydroxide Solution	240 milliliters/year	--	1993
Anti-Seize Compound	1 can/year	23/year	1993
Automotive Antifreeze/Coolant	10 gallons/year	36/year	1993
Belt Dressing	4 cans/year	90/year	1993
Black Spray Paint	6 cans/year	135/year	1993
Bleach	240 milliliters/year	--	1993
BOD Nutrient Powder Pillows	100 pills/year	--	1993
Bon Ami Polishing Cleanser	208 grams/year	1/year	1993
Buffer Solutions	1.2 liters/year	--	1993
Calcium Hypochlorite	2 drums/year	375/year	1985
Calcium Hypochlorite	400 pounds/year	180/year	1993
Chloroalert Electrolyte	10 milliliters/year	--	1993
Citric Acid	Unknown	--	1987
Cyclo Automotive Anti-Gel	6 gallons/year	22/year	1993
Denatured Alcohol	200 milliliters/year	--	1993
Electrolyte	52 milliliters/year	--	1993
Electrolyte	60 milliliters/year	--	1993
Engine Primer Fuel	96 ounces/year	2.7/year	1993
Filter Tip Cartridges	12 cans/year	270/year	1993
Floor Covering Adhesive	0.5 gallon/year	2/year	1993
Floor Enamel	6 gallons/year	22/year	1993
Floor Enamel 800	6 gallons/year	22/year	1993
Gasoline	15 gallons/year	54/year	1993
Hercules Plastic Cement	4 cans/year	90/year	1993
Hibiclens	38.5 liters/year	--	1993
Hydraulic Oil	12 gallons/year	44/year	1993
Hydrion Buffer	100 capsules/year	--	1993
Hydrion Color Key Buffer	100 milliliters/year	--	1993
Hydrochloric Acid	275 milliliters/year	--	1993

Table C-1. Hazardous Materials Storage, Facility 1800 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Hydrochloric Acid	278 drums/year	52,167/year	1985
Hydrofluorosilicic Acid	25.6 drums/year	4,804/year	1985
Hyvac Pump Oil	120 milliliters/year	--	1993
Magnesium Chloride	38 grams/year	0.38/year	1993
Magnesium Iodide	2 milliliters/week	--	1987
Magnesium Phosphate Dibasic	Unknown	--	1993
Magnesium Sulfate	10 milliliters/year	--	1987
Manganous Sulfate	2 milliliters/week	--	1987
Mercury	6 each/year	--	1993
Methanol	100 milliliters/week	--	1987
Methanol	200 milliliters/year	--	1993
Mighty Strip	Unknown	--	1993
Minwax Wood Finish	6 gallons/year	22/year	1993
Mobilgear 629	Unknown	--	1993
Motor Oil 10W	4 gallons/year	15/year	1993
Motor Oil 20W	4 gallons/year	15/year	1993
Motor Oil 40W	4 gallons/year	15/year	1993
Motor Oil 80W90	1 gallon/year	3.63/year	1993
Nalco Optimer 7110	1,200 pounds/year	540/year	1993
Nessler Reagent	1 liter/year	--	1993
Phenolphthalein Powder	50 grams/year	0.05/year	1993
Phenyarsine Oxide Solution	Unknown	--	1993
Phosphate Buffer Solution	Unknown	--	1993
Photo Flo 200 Solution	Unknown	--	1993
Polymer Solvent	5 gallons/year	18/year	1993
Potassium Chloride	12 grams/year	0.12/year	1993
Potassium Hydroxide Pellets	12 grams/year	0.12/year	1993
Potassium Hydroxide Solution	20 milliliters/year	--	1993
Potassium Hydroxide Solution	20 milliliters/year	--	1993
Potassium Iodide Reagent	Unknown	--	1993
Potassium Iodide Solution	Unknown	--	1993
Potassium Phosphate	34 grams/month	0.34/month	1987
Potassium Hydroxide	7 grams/3 days	0.7/3 days	1987
Rectorseal	2 cans/year	45/year	1993
Regal Oil	12 gallons/year	44/year	1993
Rochelle Salt Solution	750 milliliters/year	--	1993

Table C-1. Hazardous Materials Storage, Facility 1800 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Rust Marine Enamel	6 gallons/year	22/year	1993
SAE 30 Oil	12 gallons/year	44/year	1993
Silica Gel Desiccant	2 pounds/year	0.9/year	1993
Skin Cleanser	12 bottles/year	--	1993
Sodium Hydroxide	21 drums/year	3,941/year	1985
Sodium Chloride	12 grams/year	0.1/year	1993
Sodium Hydroxide	32 ounces/month	0.9/month	1987
Sodium Hydroxide	96 milliliters/year	--	1993
Sodium Phosphate Dibasic	240 grams/year	0.24/year	1993
Sodium Phosphate Monobasic	240 grams/year	0.24/year	1993
Sodium Sulfite	36 grams/year	0.04/year	1993
Sodium Thiosulfate	50 milliliters/week	--	1987
Sodium Thiosulfate Solution	60 milliliters/year	--	1993
Sodium Thiosulfate	40 grams/year	0.04/year	1993
Soldering Paste	3 ounces/year	0.08/year	1993
Spread Enamel	6 gallons/year	22/year	1993
Spread House Paint	6 gallons/year	22/year	1993
Stoddard Solvent	12 cans/year	270/year	1993
Sulfer Dioxide	2,000 pounds/year	900/year	1993
Sulfuric Acid	12 ounces/year	0.34/year	1987
Sulfuric Acid	750 milliliters/year	--	1993
Tapfree	2 cans/year	45/year	1993
Thread Sealant	4 cans/year	90/year	1993
Total Chlorine Pillows	700 pills/year	--	1993
Turner Tornado Propane	3 cylinders/year	135/year	1993
Urea Substrate	300 milliliters/year	--	1993

Table C-1. Hazardous Materials Storage, Facility 1850

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
G C Receiver Site			
Windshield Cleaning Compound	2 bottles/year	--	1990
Cleaning Compound Solvent	832 ounces/year	23/year	1990
Corrosion Preventive Compound	1 can/year	23/year	1990
General Purpose Detergent	364 ounces/year	10/year	1990
Disinfectant Detergent	156 ounces/year	4/year	1990
Insect Repellent	4 bottles/year	--	1990
Isopropyl Alcohol	416 ounces/year	31/year	1990
Lubrication Kit	0.5 kit/year	0.23/year	1990
Silicone Compound	1 tube/year	0.45/year	1990
Solder Flux	3 cups/year	0.68/year	1990
Vulcanizing Silicone Rubber	1 tube/year	0.45/year	1990

Table C-1. Hazardous Materials Storage, Facility 3500

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Bioenvironmental Engineering			
Ammonium Chloride	100 grams/year	0.1/year	1983
Brilliant Green Lactose Bile Broth	1/4 pound/year	0.11/year	1983
Calcium Chloride	Unknown	--	1983
Dibasic Potassium Phosphate	Unknown	--	1983
Ferric Chloride	Unknown	--	1983
Fluoride Solution	125 milliliters/week	--	1983
Hydrochloric Acid	100 milliliters/year	--	1983
Immersion Oil	Unknown	--	1983
Isopropyl Alcohol	Unknown	--	1983
Lauryl Tryptose Broth	1/4 pound/year	0.11/year	1983
M-Endo Medium	1.5 liters/year	--	1983
Magnesium Sulfate	Unknown	--	1983
Manganese Sulfate	Unknown	--	1983
Methanol	4 pints/year	2/year	1983
Monobasic Potassium Phosphate	Unknown	--	1983
Nitric Acid	5 pints/year	2/year	1983
PH 4 Buffer Solution	50 milliliters/week	--	1983
Phosphoric Acid	1 pint/year	0.45/year	1983
Sodium Azide	Unknown	--	1983
Sodium Bicarbonate	Unknown	--	1983
Sodium Hydroxide	1/4 pound/year	0.11/year	1983
Sodium Nitrate	50 grams/year	0.05/year	1983
Sodium Thiosulfate	1 pound/year	0.45/year	1983
Starch	1 ounce/year	0.03/year	1983
Stopcock Grease	Unknown	--	1983
Sulfuric Acid	5 pints/year	2/year	1983
Triphenyltetrazolium	5 gallons/year	18/year	1983
Hospital Dental Clinic			
Chloroform	4 ounces/year	0.11/year	1986
Cidex Sterilizing Solution	1 gallon/month	3.63/year	1986
Formalin	8 ounces/year	0.23/year	1986
Ideal Topical Fluoride	1 bottle/3 months	--	1987

Table C-1. Hazardous Materials Storage, Facility 3500 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Sodium Hypochlorite	3 gallons/year	11/year	1986
Ultrasonic Haemosol	5 pounds/month	2/month	1986
Wescodyne Disinfectant	5 gallons/year	18/year	1986
Formaldehyde	1 bottle/month	--	1984
Gemini Inorganic Phosphorous	1 kit/month	0.45/month	1984
Gemini Serum Creatine	2 kits/month	0.9/month	1984
Gemini Serum Direct Bilirubin	1 kit/month	0.45/month	1984
Gemini Serum Total Bilirubin	1 kit/month	0.45/month	1984
Gemini Serum Triglycerides	2 kits/month	0.9/month	1984
Gemini Uric Acid	2 kits/month	0.9/month	1984
Glacial Acetic Acid	1 bottle/year	--	1984
Isopropyl Alcohol	4 packages/week	2/week	1984
Sickledex	1 kit/week	0.45/week	1984

Table C-1. Hazardous Materials Storage, Facility 3502

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
OB Ward, Labor & Delivery			
Bacteriostatic	1 quart/week	0.91/week	1988
Beta Dine	Unknown	--	1988
Elimstaph Germicidal	2 quarts/week	2/week	1988
Formalin	Unknown	--	1988
Glass Cleaner	Unknown	--	1988
Isopropyl Alcohol	Unknown	--	1988
Legphene	1 quart/month	0.91/month	1988
Snap-Back	1 quart/month	0.91/month	1988
Dental Laboratory			
Acetone ACS	3 pints/year	1.35/year	1993
Acriluster	3 pints/year	1.35/year	1993
Acrylic Dental Resin	3 bottles/year	--	1993
Acrylic Resin	8 bottles/year	--	1993
Aeron A-17	25 tubes/year	11/year	1993
Alcide Brand LD Disinfectant	8 gallons/year	29/year	1993
Alcote	1 gallon/year	3.63/year	1993
Ammonium Hydroxide	1 gallon/year	3.63/year	1993
Assure-Etch Etching Solution	Unknown	--	1993
Beauty-Cast	240 packages/year	108/year	1993
Biobond	Unknown	--	1993
Bleach	2 gallons/year	7/year	1993
Bonded Abrasives And Grinding	Unknown	--	1993
Boxing Wax	10 boxes/year	450/year	1993
Brazing Filler Metal	3 grams/year	0.3/year	1993
Buffing Bar Compound	1 bar/year	0.45/year	1993
Ceramigold 2	10 boxes/year	450/year	1993
Ceramiste Points And Wheels	Unknown	--	1993
Chloroform	Unknown	--	1993
Dent Kote Paste	2 boxes/year	90/year	1993
Dental Investment	10 boxes/year	450/year	1993
Dental Wax Solvent	10 quarts/year	9/year	1993
Die-Lube	Unknown	--	1993

Table C-1. Hazardous Materials Storage, Facility 3502 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Durelon Powder	1 kit/year	0.45/year	1993
Dycal Base	1 kit/year	0.45/year	1993
Dycal Catalyst	1 kit/year	0.45/year	1993
Formatray Liquid	Unknown	--	1993
Hibiclens	5 bottles/year	--	1993
Indicating Spray	Unknown	--	1993
Isopropyl Alcohol	64 ounces/year	1.8/year	1993
Kleenol	15 cans/year	338/year	1993
Methanol	1 bottle/month	--	1993
Methyl Methacrylate Monomer	6 boxes/year	270/year	1993
Microfilm	4 ounces/year	0.11/year	1993
Mineral Oil	3 ounces/year	0.08/year	1993
Mounting Stone	5 boxes/year	225/year	1993
Occlude Green	25 boxes/year	1,125/year	1993
Orthodontic	2 bottles/year	--	1993
Orthodontic Resin Liquid	4 boxes/year	180/year	1993
Orthodontic Resin Powder	4 boxes/year	180/year	1993
Orthodontic Resin Separator	4 tubes/year	2/year	1993
Orthodontic Wire	Unknown	--	1993
Plaster And Stone Remover	Unknown	--	1993
Resistant Gel Instant Adhesive	1 ounce/year	0.03/year	1993
Rubber Bonded Grinding Wheels	Unknown	--	1993
Rubber Bonded Wheels	Unknown	--	1993
Sodium Hypochlorite Solution	12 gallons/year	0.44/year	1993
Super Sep	Unknown	--	1993
Super-Span Inlay Investment	Unknown	--	1993
Superbonder General Purpose	1 ounce/year	0.03/year	1993
Ti-Gleam	Unknown	--	1993
Tru-Fit Silver	1 bottle/year	--	1993
Vacuetim	1 bottle/year	--	1993
Wax Solvent	4 quarts/year	4/year	1993
Wire Wax	Unknown	--	1993
Dental Clinic			
Aeropres Propellant	2 cans/year	45/year	1993

Table C-1. Hazardous Materials Storage, Facility 3502 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Alumwax Bite & Impression Wax	2 boxes/year	90/year	1993
Ammonia Inhalant Solution	1 box/year	45/year	1993
Antimicrobial Lotion Soap	24 quarts/year	22/year	1993
Bactoshield Solution	Unknown	--	1993
Benzoin Tincture Compound	Unknown	--	1993
Bite Registration Paste	Unknown	--	1993
Bonding Agent Catalyst	1 kit/year	0.45/year	1993
Butane Cartridge	1 can/year	23/year	1993
Camphorated Parachlorophenol	1 ounce/year	0.03/year	1993
Caulk Tray Adhesive	6 cans/year	135/year	1993
Cavi-Line	24 kits/year	11/year	1993
Cavi-Line Thinner	24 kits/year	11/year	1993
Cavitec Accelerator	1 kit/year	0.45/year	1993
Cepacol	6 boxes/year	270/year	1993
Cidex	Unknown	--	1993
Coe Pak Retarder	1 kit/year	0.45/year	1993
Comfort Liquid	1 pint/year	0.45/year	1993
Comspan-Catalyst	1 kit/year	0.45/year	1993
Concise Etching Liquid	6 kits/year	3/year	1993
Copalite 471 Thinner	24 kits/year	11/year	1993
Correction Fluid	Unknown	--	1993
Cycal Catalyst	6 kits/year	3/year	1993
Delton Opaque Catalyst	6 kits/year	3/year	1993
Dental Adhesive	6 cans/year	135/year	1993
Developer	6 gallons/year	22/year	1993
Developer Cleaner	3 bottles/year	--	1993
Dichlorotetrafluoroethane	3 bottles/year	--	1993
Disclosing Wax	Unknown	--	1993
Dispersalloy	Unknown	--	1993
Dycal Base	6 kits/year	3/year	1993
Etching Gel & Scotchgel Enamel	Unknown	--	1993
Eugenol	4 ounces/year	0.11/year	1993
Film Processing Fixer	6 bottles/year	--	1993
Formaldehyde	Unknown	--	1993
Formo Cresol	2 ounces/year	0.06/year	1993

Table C-1. Hazardous Materials Storage, Facility 3502 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Fynal Liquid	1 kit/year	0.45/year	1993
Fynal Powder	1 kit/year	0.45/year	1993
Gel Etchant	6 kits/year	3/year	1993
Getz Hold Impression Tray Adhesive	2 cans/year	45/year	1993
Glass Cleaner	2 quarts/year	2/year	1993
Hard & Fast Accelerator	Unknown	--	1993
Harvey Metal Polish	Unknown	--	1993
Hemodent Solution	2 bottles/year	--	1993
Hibiclens	Unknown	--	1993
Hydrofluoric Acid	Unknown	--	1993
Hydrogen Peroxide	Unknown	--	1993
Impression Material	1 kit/year	0.45/year	1993
IRM Powder	2 kits/year	0.9/year	1993
Jeltrate	2 kits/year	0.9/year	1993
Lime-A-Way	Unknown	--	1993
Luster Paste	Unknown	--	1993
Luster Stainless Steel Cleaner	Unknown	--	1993
Lynal Liquid	1 kit/year	0.45/year	1993
Nitrogen	2 tanks/year	--	1993
Nu Gauze	12 boxes/year	540/year	1993
Nupro	12 packages/year	5/year	1993
Nupro Fluoride Medium	12 boxes/year	540/year	1993
Nupro-Neutral Sodium Fluoride	12 boxes/year	540/year	1993
P & F Sealant	1 kit/year	0.45/year	1993
Permagum Adhesive	Unknown	--	1993
Permlastic Catalyst	Unknown	--	1993
Phosphoric Acid	1 kit/year	0.45/year	1993
Pit And Fissure Sealant	Unknown	--	1993
Polocaine Injection	2 boxes/year	90/year	1993
Polyjel NF Adhesive	Unknown	--	1993
Prisma Bond Adhesive	2 kits/year	0.9/year	1993
Prisma Bond Primer	2 kits/year	0.9/year	1993
Prisma VLC Dycal	Unknown	--	1993
Rapid Klene Processor Cleaner	Unknown	--	1993
RCK Mercury Decontaminant	Unknown	--	1993

Table C-1. Hazardous Materials Storage, Facility 3502 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Red & Green Occlude	6 cans/year	135/year	1993
Rinn X Ray Developer	Unknown	--	1993
Rinn X Ray Fixer	Unknown	--	1993
Root Canal Sealer	Unknown	--	1993
Self Cure Sealant Catalyst	Unknown	--	1993
Silar Paste A	1 kit/year	0.45/year	1993
Silar Paste B	1 kit/year	0.45/year	1993
Snap/Relate Monomer	1 bottle/year	--	1993
Soft Liquid	1 kit/year	0.45/year	1993
Stannous Fluoride	Unknown	--	1993
Temp-Bond Accelerator	2 kits/year	0.9/year	1993
Temporary Bridge Resin Liquid	1 kit/year	0.45/year	1993
Temporary Bridge Resin Powder	1 kit/year	0.45/year	1993
Tooth Conditioner	2 cans/year	45/year	1993
Topical Fluoride Gel	6 quarts/year	5/year	1993
Varnish	Unknown	--	1993
Visio-Bond	Unknown	--	1993
Wescodyne G	1 gallon/year	3.63/year	1993
Radiology			
Developer Replenisher	80 gallons/year	290/year	1991
Fixer/Replenisher	80 gallons/year	290/year	1991
Medical X-Ray			
Developer/Replenisher	5 gallons/month	18/month	1987
Fixer Replenisher	5 gallons/month	18/month	1987
Medical Laboratory			
Acetic Acid Glacial	12 pints/year	5/year	1991, 1993
Acetone ACS	120 pints/year	54/year	1991, 1993
Boric Acid	12 pounds/year	5/year	1991, 1993
Ethyl Acetate	12 pints/year	5/year	1991, 1993
Formaldehyde	144 pints/year	65/year	1991, 1993

Table C-1. Hazardous Materials Storage, Facility 3502 (Continued)

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Glycerine USP	12 pints/year	5/year	1991, 1993
Grain Neutral Spirits	12 pints/year	5/year	1991, 1993
Hydrochloric Acid	24 pints/year	11/year	1991, 1993
Isopropyl Rubbing Alcohol	12 pints/year	5/year	1991, 1993
Methanol ACS	120 pints/year	54/year	1991, 1993
Nitric Acid ACS	12 pints/year	5/year	1991
Phosphoric Acid ACS	12 pints/year	5/year	1991
Propylene Glycol USP	24 pints/year	11/year	1991, 1993
Sodium Hydrosulfite	1,200 grams/year	1.2/year	1991, 1993
Sodium Hypochlorite Solution	12 gallons/year	44/year	1991, 1993
Sodium Phosphate Monobasic	60 pounds/year	27/year	1991, 1993
Sulfosalicylic Acid	48 ounces/year	1.35/year	1991, 1993
Toluene	12 pints/year	5/year	1991, 1993
Dental X-Ray			
Developer	156 ounces/year	4.39/year	1991
Developer/Replenisher	52 gallons/year	189/year	1988-1989
Fixer	156 ounces/year	4.39/year	1991
Fixer/Replenisher	52 gallons/year	189/year	1988
General Purpose Disinfectant	52 ounces/year	1.46/year	1991

Table C-1. Hazardous Materials Storage, Facility 4000

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Zone D			
General Purpose Detergent	1 gallon/year	3.63/year	1986
Kentile Adhesive	15 gallons/year	54/year	1986
Mineral Spirits	1 gallon/year	3.63/year	1986
Propane	144 liters/year	--	1986
Protective Coatings	50 liters/year	--	1986
Red Paint	12 ounces/year	0.34/year	1986
Rustoleum	Unknown	--	1986
Solder	5 pounds/year	2/year	1986
Wall Board Adhesive	12 liters/year	--	1986
Yellow Enamel	156 ounces/year	4.39/year	1986

Table C-1. Hazardous Materials Storage, Facility 5001

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Telecommunications			
All Purpose Cleaner	1 quart/year	0.91/year	1992
Cleaner Lubricant	8 ounces/year	0.23/year	1992
Cleaning Compound Solvent	16 ounces/year	0.45/year	1992
Denatured Alcohol	1 gallon/year	3.63/year	1992
Disinfectant Pine Oil	12 quarts/year	11/year	1992
Finish Floor Wax	2 gallons/year	7/year	1992
Floor Wax Remover	2 gallons/year	7/year	1992
General Purpose Lubricating Oil	48 ounces/year	1.35/year	1992
Glass Cleaner	1 quart/year	0.91/year	1992
Rubber Rejuvenator	1 bottle/year	--	1992
Silicone Compound	Unknown	--	1992
Soldering Flux	24 ounces/year	0.68/year	1992
Switch Lubricant	8 ounces/year	0.23/year	1992
Trichloroethane	2 gallons/year	7/year	1992
Watch Lubricant Oil	8 ounces/year	0.23/year	1992
Telecom Maintenance			
Cleaning Solvent	2.5 gallons/year	0.69/year	1985
Cleaning Solvent	3 gallons/year	11/year	1986, 1990
Denatured Alcohol	1 gallon/year	3.63/year	1985
Denatured Alcohol	2 gallons/year	7/year	1986, 1990
Denatured Alcohol	Unknown	--	1989
Duster Assembly	1 can/week	23/week	1989-1990
Freon	1 can/year	23/year	1985
Lubricating Oil	Unknown	--	1989-1990
Protective Coating Compound	Unknown	--	1989
Rubber Rejuvenator	Unknown	--	1989-1990

Table C-1. Hazardous Materials Storage, Facility 5050

Product	Quantity Stored (Units Provided)	Quantity Stored (kg)	Documented Year(s) of Storage
Base Reprographics			
Developer	12 boxes/year	540/year	1990
Dry Ink Cartridge	120 cartridges/year	54/year	1990
Electrostatic Ink	576 ounces/year	16.2/year	1990
Indirect Electrostat Developer	2 boxes/year	90/year	1990
Lithograph Conversion Solution	96 gallons/year	348/year	1990
Lithographic Blanket Roller	120 gallons/year	436/year	1990
Methylene Chloride Technical	1 gallon/year	3.63/year	1990
Silicone Oil	64 ounces/year	1.8/year	1990
Toner Direct Electrostatic Product	908 grams/year	0.90/year	1990
Tower Savin	24 each/year	11/year	1990