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1995

EPA Superfund
Record of Decision:

LORING AIR FORCE BASE
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OU 01
LIMESTONE, ME
09/20/1995

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LORING AFB
MAINE

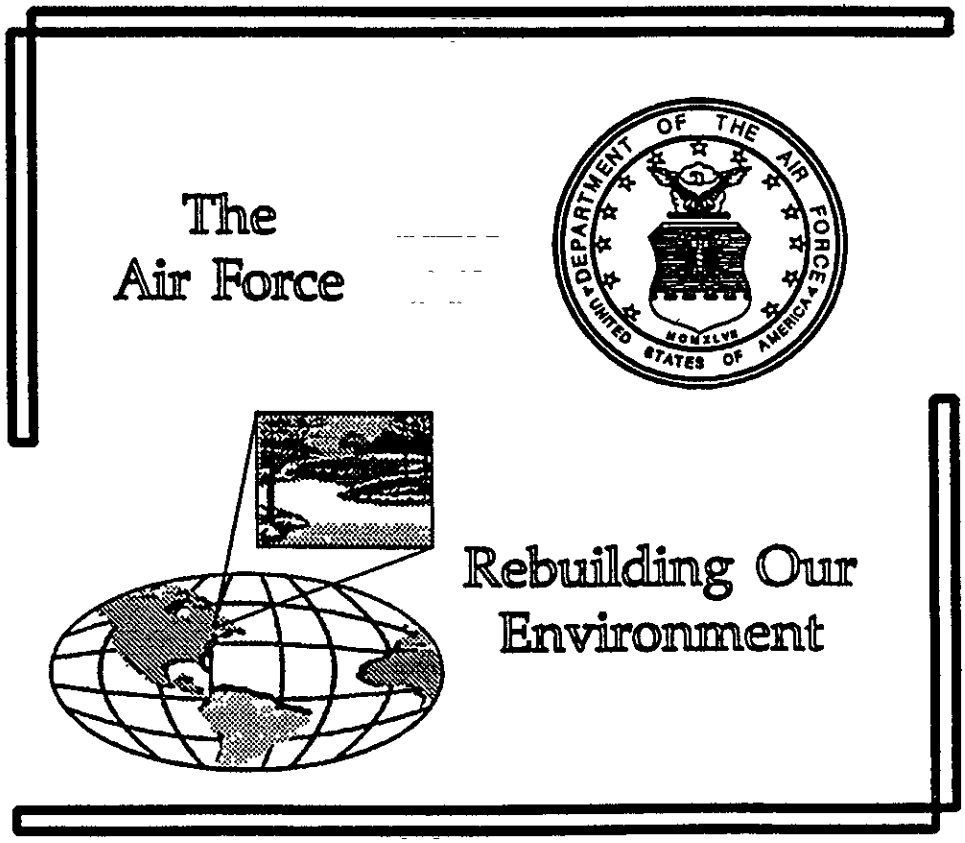
ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 2410

FINAL

OPERABLE UNIT 1 (OU 1) RECORD OF DECISION

August 1995



Installation Restoration Program
Loring Air Force Base, Maine

FINAL

Loring Air Force Base

OPERABLE UNIT 1 (OU 1)
RECORD OF DECISION

August 1995

Prepared for:

Air Force Base Conversion Agency
Limestone, Maine
(207) 328-7109

Prepared by:

Service Center: Hazardous Waste Remedial Actions Program
Oak Ridge, Tennessee

Contractor: ABB Environmental Services, Inc.
Portland, Maine

Project No. 7656-16

OU 1 RECORD OF DECISION
LORING AIR FORCE BASE

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DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Loring Air Force Base (LAFB) Operable Unit 1 (OU 1), the Low Level Radioactive Waste Disposal Sites (LLRWDS), Limestone, Maine.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected No-Action decision for the LLRWDS, OU 1, at LAFB in Limestone, Maine. OU 1 consists of Areas A-G as identified in Figure 1-2. This decision document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), (USEPA, 1990). It is based on the Administrative Record for the site, which was developed in accordance with Section 113(k) of CERCLA and is available for public review at the Air Force Base Closure Agency Office, 5100 Texas Road, Limestone, Maine. The Administrative Record for the LLRWDS, OU 1, includes the memos, letters, reports, and associated information developed during the CERCLA response at OU 1 that provide the basis for selecting No Action.

The State of Maine Department of Environmental Protection concurs with the No-Action under CERCLA remedy for OU 1.

DESCRIPTION OF THE SELECTED REMEDY

The U.S. Air Force and U.S. Environmental Protection Agency (USEPA), with concurrence of the Maine Department of Environmental Protection, have determined that no action under CERCLA is necessary to address the contamination of OU 1 soils, surface water, sediments, and groundwater. Previous response actions relating to radionuclides at OU 1 (Areas A through F) have eliminated the need to conduct a remedial action. OU 1 inorganic groundwater contamination will be addressed in a separate Record of Decision, and the petroleum contamination at Area G will be addressed separately under the Maine Underground Storage Tank Regulations.

DECLARATION

Because this No Action Record of Decision does not result in hazardous substances, pollutants, or contaminants being left at the site above levels that allow for unrestricted exposure, pursuant to CERCLA § 122(c), no five-year review will be undertaken.

DECLARATION

The U.S. Air Force and USEPA, with concurrence of the Maine Department of Environmental Protection, have determined that no remedial action under CERCLA is necessary at OU 1.

By: _____ Date: Sep 19, '95

Department of the Air Force
Alan K. Olsen
Director
Air Force Base Conversion Agency

By: _____ Date: Sept. 20, 1995

United States Environmental
Protection Agency
Linda M. Murphy
Director
Waste Management Division
Region I

1.0 SITE NAME, LOCATION, AND DESCRIPTION

Loring Air Force Base (LAFB), in northeastern Maine, is bordered on the south and east by the Town of Limestone, on the north by the towns of Caswell and Connor, and on the east by the City of Caribou (Figure 1-1). The base is approximately three miles west of the United States/Canadian border and covers approximately 9,000 acres. The base was closed September 1994.

LAFB is a National Priorities List (NPL) site. There are currently a number of areas of concern within LAFB that are under investigation. For purposes of investigation and remedial response, the areas of concern at LAFB have been organized into several operable units (OUs). This Record of Decision (ROD) addresses the former source areas, surface water, sediment, and groundwater at OU 1, the Low Level Radioactive Waste Disposal Sites (LLRWDS). The LLRWDS Areas A through G, identified in Figure 1-2 are discussed further in Subsection 5.1.

Because of its primary mission, LAFB personnel were engaged in various operations, a number of which required the use, handling, storage, and disposal of hazardous materials and substances. In the past, these materials entered the environment through accidental spills, leaks in piping, landfilling operations, burning of liquid wastes during fire-training exercises, and the cumulative effects of operations conducted at the base's flightline and industrial areas. As part of the Department of Defense's (DOD) Installation Restoration Program (IRP), the Air Force has initiated activities to identify, evaluate, and remediate former disposal or spill sites containing hazardous substances.

Since initiation of the IRP, the Base has been placed on the U.S. Environmental Protection Agency's (USEPA's) NPL of sites and will be remediated according to the Federal Facility Agreement (FFA) entered into by U.S. Air Force (USAF), the USEPA, and the Maine Department of Environmental Protection (MEDEP).

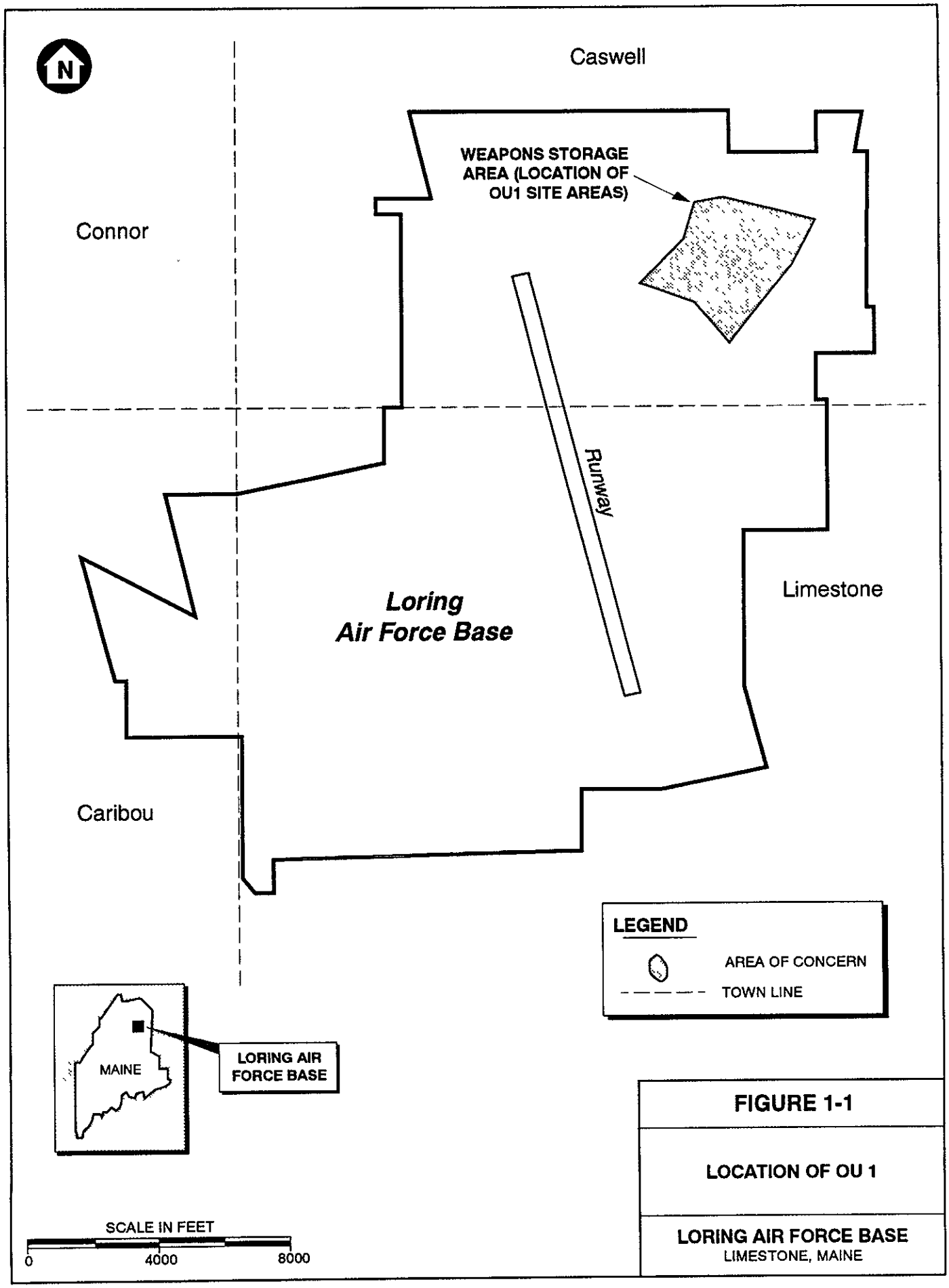

FIGURE 1-1

LOCATION OF OU 1

LORING AIR FORCE BASE
LIMESTONE, MAINE

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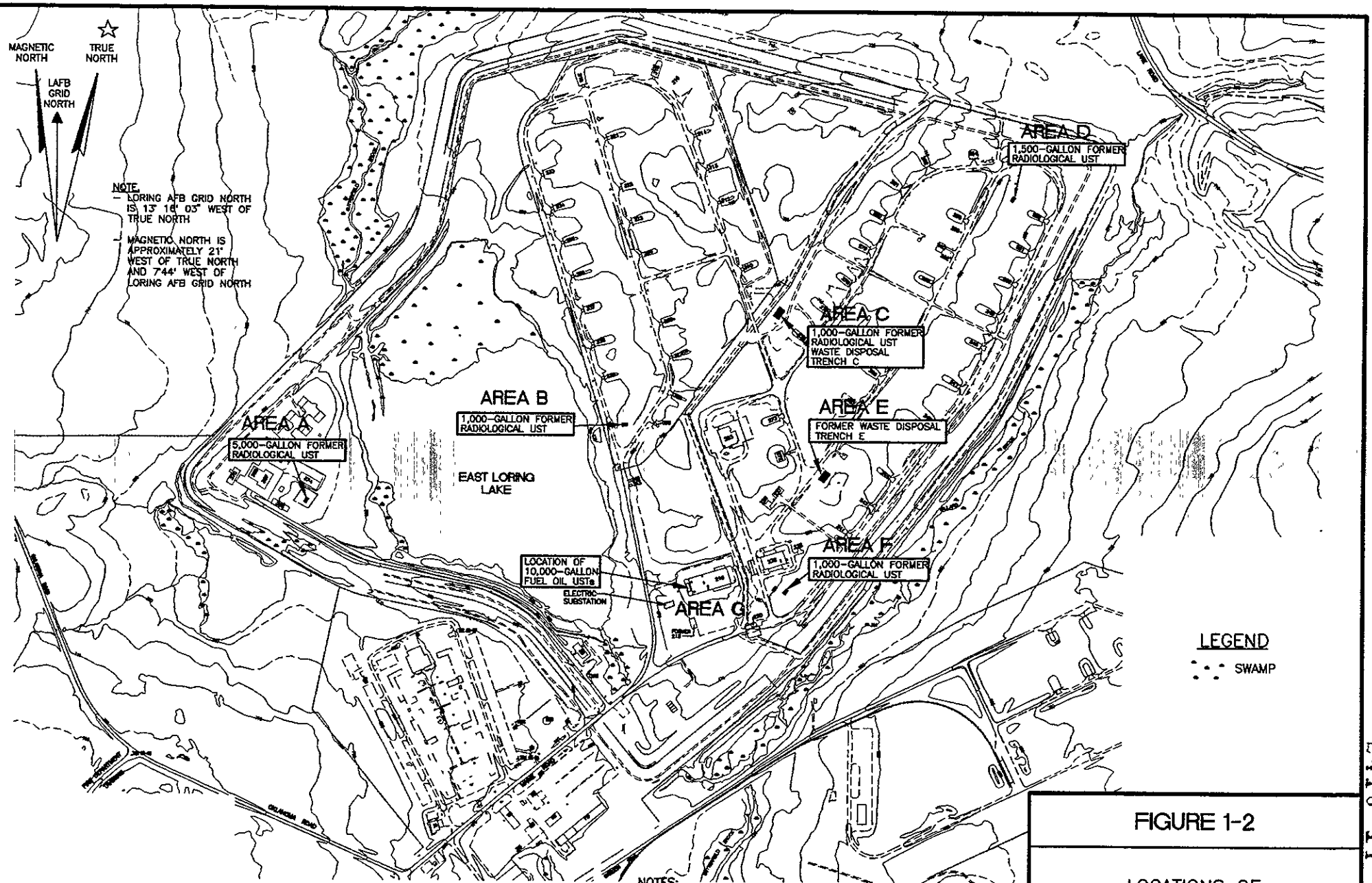

NOTES:

1. THE FIVE RADIOLOGICAL USTs AND CONTENTS OF BOTH LOW-LEVEL RADIOACTIVE WASTE DISPOSAL TRENCHES WERE REMOVED AND DISPOSED OFF-SITE IN 1994.
2. FORMER UST LOCATIONS ARE APPROXIMATE

FIGURE 1-2

LOCATIONS OF AREAS A THROUGH G

LORING AIR FORCE BASE
LIMESTONE, MAINE

1-3

11 OF 12

2.0 SITE AND INVESTIGATION HISTORY

This section summarizes the uses, response history, and investigation activities at OU 1.

2.1 LAND USE AND RESPONSE HISTORY

The seven LLRWDS in OU 1 are associated with buildings and operations in the Weapon Storage Area (WSA) (Figure 2-1). The WSA was used for the storage and routine maintenance of strategic and conventional weapons from 1952 through 1993. During the 1950s, weapons inspection and maintenance required disassembly and direct handling of radioactive materials. By the mid-1950s, weapon designs had changed, radioactive material was no longer exposed in the new designs, and the earlier type of weapons were progressively phased out of stockpile by 1962. Strategic weapons were removed from the WSA in May 1989. Conventional weapons were progressively removed in 1993 in anticipation of base closure, with the last conventional weapons removed in December 1993.

Five underground storage tanks (USTs) were installed at the WSA LLRWDS to receive and contain potentially radioactive liquids in the event of a release in one of the facilities. USAF records indicated there was never a release of radioactive materials to any of the five USTs. The USTs were excavated and disposed off-site during a removal action in 1994. The USTs were observed to be intact at the time of their removal (Ogden, 1995).

Low-level dry radioactive wastes (e.g., swipes, butcher paper, tape, gloves, protective clothing, respirator cartridges) from maintenance operations were typically placed in cardboard boxes. From 1954 through 1962, the boxes were reportedly disposed of on-site in two waste disposal trenches. During the 1994 removal action, the two waste trenches were delineated, exhumed, and the contents were disposed off-site.

2.2 INVESTIGATION AND RESPONSE HISTORY

The USAF has followed USEPA guidelines for most of the IRP investigations conducted at LAFB since 1983, and for all investigations completed since 1988, when

the IRP investigation process was revised to more closely follow the National Contingency Plan (NCP) used by the USEPA (USEPA, 1990).

The investigation history of OU 1 is summarized as follows:

- In 1983, a Preliminary Assessment (PA) was performed by detailing historical hazardous material usage and waste disposal practices (CH_2M Hill, 1984).
- A Site Inspection (SI) was conducted between 1985 and 1988 to confirm the presence of contaminants at OU 1 (Roy F. Weston, Inc., 1988).
- Between 1988 and 1994, Remedial Investigation (RI) activities were conducted and a Public Health and Ecological Baseline Risk Assessment (RA) was completed (ABB Environmental Services, Inc. [ABB-ES], 1995a).
- LAFB was added to the NPL in February 1990.
- The USAF entered into an FFA in 1991 with the USEPA and MEDEP regarding the cleanup of environmental contamination at LAFB (FFA, 1991).
- In 1994, a removal action was conducted that included excavation of the five radiological USTs and two waste disposal trenches. The USTs and contents of the trenches were disposed off-site (Ogden, 1995).
- The FFA was modified in December 1993 to address base closure-related issues, such as real property transfer and a revised schedule. The FFA was further modified in January 1995 to allow Remedial Project Managers to make minor modification to the FFA, such as schedule adjustments or removal of petroleum-contaminated sites from the agreement.
- Contamination detected at Area G is attributed to fuel oil that leaked from a former UST and pipeline, and as such, future remedial actions should be conducted in accordance with State of Maine UST regulations.

3.0 COMMUNITY PARTICIPATION

Throughout LAFB's history, the community has been involved in base activities. The USAF, USEPA, and MEDEP have kept the community and other interested parties apprised of LAFB IRP activities through informational meetings, fact sheets, press releases, public meetings, site tours, and open houses.

In addition to these activities, during the course of IRP activities at LAFB, there have been regular meetings of the Restoration Advisory Board (RAB) (formerly the Technical Review Committee). The RAB, chaired by the USAF and a representative of the community, is composed of representatives of USEPA, MEDEP, the community, and local officials. The purpose of the RAB meetings has been to ensure clear communication with the public, timely transfer of information, and opportunity for public comment.

The framework for the USAF's approach to community involvement is the LAFB Community Relations Plan (CRP), which was released in August 1991 and subsequently revised in May 1995. The CRP outlines the USAF's program for addressing community concerns and keeping citizens informed and involved during remedial activities.

Documentation of the reports, memoranda, and correspondence that are the basis for IRP remedial response decisions are kept in an Administrative Record. The Administrative Record is open and available for public review at the Air Force Base Conversion Agency Office, 5100 Texas Road, Limestone, Maine.

The following is a summary of the activities the USAF has undertaken to keep the public informed and involved regarding the remedial response at OU 1.

- On June 2, 1994, a RAB meeting was held to discuss the results of the OU 1 investigations and the approach for conducting the UST and radioactive waste disposal trench removal action.

- An IRP Fact Sheet, explaining activities planned for OU 1, was issued in July 1994.

- The USAF published a notice and brief discussion of the proposed removal action in the Aroostook Republican on July 6, 1994 and the Bangor Daily News on July 7, 1994.

- From July 11 through August 10, 1994, the USAF held a 30-day public comment period to accept public input on the Action Memorandum outlining the proposed removal action, and on any other OU 1 documents in the Administrative Record. On July 28, 1994, USAF personnel and regulatory representatives held a public meeting to discuss the Action Memorandum and to accept oral comments.

- During the removal action, the USAF invited the local press to cover the trench removal activities. Information regarding both the trench and UST tank removals was made available to representatives of local media.

- The USAF published a notice and brief analysis of the Proposed Plan in the Bangor Daily News, Aroostook Republican, Fort Fairfield Review, and Presque Isle Maine Star-Herald on July 12, 1995, recommending No Action under CERCLA as the preferred alternative for OU 1.

- From July 17 through August 16, 1995, the USAF held a 30-day public comment period to accept public input on the information presented in the RI/Baseline Risk Assessment and Proposed Plan, and on any other OU 1 documents in the Administrative Record. On August 2, 1995, USAF personnel and regulatory representatives held a public meeting and hearing to discuss the Proposed Plan and to accept oral comments. A transcript of this hearing is included in Appendix A. Comments received during the comment periods and the USAF's response to these comments are included in the Responsiveness Summary in Appendix B.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The USAF and USEPA have determined that no further Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action is required at OU 1 because (1) previous response actions conducted at the operable unit have eliminated the need to conduct further remedial action and (2) the petroleum contamination at Area G will be effectively addressed under State of Maine regulations.

USEPA has the authority to revisit the No Action under CERCLA decision even if LAFB is removed from the NPL. This could occur if future conditions indicate that an unacceptable risk to human health or the environment would result from exposure to contaminants at OU 1.

5.0 SUMMARY OF SITE CHARACTERISTICS

The investigation process began at LAFB in 1983 as part of the DOD IRP. The process was revised during 1988 to follow the NCP. Investigations performed to date include a 1983 PA performed to investigate past activities at LAFB (CH_2M Hill, 1984). An SI was initiated in June 1985 to confirm the presence of contaminants at OU 1 (Roy F. Weston, Inc., 1988). In addition, RI activities were conducted from 1988 through 1994 (ABB-ES, 1995b).

There are seven OU 1 sites, Areas A through G, that were grouped together due to their proximity in the former WSA (Figure 2-1). With one exception, the sites were used for low-level radioactive waste disposal. The one exception is Area G, which was inaccurately identified as a low-level radioactive waste disposal site in the Base Master Plan during the 1970s and 1980s. Research and the results of the RI have shown that Area G was not used for low-level radioactive waste disposal. The Base Master Plan was corrected in the 1990s. A more complete description of the site can be found in Section 4 of the Operable Unit (OU 1) Remedial Investigation Report, Volume I (ABB-ES, 1995a).

The site areas comprising OU 1 that potentially received low-level radioactive waste are:

Area A: 5,000-gallon liquid waste disposal UST attached to Building 365 floor drains. Building 365 was the strategic weapon component inspection laboratory that maintained radioactive components. Potential contamination included radioactive materials (uranium oxide) and solvents generated during weapon maintenance activities.

Area B: 1,000-gallon liquid waste disposal UST attached to a floor drain in Building 329. Building 329 was used to store tritium containers. Tritium generated during routine venting of tritium gas during weapon maintenance activities at Building 329 was the primary focus of the investigation at Area B.

Area C: 1,000-gallon liquid waste disposal UST and a dry radioactive waste disposal trench, Trench C. The UST was attached to former Building 309 used to store tritium containers. The waste disposal trench was used in the 1950s and possible early 1960s to dispose of small quantities of low-level radioactive waste, primarily uranium oxides. Potential contamination to be

investigated at Area C included tritium generated during routine venting of tritium gas during weapon maintenance activities, and radioactive materials and solvents generated at Area A disposed in Trench C.

Area D: 1,500-gallon liquid waste disposal UST. This UST was attached to floor drains in Buildings 255 and 284, both used for storage of tritium containers. Tritium was identified as a potential contamination source at Area D.

Area E: Dry radioactive waste disposal Trench E, similar to the trench at Area C in its history and use. The focus of the Area E investigation was radioactive materials and solvents from wastes generated at Area A and disposed of in Trench E.

Area F: 1,000-gallon liquid waste disposal UST. This UST was attached to a floor drain in a weapon assembly and maintenance structure, Building 232. Potential contaminants at Area F included radioactive materials from weapon assembly and maintenance activities at Building 232.

The five radiological USTs were removed from Areas A, B, C, D, and F in 1994. In addition, the contents of both waste trenches (Areas C and E) were removed and disposed off-site in 1994.

Area G is not a radioactive waste disposal site. Building 216, located at Area G, was a weapon assembly building. There were two 10,000-gallon underground fuel storage tanks located at the west end of Building 216. In 1991, both tanks were replaced. During replacement of the tanks, contaminated subsurface soil, attributed to leakage from the tanks or piping, was observed. A former underground fuel pipeline, that supplied the 10,000-gallon tanks, traverses Area G. The pipeline is now abandoned. Investigations at Area G have detected solvents and fuel oil in soil and groundwater.

Other investigations and remedial actions have occurred at the WSA in addition to the PA and RI programs. The five radiological USTs were removed in 1994 as part of a removal action (Ogden, 1995). All five of the tanks were reported to be intact (i.e., not leaking). Based on analysis of UST content samples and confirmatory soil samples collected following UST removal, the Radioisotope Committee and MEDEP acknowledged, through verbal agreement, clean closure of the radiological USTs. Wipe samples from the building floor drains and the cut end of the piping at each UST were also analyzed and reported to be free of radioactive contamination.

During the 1994 removal actions, the dry radioactive wastes disposed in the trenches at Areas C and E were also removed. The contents of both trenches were delineated, analyzed, exhumed, and disposed off-site. Analysis of confirmatory soil samples collected after trench excavation indicated that the radioactive material was successfully removed from both trenches.

In addition to characterizing the sites, radiological building decommissioning surveys were conducted at 56 weapon storage and maintenance structures located within the WSA. No radioactivity above background levels was reported in the surveyed structures.

The University of Maine, on behalf of the MEDEP, conducted supporting radiological investigations to evaluate the possible presence of unidentified or undocumented radioactive waste disposal sites within the WSA. University of Maine personnel performed radiological surveys and laboratory analysis of groundwater, soil, surface water, and sediment samples from OU 1 and vicinity. Their OU 1 data were compared to off-site background samples and data from across the State of Maine. The comparisons indicated that levels of radioactivity across the entire WSA were at background levels, and the study did not identify any undocumented radioactive waste disposal areas. The University of Maine data were not utilized in establishing specific background values for the agreed-upon radionuclides of concern investigated in the RI. However, the University of Maine was involved in the review process for the establishment of these background concentrations developed during the RI.

The following subsections present contamination assessments for various environmental media at OU 1. A more detailed discussion of the contamination assessment is presented in Section 4 of the RI Report (ABB-ES, 1995a).

5.1 ANALYTICAL CHEMISTRY ISSUES

In order to better evaluate the nature and distribution of detected analytes, there are three issues which require preliminary discussion. These include:

- effects of turbidity on groundwater sample inorganic results
- the occurrence of Radium (Ra)-226
- radioactive isotope analytical results

Each of these topics is discussed in the following paragraphs.

Turbidity. Inorganics analytes were detected at varying levels above natural LAFB background concentrations in bedrock monitoring wells at OU 1. Inorganics were also detected in the two overburden wells. Background concentrations of inorganics in overburden and bedrock groundwater are currently being reassessed as part of the OU 12 basewide groundwater RI. Concentrations of inorganics in groundwater at OU 1 will be compared to the OU 12 background concentrations upon approval and acceptance of those levels. Problems identified during this re-evaluation of OU 1 groundwater inorganic data will be addressed in the OU 12 ROD. As indicated by current and past OU 12 background bedrock and overburden groundwater dissolved and total inorganic analyses, the amount of turbidity in a sample can affect the inorganic concentrations reported by the laboratory. Inorganic concentrations typically decrease in the filtered (dissolved) samples, as compared to the non-filtered (total) samples. Turbidity is often generated during sample collection in both bedrock and overburden monitoring wells.

Soil samples from OU 1, the former radiological UST liquids, and waste samples from the LLRWDS trenches did not contain inorganic concentrations indicative of source areas. Inorganic concentrations in OU 1 groundwater are attributable to natural occurrence, background variation, and/or impacts of turbidity.

Occurrence of Ra-226. Ra-226, one of the most abundant naturally occurring radioactive isotopes, was detected in 80 out of 108 soil samples throughout OU 1. The site-related Ra-226 data have been compared to two sets of off-site background sample concentrations that were developed in 1993 and 1994, respectively. If the site soil samples, collected in 1993 and before, are compared with the 1993 background concentrations, no exceedances of background are observed. If the 1993 and before site soil samples are compared with the 1994 background concentrations, many exceedances of background area observed. However, the exceedances of 1994 background values are a result of analytical method changes between the two years. The reporting limit, or minimum detectable activity, was lower for the 1994 background sample analyses due to increased analytical sensitivity. The background data reported in 1994 therefore had lower and more reliable values than the 1993 background data, with the result that samples collected in 1993 and before exceeded the lower 1994 background values. Based on this fact, and the widespread occurrence of Ra-226, Ra-226 detected at OU 1 is believed to be naturally occurring.

Radioactive Isotope Analytical Results. During the RI, several analytical issues regarding the quantification and identification of radioactive isotopes were identified. Issues associated with the analysis for Uranium (U)-235, Americium (Am)-241, and Neptunium (Np)-237 are discussed in the following paragraphs. For a detailed explanation of the specific technical issues associated with the radioactive isotopic analytical program, refer to the OU 1 RI (ABB-ES, 1995a).

Gamma spectroscopy U-235 results are considered questionable due to analytical interference caused by Ra-226. U-235 analyzed by alpha spectroscopy was not subject to this interference and provided more accurate data.

Am-241 was detected once in a surface soil sample at Area A. Am-241 is primarily an alpha-emitting isotope accompanied by low energy gamma rays, however, the low gamma energy is subject to analytical interferences. The laboratory noted that the peak used to identify and quantify Am-241 in this sample had a bad peak shape which indicated an interference. Therefore, the Am-241 result is considered suspect.

Np-237 is also primarily an alpha-emitting isotope accompanied by low energy gamma rays. During the analysis for Np-237 by gamma spectroscopy, interferences were noted by the laboratory, thereby calling into question the identification and quantitation of this isotope. Therefore, the identification and quantification of Np-237 detected by gamma spectroscopy in sediments associated with Area A, Butterfield Brook, and East Loring Lake are questionable.

5.2 SUMMARY OF CONTAMINANTS DETECTED

Results of the RI sampling and analysis are briefly summarized in the following paragraphs. Results are presented for the radiological USTs and waste disposal trenches first, followed by additional results for each site area.

Radiological USTs. Essentially no contaminants were detected in liquid, sediment, or scrape samples collected from the five USTs at Areas A, B, C, D, and F. Analysis of confirmatory soil samples collected from the bottom of the UST excavations also did not detect contamination indicative of a source.

Waste Disposal Trenches. Radiological contamination (enriched uranium) was detected in samples collected from the waste disposal trenches at Areas C and E. Subsequently, removal actions were performed in both trenches in 1994.

Confirmatory samples collected from the limits of the trench excavations following the removal action indicate that radioactive waste was successfully removed from both Trench C and E.

Arsenic was detected above background in only one of 18, closely gridded, confirmatory soil samples at Trench E. Arsenic is not a documented contaminant associated with OU 1. Detection of arsenic in Area E may be attributable to rodenticides used to control burrowing animals at the trench location.

Area A. Polyaromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), lead, and zinc were detected above background in Area A surface soil. The PAHs, PCBs, and metals in surface soil are attributable to non-point source erosion and runoff from nearby parking areas, roads, and former operational areas. The detection of pesticides is consistent with the compounds and concentrations detected at other OUs at LAFB. The presence of these compounds is a result of routine basewide use of pesticides.

Radiological analytes detected above background levels in Area A soils and sediments were Am-241, Np-237, Ra-226, U-235, Thorium (Th)-231, and Th-234. Am-241, Np-237, and U-235 detections are suspect due to analytical difficulties in identification and quantitation as discussed in Subsection 5.1. The detections of Th-231 and Th-234 are considered to be naturally occurring. Ra-226 is an abundant naturally occurring radionuclide and was detected in nearly all OU 1 soil samples.

Concentrations of aluminum, chromium, manganese, and nickel exceeded USEPA Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and MEDEP Maximum Exposure Guidelines (MEGs). These inorganics are naturally occurring and have not been identified as site-related. The detection of these inorganics above background in OU 1 groundwater is assumed to be a result of sample turbidity. Tritium was detected in one groundwater sample at a level approximately 100 times lower than the drinking water standard.

Area B. In general, detected volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and inorganics were below background levels or at low estimated concentrations. No PCBs were detected at Area B. U-235, Th-231, and Ra-226 were detected above background levels in soil at Area B. As discussed previously, the identification and quantitation of U-235 is suspect due to analytical interferences. Th-231 is believed to be naturally occurring at

Area B. The Ra-226 detection at Area B is typical of Ra-226 concentrations throughout OU 1.

Inorganics (iron, chromium, lead, manganese, and nickel) were detected in groundwater above MCLs and MEGs at Area B. These detections are likely associated with turbidity.

Area C. Three inorganic analytes (calcium, mercury, and sodium) were detected above background in Area C soil. These analytes were detected at estimated concentrations except for calcium, which is considered to be an essential nutrient. U-235, Th-234, and Ra-226 were detected in soil at concentrations above background concentrations. These radionuclides are naturally occurring and their detection above background levels is attributable to natural differences in background and analytical variability. The detections of U-235 are suspect due to analytical difficulties in identification and quantification.

Trace or estimated levels of VOCs and pesticides were detected in groundwater samples collected in 1993, but were not reported in 1994 samples. Inorganics (aluminum, lead, and manganese) were detected in groundwater; however, as in the case of other groundwater samples, the concentrations likely reflect natural variation and the effect of sample turbidity. Th-232 and U-234 were detected at background in groundwater at Area C. Both of these radionuclides are naturally occurring. Tritium was detected in one groundwater sample at a level approximately 100 times lower than the drinking water standard.

Area D. Other than the detection of three pesticide compounds at or just above background levels, no organic or inorganic contamination was detected in soils at Area D. Ra-226 was the only radionuclide detected in soil at Area D at a concentration above background levels.

Aluminum, lead, and manganese were detected in Area D groundwater at concentrations greater than MCLs and MEGs. However, the groundwater samples were turbid. Th-230, U-234, and U-238 were detected above background levels in 1993, but not in 1994. These are naturally occurring radionuclides.

Area E. PAHs were detected below LAFB background levels in surface soil in the drainage swale at Area E. The occurrence of these compounds is attributable to non-point source runoff from the former operations at Area E. No other organic contaminants were detected in soil at Area E. Lead, silver, and sodium were

detected above background concentrations in surface soil samples. In subsurface soil, cadmium (in five samples), zinc (in three samples), and arsenic, cobalt, and lead were detected above background values. The arsenic and lead detections were each localized in a trench confirmatory sample. Their detection is not indicative of widespread residual contamination.

U-235, Ra-226, Ra-228, Th-228, and Th-231 were detected above background levels in Area E soils. These isotopes are naturally occurring and were present at concentrations that slightly exceeded LAFB background concentrations.

Aluminum, chromium, lead, and manganese were detected in groundwater samples at Area E at concentrations exceeding MCLs and MEGs. As with the other sites throughout the OU, the concentrations of inorganics are assumed to reflect the effect of turbidity in the samples. Th-230, U-234, and U-238 were detected in groundwater in 1993 at estimated concentrations above background levels. In the 1994 groundwater sampling round, Th-228, Th-230, and Th-232 (estimated concentration) were detected above background levels. These analytes are naturally occurring, and their detection above background levels is attributable to analytical variability and differences in natural background concentrations. Tritium was detected in one groundwater sample at a level approximately 100 times lower than the drinking water standard.

Area F. No organic compounds were detected in soils at Area F other than one detection of a compound believed to be a laboratory contaminant. Pesticide compounds were detected at concentrations below, or slightly exceeding, background concentrations. The occurrence of these compounds is attributable to the routine application of pesticides at LAFB. Arsenic, lead, and zinc were detected at estimated concentrations and were slightly above background levels. Protactinium (Pa)-234, Th-234, and U-235 were detected in soils at Area F. Th-234, Pa-234, and U-235 are naturally occurring radionuclides. The U-235 result is suspect due to analytical interferences.

No organic compounds were detected in groundwater at concentrations above MCLs or MEGs at Area F. Two pesticide compounds were detected in the 1993 round of sampling, but were not reported in 1994. Aluminum is the only inorganic analyte detected above MCLs and MEGs in groundwater at Area F. In 1994, aluminum was detected below the MEG in the same well. No radionuclides were detected above background concentrations in groundwater at Area F.

Area G. No VOCs were detected in surface soil. PAHs were detected in several surface soil samples. Total PAH concentrations exceeded background levels at one location at the head of a drainage swale that receives runoff from a paved parking area, from Building 216 floor drains, and is located adjacent to and downslope from the fuel pipeline and two fuel oil USTs. In general, inorganics, primarily barium, lead, sodium, and zinc, were detected sightly above background concentrations in several samples at Area G. Most of these samples showed detections of one or two inorganic analytes. One sample, located at the head of the drainage ditch that receives runoff from much of the site, contained 11 inorganic analytes above background concentrations.

TCE and total xylenes were detected once at estimated concentrations in subsurface soil. The concentration of TCE is not indicative of a potential source area. Total xylenes in subsurface soil had been detected in an area where fuel-related contaminants had been detected by field screening. No PCBs were found in subsurface soils at Area G. One inorganic compound (sodium) was detected above background levels.

Pa-234, Th-231, and U-235 were detected in soils at Area G. Th-234, U-235, and Pa-234 are naturally occurring radionuclides. The U-235 result is questionable due to interferences in quantitation and identification. Ra-226 is an abundant, naturally occurring radionuclide and was detected in nearly all OU 1 samples.

In 1993, trichloroethene (TCE) was detected above its MCL and MEG in one downgradient groundwater sample. However, in 1994, TCE concentrations in groundwater were below regulatory limits. Several PAHs, indicative of fuel contaminants, were detected at estimated concentrations in a downgradient monitoring well location. Pesticides were detected at low, estimated concentrations in the samples in 1993, and only in deep bedrock groundwater in 1994. The occurrence of these compounds is attributable to the widespread application of pesticides at LAFB.

U-234, U-235, Ra-226, Th-230, and Th-232 were detected in groundwater above background concentrations. These isotopes are naturally occurring and were detected sporadically during the groundwater sampling rounds. Their detection above background levels is likely the result of natural background differences and analytical variability. Tritium was detected in one groundwater sample at a level approximately 100 times lower than the drinking water standard.

6.0 SUMMARY OF SITE RISKS

Human health and ecological risk assessments were conducted to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants at OU 1. The risk assessments followed a four-step process:

1) contaminant identification, which identified those hazardous substances that were of significant concern;

2) exposure assessment, which identified actual or potential exposure pathways, characterized potentially exposed populations and receptors, and determined the magnitude of possible exposure;

3) toxicity assessment, which considered the types and severity of adverse health effects associated with exposure to hazardous substances; and

4) risk characterization, which integrated the three earlier steps to estimate the potential risks posed by hazardous substances at the site, including carcinogenic and non-carcinogenic risks.

The methodologies of the baseline human health and ecological risk assessment for the site areas are discussed below, followed by a summary of the conclusions.

6.1 HUMAN HEALTH RISK ASSESSMENT

For the purpose of the human health baseline risk assessment, the areas within OU 1 were segregated as Area A and Areas B through G. Area A is situated west of East Loring Lake (see Figure 1-1) and is isolated from the remaining OU 1 areas, which are located to the east of the lake. The focus of the risk assessment was on both non-radiological (i.e., chemical) and radiological contaminants in soil, sediment, surface water, and groundwater. During the initial evaluation of data, contaminants of potential concern (CPCs) were identified. The rationale for exclusion of selected compounds is included in Tables 6-1 and 6-2. The CPCs were selected to represent potential hazards based on toxicity, concentration, frequency of detection, mobility, and persistence in the environment. A summary of the health effects associated with each CPC can be found in the RI Report (ABB-ES, 1995a).

TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean of all Samples*	Back-Ground**	MCL	MEG	CPC?	Notes
Area A Surface Soil* (0-2 feet bgs) (mg/kg)											
SEMIVOLATILE ORGANIC COMPOUNDS											
Acenaphthene	0 3600 -	0 4100	1 / 3	0 065	0 0650	0 15	NDB	-	-	Yes	Class[1]
Anthracene	0 3600 -	0 4100	1 / 3	0 065	0 0650	0 15	NDB	-	-	Yes	Class[1]
Benzo(a)Anthracene	0 3600 -	0 3600	2 / 3	0 047	0 1600	0 129	NDB	-	-	Yes	
Benzo(a)Pyrene	0 3600 -	0 4100	1 / 3	0 099	0 099	0 1613	NDB	-	-	Yes	
Benzo(b,k)Fluoranthene	0 3600 -	0 4100	1 / 3	0 22	0 22	0 33	NDB	-	-	Yes	
Carbazole	0 3600 -	0 4100	1 / 3	0 056	0 056	0 147	NDB	-	-	No	Toxicity Screening[2]
Chrysene	0 3600 -	0 3600	2 / 3	0 043	0 15	0 1243	NDB	-	-	Yes	Class[1]
Fluoranthene	0 3600 -	0 3600	2 / 3	0 11	0 42	0 2367	NDB	-	-	Yes	Class[1]
Fluorene	0 3600 -	0 4100	1 / 3	0 05	0 05	0 145	NDB	-	-	Yes	Class[1]
Indeno(1,2,3-c,d)Pyrene	0 3600 -	0 4100	1 / 3	0 049	0 049	0 1447	NDB	-	-	Yes	
Phenanthrene	0 3600 -	0 3600	2 / 3	0 09	0 36	0 21	NDB	-	-	Yes	Class[1]
Pyrene	0 3600 -	0 3600	2 / 3	0 075	0 28	0 1783	NDB	-	-	Yes	Class[1]
PESTICIDES/PCBs											
4,4 -DDE			3 / 3	0 0001	0 0019	0 0009	0 16	-	-	No	Toxicity Screening[2]
4,4'-DDT	0 0036 -	0 0036	2 / 3	0 0003	0 0035	0 0019	0 94	-	-	No	Toxicity Screening[2]
Aroclor-1260	0 0360 -	0 0380	1 / 3	0 061	0 061	0 0327	0 24	-	-	Yes	
Dieldrin	0 0036 -	0 0041	1 / 3	0 0008	0 0008	0 0016	0 0002	-	-	No	Toxicity Screening[2]
Endosulfan Sulfate	0 0036 -	0 0036	2 / 3	0 0025	0 0031	0 0025	0 0062	-	-	No	Toxicity Screening[2]
Endrin	0 0036 -	0 0041	1 / 3	0 0002	0 0002	0 0013	0 0003	-	-	No	Toxicity Screening[2]
Endrin Aldehyde	0 0036 -	0 0038	1 / 3	0 0046	0 0046	0 0028	0 0008	-	-	No	Toxicity Screening[2]
Endrin Ketone	0 0036 -	0 0041	1 / 3	0 0005	0 0005	0 0014	0 0030	-	-	No	Toxicity Screening[2]
Methoxychlor	0 0180 -	0 0180	2 / 3	0 0016	0 0026	0 0045	NDB	-	-	No	Toxicity Screening[2]
gamma-Chlordane	0 0018 -	0 0021	1 / 3	0 0009	0 0009	0 001	NDB	-	-	No	Toxicity Screening[2]
INORGANIC ANALYTES											
Aluminum			3 / 3	9800	16100	13933	25400	-	-	No	Background[3]
Arsenic			3 / 3	4 2	6 2	5 37	16 2	-	-	No	Background[3]
Barium			3 / 3	19 1	38 6	30 4	93 3	-	-	No	Background[3]
Beryllium	0 9300 -	1 0000	1 / 3	0 23	0 23	0 398	1 8	-	-	No	Background[3]
Calcium			3 / 3	1560	2830	2127	69700	-	-	No	Background[3], Essential Nutrient[4]
Chromium			3 / 3	20 2	33 1	27 9	56 9	-	-	No	Background[3]
Cobalt			3 / 3	6 9	11 6	9 97	18 5	-	-	No	Background[3]
Copper			3 / 3	12 5	22 1	18 27	65 6	-	-	No	Background[3]
Iron			3 / 3	18800	30200	26167	47100	-	-	No	Background[3]
Lead			3 / 3	10 6	23 4	16 2	22 6	-	-	No	State[5]
Magnesium			3 / 3	4580	7490	6460	12700	-	-	No	Background[3], Essential Nutrient[4]
Manganese			3 / 3	327	504	429 7	1400	-	-	No	Background[3]
Nickel			3 / 3	22	44 1	35 37	73	-	-	No	Background[3]
Potassium			3 / 3	537	986	831 3	2900	-	-	No	Background[3], Essential Nutrient[4]
Sodium			3 / 3	41 9	85 4	57 27	110	-	-	No	Background[3], Essential Nutrient[4]
Vanadium			3 / 3	13 8	21	18 57	40	-	-	No	Background[3]
Zinc			3 / 3	44 2	89 9	65	83 9	-	-	Yes	
Areas B-G' Surface Soil* (0-2 feet bgs) (mg/kg)											
SEMIVOLATILE ORGANIC COMPOUNDS											
Benzo(a)Anthracene	0 3600 -	0 4700	1 / 10	0 11	0 11	0 1925	NDB	-	-	Yes	
Benzo(a)Pyrene	0 3600 -	0 4700	1 / 9	0 038	0 038	0 1831	NDB	-	-	Yes	
Benzo(b,k)Fluoranthene	0 3600 -	0 4700	2 / 9	0 059	0 145	0 3459	NDB	-	-	Yes	
Butylbenzylphthalate	0 3500 -	0 4700	2 / 10	0 047	0 14	0 1782	NDB	-	-	No	Toxicity Screening[2]
Chrysene	0 3600 -	0 4700	2 / 10	0 04	0 12	0 1785	NDB	-	-	Yes	Class[1]
Di-n-butylphthalate	0 3500 -	0 4700	1 / 10	0 043	0 043	0 1848	NDB	-	-	No	Toxicity Screening[2]
Fluoranthene	0 3600 -	0 4700	3 / 10	0 037	0 077	0 1579	NDB	-	-	Yes	Class[1]
Phenanthrene	0 3500 -	0 4700	1 / 10	0 048	0 048	0 1917	NDB	-	-	Yes	Class[1]
Pyrene	0 3600 -	0 4700	3 / 10	0 049	0 085	0 1609	NDB	-	-	Yes	Class[1]
bis(2-Chloroisopropyl)ether	0 3500 -	0 4700	1 / 10	0 076	0 076	0 1856	NDB	-	-	No	Toxicity Screening[2]
bis(2-Ethylhexyl)phthalate	0 3500 -	0 4700	2 / 10	0 042	0 044	0 1701	NDB	-	-	No	Toxicity Screening[2]
PESTICIDES/PCBs											
4,4'-DDD	0 0036 -	0 0042	4 / 10	0 0002	0 011	0 0025	0 47	-	-	Yes	Class[1]
4,4'-DDE	0 0037 -	0 0042	7 / 10	0 0003	0 014	0 0033	0 16	-	-	Yes	Class[1]
4,4'-DDT	0 0036 -	0 0042	7 / 10	0 0015	0 042	0 0077	0 94	-	-	Yes	
Aldrin	0 0019 -	0 0025	1 / 10	0 0004	0 0004	0 0010	NDB	-	-	No	Toxicity Screening[2]
Aroclor-1260	0 0360 -	0 0480	4 / 10	0 009	0 1	0 0335	0 24	-	-	Yes	
Dieldrin	0 0036 -	0 0048	5 / 10	0 0001	0 0006	0 0013	0 0002	-	-	No	Toxicity Screening[2]
Endosulfan I	0 0019 -	0 0025	2 / 10	0 0001	0 0006	0 0009	NDB	-	-	No	Toxicity Screening[2]
Endosulfan II	0 0036 -	0 0048	1 / 10	0 0004	0 0004	0 0019	NDB	-	-	No	Toxicity Screening[2]
Endosulfan Sulfate	0 0036 -	0 0048	3 / 10	0 0005	0 0023	0 0019	0 0062	-	-	No	Toxicity Screening[2]
Endrin	0 0035 -	0 0048	2 / 10	0 0004	0 0007	0 0017	0 0003	-	-	No	Toxicity Screening[2]
Endrin Aldehyde	0 0035 -	0 0048	2 / 10	0 0005	0 0013	0 0018	0 0008	-	-	No	Toxicity Screening[2]
Heptachlor	0 0018 -	0 0025	1 / 10	0 0001	0 0001	0 0009	0 0002	-	-	No	Toxicity Screening[2]
Heptachlor Epoxide	0 0018 -	0 0025	3 / 10	0 0002	0 0013	0 0009	0 0001	-	-	No	Toxicity Screening[2]
Methoxychlor	0 0180 -	0 0250	2 / 10	0 0004	0 0005	0 0084	NDB	-	-	No	Toxicity Screening[2]
alpha-Chlordane	0 0019 -	0 0025	2 / 10	0 0006	0 013	0 0022	NDB	-	-	Yes	
delta-BHC	0 0019 -	0 0025	2 / 10	0 0002	0 0002	0 0009	0 0002	-	-	No	Toxicity Value[6]
gamma-Chlordane	0 0019 -	0 0025	3 / 10	0 0015	0 01	0 0022	NDB	-	-	Yes	

TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

	Range of SQLs	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean of all Samples*	Back-Ground**	MCL	MEG	CPC?	Notes
INORGANIC ANALYTES										
Aluminum		10 / 10	13900	20600	16855	25400	-	-	No	Background[3]
Arsenic		10 / 10	3 7	10 1	6 645	16 2	-	-	No	Background[3]
Barium		10 / 10	23 6	73	43 525	93 3	-	-	No	Background[3]
Beryllium	0 24 - 1 2	4 / 10	0 3	0 54	0 471	1 8	-	-	No	Background[3]
Calcium		10 / 10	659	23500	5192 25	69700	-	-	No	Background[3], Essential Nutrient[4]
Chromium		10 / 10	24 4	33 9	31 41	56 9	-	-	No	Background[3]
Cobalt		10 / 10	5 2	16 1	11 55	18 5	-	-	No	Background[3]
Copper		10 / 10	3 9	38 3	20 545	65 6	-	-	No	Background[3]
Iron		10 / 10	18800	32300	28455	47100	-	-	No	Background[3]
Lead	14 9 - 17	8 / 10	8 6	33 4	20 145	22 6	-	-	No	State[3]
Magnesium		10 / 10	3460	8950	7261 5	12700	-	-	No	Background[3], Essential Nutrient[4]
Manganese		10 / 10	248	999	627 05	1400	-	-	No	Background[3]
Mercury	0 11 - 0 14	2 / 10	0 12	2 6	0 317	0 17	-	-	Yes	
Nickel		10 / 10	12 2	46 5	37 475	73	-	-	No	Background[3]
Potassium		10 / 10	495	1110	826 15	2900	-	-	No	Background[3], Essential Nutrient[4]
Silver	0 85 - 1 5	1 / 10	1 2	1 2	0 6415	0 09	-	-	Yes	
Sodium	37 6 - 57	8 / 10	57 2	124	80 35	110	-	-	No	Essential Nutrient[4]
Vanadium		10 / 10	18 2	30 4	23 14	40	-	-	No	Background[3]
Zinc		10 / 10	34 8	141	81 11	83 9	-	-	Yes	
Areas B-G, Surface Soil Sample JSS-2580* (0-1 feet bgs) (mg/kg)										
SEMIVOLATILE ORGANIC COMPOUNDS										
2-Methylnaphthalene		1 / 1	36	36	36	NDB	-	-	Yes	
Anthracene		1 / 1	25	25	25	NDB	-	-	Yes	Class[1]
Fluoranthene		1 / 1	3 1	3 1	3 1	NDB	-	-	Yes	Class[1]
Naphthalene		1 / 1	10	10	10	NDB	-	-	Yes	Class[1]
Phenanthrene		1 / 1	12	12	12	NDB	-	-	Yes	Class[1]
Pyrene		1 / 1	8 2	8 2	8 2	NDB	-	-	Yes	Class[1]
PESTICIDES/PCBs (mg/kg)										
4,4'-DDT		1 / 1	0 021	0 021	0 021	0 94	-	-	Yes	
Aldrin		1 / 1	0 0036	0 0036	0 0036	NDB	-	-	Yes	
Endosulfan I		1 / 1	0 0013	0 0013	0 0013	NDB	-	-	No	Toxicity Screening[2]
Endosulfan II		1 / 1	0 12	0 12	0 12	NDB	-	-	No	Toxicity Screening[2]
Endosulfan Sulfate		1 / 1	0 024	0 024	0 024	0 0062	-	-	No	Toxicity Screening[2]
Endrin		1 / 1	0 0027	0 0027	0 0027	0 0003	-	-	No	Toxicity Screening[2]
Endrin Ketone		1 / 1	0 0052	0 0052	0 0052	0 003	-	-	No	Toxicity Screening[2]
Heptachlor Epoxide		1 / 1	0 011	0 011	0 011	0 0001	-	-	Yes	
alpha-Chlordane		1 / 1	0 0024	0 0024	0 0024	NDB	-	-	Yes	
beta-BHC		1 / 1	0 024	0 024	0 024	0 0002	-	-	Yes	
delta-BHC		1 / 1	0 011	0 011	0 011	0 0002	-	-	Yes	Class[1], Toxicity Value[6]
gamma-BHC (Lindane)		1 / 1	0 024	0 024	0 024	NDB	-	-	Yes	
gamma-Chlordane		1 / 1	0 0044	0 0044	0 0044	NDB	-	-	Yes	
INORGANIC ANALYTES										
Aluminum		1 / 1	22000	22000	22000	25400	-	-	No	Background[3]
Arsenic		1 / 1	4 8	4 8	4 8	16 2	-	-	No	Background[3]
Barium		1 / 1	157	157	157	93 3	-	-	Yes	
Cadmium		1 / 1	11 8	11 8	11 8	0 31	-	-	Yes	
Calcium		1 / 1	10700	10700	10700	69700	-	-	No	Background[3], Essential Nutrient[4]
Chromium		1 / 1	81 4	81 4	81 4	56 9	-	-	Yes	
Cobalt		1 / 1	19 3	19 3	19 3	18 5	-	-	No	Background[3]
Copper		1 / 1	790	790	790	65 6	-	-	Yes	
Iron		1 / 1	34400	34400	34400	47100	-	-	No	Background[3]
Lead		1 / 1	493	493	493	22 6	-	-	Yes	State[3]
Magnesium		1 / 1	13500	13500	13500	12700	-	-	No	Essential Nutrient[4]
Manganese		1 / 1	984	984	984	1400	-	-	No	Background[3]
Mercury		1 / 1	2 2	2 2	2 2	0 17	-	-	Yes	
Nickel		1 / 1	69 5	69 5	69 5	73	-	-	No	Background[3]
Potassium		1 / 1	2170	2170	2170	2900	-	-	No	Background[3], Essential Nutrient[4]
Sodium		1 / 1	139	139	139	110	-	-	No	Essential Nutrient[4]
Vanadium		1 / 1	68 3	68 3	68 3	40	-	-	Yes	
Zinc		1 / 1	1240	1240	1240	83 9	-	-	Yes	

TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean of all Samples*	Back-Ground**	MCL	MEG	CPC?	Notes
Areas B-G Subsurface Soil[a] (0-10 feet bgs) (mg/kg)											
VOLATILE ORGANIC COMPOUNDS											
1,2-Dichloroethene (total)	0 011 -	0 014	1 / 22	0 002	0 002	0 006	NDB	-	-	No	Frequency[7]
2-Butanone	0 011 -	0 014	1 / 22	0 008	0 008	0 006	NDB	-	-	No	Frequency[7]
Acetone	0 011 -	0 044	1 / 22	0 01	0 01	0 008	NDB	-	-	No	Frequency[7]
Methylene Chloride	0 006 -	0 068	7 / 22	0 005	0 024	0 011	NDB	-	-	No	Toxicity Screening[2]
Toluene	0 011 -	0 014	1 / 22	0 002	0 002	0 006	NDB	-	-	No	Frequency[7]
Trichloroethene	0 011 -	0 014	4 / 22	0 001	0 003	0 005	NDB	-	-	No	Toxicity Screening[2]
SEMIVOLATILE ORGANIC COMPOUNDS											
Benzo(a)Anthracene	0 36 -	0 47	1 / 21	0 11	0 11	0 19	NDB	-	-	No	Toxicity Screening[2], Frequency[7]
Benzo(a)Pyrene	0 36 -	0 47	1 / 20	0 038	0 038	0 186	NDB	-	-	No	Toxicity Screening[2], Frequency[7]
Benzo(b,k)Fluoranthene	0 36 -	0 47	2 / 20	0 059	0 145	0 363	NDB	-	-	No	Toxicity Screening[2]
Butylbenzylphthalate	0 35 -	0 47	3 / 21	0 047	0 14	0 178	NDB	-	-	No	Toxicity Screening[2]
Chrysene	0 36 -	0 47	2 / 21	0 04	0 12	0 184	NDB	-	-	No	Toxicity Screening[2]
Di-n-butylphthalate	0 35 -	0 47	1 / 21	0 043	0 043	0 187	NDB	-	-	No	Frequency[7]
Fluoranthene	0 36 -	0 47	3 / 21	0 037	0 077	0 174	NDB	-	-	No	Toxicity Screening[2]
Phenanthrene	0 35 -	0 47	1 / 21	0 048	0 048	0 19	NDB	-	-	No	Toxicity Screening[2], Frequency[7]
Pyrene	0 36 -	0 47	3 / 21	0 049	0 085	0 175	NDB	-	-	No	Toxicity Screening[2]
bis(2-Chloroisopropyl)ether	0 35 -	0 47	1 / 13	0 076	0 076	0 184	NDB	-	-	No	Frequency[7]
bis(2-Ethylhexyl)phthalate	0 35 -	0 47	2 / 21	0 042	0 044	0 18	NDB	-	-	No	Toxicity Screening[2]
PESTICIDES/PCBs											
4,4'-DDD	0 0036 -	0 019	4 / 21	0 0002	0 011	0 0025	0 47	-	-	No	Toxicity Screening[2]
4,4'-DDE	0 0036 -	0 019	7 / 21	0 0003	0 014	0 0029	0 16	-	-	No	Toxicity Screening[2]
4,4'-DDT	0 0036 -	0 019	7 / 21	0 0015	0 042	0 005	0 94	-	-	No	Toxicity Screening[2]
Aldrin	0 0018 -	0 0098	1 / 21	0 0004	0 0004	0 0012	NDB	-	-	No	Frequency[7]
Aroclor-1260	0 036 -	0 19	4 / 21	0 009	0 1	0 0294	0 24	-	-	Yes	
Dieldrin	0 0036 -	0 019	5 / 21	0 0001	0 0006	0 0019	0 0002	-	-	No	Toxicity Screening[2]
Endosulfan I	0 0018 -	0 0098	2 / 21	0 0001	0 0006	0 0011	NDB	-	-	No	Toxicity Screening[2]
Endosulfan II	0 0036 -	0 019	1 / 21	0 0004	0 0004	0 0022	NDB	-	-	No	Toxicity Screening[2], Frequency[7]
Endosulfan Sulfate	0 0036 -	0 019	3 / 21	0 0005	0 0023	0 0022	0 0062	-	-	No	Toxicity Screening[2]
Endrin	0 0035 -	0 019	2 / 21	0 0004	0 0007	0 0021	0 0003	-	-	No	Toxicity Screening[2]
Endrin Aldehyde	0 0035 -	0 019	2 / 21	0 0005	0 0013	0 0022	0 0008	-	-	No	Toxicity Screening[2]
Heptachlor	0 0018 -	0 0098	1 / 21	0 0001	0 0001	0 0011	0 0002	-	-	No	Toxicity Screening[2], Frequency[7]
Heptachlor Epoxide	0 0018 -	0 0098	3 / 21	0 0002	0 0013	0 0011	0 0001	-	-	No	Toxicity Screening[2]
Methoxychlor	0 018 -	0 098	4 / 21	0 0004	0 0059	0 0104	NDB	-	-	No	Toxicity Screening[2]
alpha-Chlordane	0 0018 -	0 0098	2 / 21	0 0006	0 013	0 0017	NDB	-	-	No	Toxicity Screening[2]
delta-BHC	0 0018 -	0 0098	2 / 21	0 0002	0 0002	0 0011	0 0002	-	-	No	Toxicity Value[6]
gamma-Chlordane	0 0018 -	0 0098	3 / 21	0 0015	0 01	0 0017	NDB	-	-	No	Toxicity Screening[2]
INORGANIC ANALYTES											
Aluminum			44 / 44	3900	23000	18408	25400	-	-	No	Background[3]
Antimony	7 8 -	20	1 / 44	30	30	8 9	NDB	-	-	No	Frequency[7]
Arsenic			44 / 44	0 7	110	10	16 2	-	-	Yes	
Barium	50 -	50	42 / 44	3 6	80	55 2	93 3	-	-	No	Background[3]
Beryllium	0 24 -	2	6 / 44	0 3	0 85	0 852	1 8	-	-	No	Background[3]
Cadmium	1 1 -	2	5 / 44	2	3	1	0 21	-	-	No	Toxicity Screening[2]
Calcium	2000 -	2000	27 / 44	659	23500	3486	69700	-	-	No	Background[3], Essential Nutrient[4]
Chromium			44 / 44	24 4	44	34 5	56 9	-	-	No	Background[3]
Cobalt	20 -	20	14 / 44	5 2	120	13	18 5	-	-	No	Toxicity Screening[2]
Copper			44 / 44	3 9	38 3	22	65 6	-	-	No	Background[3]
Iron			44 / 44	18800	47000	33756	47100	-	-	No	Background[3]
Lead	13 6 -	17	41 / 44	6 8	270	20 2	22 6	-	-	Yes	State[5]
Magnesium			44 / 44	3460	11000	7955	12700	-	-	No	Background[3], Essential Nutrient[4]
Manganese			44 / 44	248	1070	651	1400	-	-	No	Background[3]
Mercury	0 11 -	0 2	2 / 44	0 12	2 6	0 146	0 17	-	-	No	Frequency[7]
Nickel			44 / 44	12 2	70	42	73	-	-	No	Background[3]
Potassium	2000 -	2000	22 / 44	495	3000	1190	2900	-	-	No	Essential Nutrient[4]
Silver	0 85 -	3	1 / 44	1 2	1 2	1 2	0 09	-	-	No	Frequency[7]
Sodium	37 6 -	2000	10 / 44	57 2	126	729	110	-	-	No	Essential Nutrient[4]
Uranium (total U-234, U-235, U-238)			3 / 3	1 94	2 45	2 14	3 897	-	-	No	Toxicity Screening[2]
Vanadium			44 / 44	18 2	30 4	25	40	-	-	No	Background[3]
Zinc			44 / 44	34 8	80	94 3	83 9	-	-	No	Background[3]

TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean of all Samples*	Back-Ground**	MCL	MEG	COPC?	Notes
Area A 1994 Groundwater* (mg/L)											
SEMIVOLATILE ORGANIC COMPOUNDS											
Phenol			1 / 1	0 002	0 002	0 002	NA	–	–	No	Toxicity Screening[2]
INORGANIC ANALYTES											
Aluminum			1 / 1	1 18	1 18	1 18	NA	0 05 #	1 43	No	Toxicity Value[6]
Barium			1 / 1	0 0219	0 0219	0 0219	NA	2	1 5	No	Toxicity Screening[2]
Calcium			1 / 1	110	110	110	NA	–	–	No	Essential Nutrient[4]
Chromium			1 / 1	0 311	0 311	0 311	NA	0 1	0 1	Yes	
Copper			1 / 1	0 0254	0 0254	0 0254	NA	1 3 T	–	No	Toxicity Screening[2]
Iron			1 / 1	4 31	4 31	4 31	NA	0 3 #	–	Yes	
Lead			1 / 1	0 0022	0 0022	0 0022	NA	0 015 T	0 02	No	State[5]
Magnesium			1 / 1	7 74	7 74	7 74	NA	–	–	No	Essential Nutrient[4]
Manganese			1 / 1	0 174	0 174	0 174	NA	0 05 #	0 2	Yes	
Nickel			1 / 1	0 173	0 173	0 173	NA	0 1	0 15	Yes	
Potassium			1 / 1	0 983	0 983	0 983	NA	–	–	No	Essential Nutrient[4]
Sodium			1 / 1	7 65	7 65	7 65	NA	–	–	No	Essential Nutrient[4]
Zinc			1 / 1	0 139	0 139	0 139	NA	5 #	–	No	Toxicity Screening[2]
Area A 1993 Groundwater* (mg/L)											
VOLATILE ORGANIC COMPOUNDS											
Total Xylenes			1 / 1	0 001	0 001	0 001	NA	10	0 6	No	Toxicity Screening[2]
PESTICIDES/PCBs											
Endosulfan Sulfate			1 / 1	0 0000009	0 0000009	0 0000009	NA	–	–	No	Toxicity Screening[2]
Endrin Aldehyde			1 / 1	0 0000018	0 0000018	0 0000018	NA	–	–	No	Toxicity Screening[2]
Heptachlor			1 / 1	0 000012	0 000012	0 000012	NA	0 0004	0 00008	No	Toxicity Screening[2]
INORGANIC ANALYTES											
Aluminum			1 / 1	30	30	30	NA	0 05 #	1 43	No	Toxicity Value[6]
Arsenic			1 / 1	0 009	0 009	0 009	NA	0 05	–	Yes	
Calcium			1 / 1	128	128	128	NA	–	–	No	Essential Nutrient[4]
Chromium			1 / 1	0 0733	0 0733	0 0733	NA	0 1	0 1	Yes	
Copper			1 / 1	0 0351	0 0351	0 0351	NA	1 3 T	–	No	Toxicity Screening[2]
Iron			1 / 1	45 3	45 3	45 3	NA	0 3 #	–	Yes	
Lead			1 / 1	0 0135	0 0135	0 0135	NA	0 015 T	0 02	No	State[5]
Magnesium			1 / 1	19 5	19 5	19 5	NA	–	–	No	Essential Nutrient[4]
Manganese			1 / 1	0 683	0 683	0 683	NA	0 05 #	0 2	Yes	
Nickel			1 / 1	0 0687	0 0687	0 0687	NA	0 1	0 15	Yes	
Potassium			1 / 1	6 17	6 17	6 17	NA	–	–	No	Essential Nutrient[4]
Sodium			1 / 1	9 54	9 54	9 54	NA	–	–	No	Essential Nutrient[4]
Zinc			1 / 1	0 101	0 101	0 101	NA	5 #	–	No	Toxicity Screening[2]
Areas B-F 1994 Bedrock Groundwater* (mg/L)											
VOLATILE ORGANIC COMPOUNDS											
4-Methyl-2-pentanone	0 002 –	0 002	2 / 12	0 0001	0 0001	0 0001	NDB	–	–	No	Toxicity Screening[2]
Total Xylenes	0 002 –	0 002	1 / 12	0 0002	0 0002	0 0009	NDB	10	0 6	No	Toxicity Screening[2]
Trichloroethene	0 002 –	0 002	1 / 12	0 0002	0 0002	0 0009	NDB	0 005	0 005	No	Toxicity Screening[2]
SEMIVOLATILE ORGANIC COMPOUNDS											
2-Methylnaphthalene	0 01 –	0 01	1 / 12	0 004	0 004	0 0049	NDB	–	–	No	Toxicity Screening[2]
Di-n-butylphthalate	0 01 –	0 01	2 / 12	0 0006	0 0007	0 0043	NDB	–	0 22	No	Toxicity Screening[2]
Phenol	0 01 –	0 01	1 / 12	0 001	0 001	0 0048	NDB	–	–	No	Toxicity Screening[2]
PESTICIDES/PCBs											
4,4'-DDT	0 00001 –	0 00001	1 / 12	0 000011	0 000011	0 00001	NDB	–	0 00083	No	Toxicity Screening[2]
INORGANIC ANALYTES											
Aluminum			12 / 12	0 402	33 4	6 7631	0 145	0 05 #	1 43	No	Toxicity Value[6]
Arsenic	0 0015 –	0 0015	5 / 12	0 0017	0 0084	0 0018	NDB	0 05	–	Yes	
Barium			12 / 12	0 0119	0 222	0 0663	0 0639	2	1 5	No	Toxicity Screening[2]
Beryllium	0 0003 –	0 0003	2 / 12	0 001	0 0012	0 0003	NDB	0 004	–	Yes	
Calcium			12 / 12	41 8	262	104 7250	163 897	–	–	No	Essential Nutrient[4]
Chromium	0 0074 –	0 0074	7 / 12	0 0095	0 0404	0 0145	NDB	0 1	0 1	Yes	
Copper	0 0086 –	0 0086	6 / 12	0 0095	0 103	0 0157	NDB	1 3 T	–	No	Toxicity Screening[2]
Iron			12 / 12	0 418	45 8	10 2228	0 313	0 3 #	–	Yes	
Lead	0 0007 –	0 0007	11 / 12	0 00076	0 041	0 0084	NDB	0 015 T	0 02	Yes	State[5]
Magnesium			12 / 12	3 06	30 3	14 7600	22 91	–	–	No	Essential Nutrient[4]
Manganese			12 / 12	0 0061	1 19	0 2361	0 0249	0 05 #	0 2	Yes	
Mercury	0 0001 –	0 0001	1 / 12	0 00011	0 00011	0 0001	NDB	0 002	0 002	No	Toxicity Screening[2]
Nickel	0 0226 –	0 0226	3 / 12	0 0328	0 0447	0 0170	NDB	0 1	0 15	No	Toxicity Screening[2]
Potassium			12 / 12	0 542	5 65	1 6897	0 314	–	–	No	Essential Nutrient[4]
Sodium			12 / 12	2 25	23 2	6 4933	15 213	–	–	No	Essential Nutrient[4]
Vanadium	0 012 –	0 012	1 / 12	0 0194	0 0194	0 0071	NDB	–	–	No	Toxicity Screening[2]
Zinc	0 0187 –	0 0618	2 / 12	0 154	0 183	0 0418	NDB	5 #	–	No	Toxicity Screening[2]

TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean of all Samples*	Back-Ground**	MCL	MEG	COPC?	Notes
Areas B-F 1993 Bedrock Groundwater* (mg/L)											
VOLATILE ORGANIC COMPOUNDS											
Chloroform	0 001 -	0 001	1 / 12	0 002	0 002	0 0006	NDB	0 1	-	No	Toxicity Screening[2]
Ethylbenzene	0 001 -	0 001	1 / 12	0 0005	0 0005	0 0005	NDB	0 7	0 7	No	Toxicity Screening[2]
Toluene	0 001 -	0 001	1 / 12	0 0006	0 0006	0 0005	NDB	1	1 4	No	Toxicity Screening[2]
Total Xylenes	0 002 -	0 002	3 / 12	0 0007	0 002	0 0008	NDB	10	0 6	No	Toxicity Screening[2]
Trichloroethene	0 001 -	0 001	1 / 12	0 0005	0 0005	0 0005	NDB	0 005	0 005	No	Toxicity Screening[2]
SEMIVOLATILE ORGANIC COMPOUNDS											
4-Nitrophenol	0 025 -	0 025	1 / 12	0 001	0 001	0 0115	NDB	-	0 083	No	Toxicity Value[5]
Di-n-octylphthalate	0 01 -	0 01	1 / 12	0 001	0 001	0 0047	NDB	-	-	No	Toxicity Screening[2]
PESTICIDES/PCBs											
4,4'-DDE	0 00002 -	0 00002	2 / 12	0 0000007	0 0000035	0 0000087	NDB	-	-	No	Toxicity Screening[2]
4,4'-DDT	0 00002 -	0 00002	1 / 12	0 0000013	0 0000013	0 0000093	NDB	-	0 00083	No	Toxicity Screening[2]
Aldrin	0 00001 -	0 00001	2 / 12	0 000002	0 000002	0 0000045	NDB	-	-	No	Toxicity Screening[2]
Dieldrin	0 00002 -	0 00002	2 / 12	0 0000007	0 0000011	0 0000085	NDB	-	0 00002	No	Toxicity Screening[2]
Endosulfan Sulfate	0 00002 -	0 00002	3 / 12	0 0000006	0 000004	0 0000080	NDB	-	-	No	Toxicity Screening[2]
Heptachlor	0 00001 -	0 00001	3 / 12	0 0000004	0 000015	0 0000052	NDB	0 0004	0 00008	No	Toxicity Screening[2]
Heptachlor Epoxide	0 00001 -	0 00001	4 / 12	0 0000011	0 0000055	0 0000043	NDB	0 0002	0 00004	No	Toxicity Screening[2]
Methoxychlor	0 0001 -	0 0001	4 / 12	0 0000018	0 0000044	0 0000342	NDB	0 04	0 1	No	Toxicity Screening[2]
alpha-BHC	0 00001 -	0 00001	1 / 12	0 0000017	0 0000017	0 0000047	NDB	-	-	No	Toxicity Screening[2]
alpha-Chlordane	0 00001 -	0 00001	2 / 12	0 0000003	0 0000025	0 0000044	NDB	0 002	0 00027	No	Toxicity Screening[2]
delta-BHC	0 00001 -	0 00001	1 / 12	0 0000006	0 000001	0 0000047	NDB	-	-	No	Toxicity Value[5]
gamma-BHC (Lindane)	0 00001 -	0 00001	2 / 12	0 0000015	0 0000032	0 0000046	NDB	0 0002	0 0002	No	Toxicity Screening[2]
gamma-Chlordane	0 00001 -	0 00001	3 / 12	0 0000005	0 0000008	0 0000039	NDB	0 002	0 00027	No	Toxicity Screening[2]
INORGANIC ANALYTES											
Aluminum			12 / 12	0 668	41 3	11 0077	0 145	0 05 #	1 43	No	Toxicity Value[5]
Arsenic	0 0052 -	0 0052	5 / 12	0 0054	0 0083	0 0042	NDB	0 05	-	Yes	
Barium	0 0162 -	0 135	2 / 12	0 186	0 226	0 0500	0 0639	2	1 5	No	Toxicity Screening[2]
Calcium			12 / 12	20 3	257	109 4833	163 897	-	-	No	Essential Nutrient[4]
Chromium	0 0092 -	0 0092	10 / 12	0 0127	0 163	0 0335	NDB	0 1	0 1	Yes	
Copper	0 0111 -	0 0111	4 / 12	0 0123	0 127	0 0180	NDB	1 3 T	-	No	Toxicity Screening[2]
Iron			12 / 12	0 4	40 6	11 7288	0 313	0 3 #	-	Yes	
Lead	0 002 -	0 002	7 / 12	0 0023	0 0272	0 0057	NDB	0 015 T	0 02	Yes	State[3]
Magnesium			12 / 12	4 95	24 7	13 1442	22 91	-	-	No	Essential Nutrient[4]
Manganese	0 0043 -	0 0043	11 / 12	0 0217	0 917	0 2358	0 0249	0 05 #	0 2	Yes	
Mercury	0 0002 -	0 0002	1 / 12	0 00027	0 00027	0 0001	NDB	0 002	0 002	No	Toxicity Screening[2]
Nickel	0 0142 -	0 0142	5 / 12	0 0185	0 0458	0 0153	NDB	0 1	0 15	No	Toxicity Screening[2]
Potassium	1 76 -	1 76	10 / 12	1 79	31 9	5 3250	0 314	-	-	No	Essential Nutrient[4]
Sodium			12 / 12	2 87	34 3	10 6879	15 213	-	-	No	Essential Nutrient[4]
Zinc	0 01 -	0 043	2 / 12	0 106	0 171	0 0322	NDB	5 #	-	No	Toxicity Screening[2]
Areas B-F 1994 Overburden Groundwater* (mg/L)											
INORGANIC ANALYTES											
Aluminum			1 / 1	28 9	28 9	28 9	NA	0 05 #	1 43	No	Toxicity Value[5]
Arsenic			1 / 1	0 0025	0 0025	0 0025	NA	0 05	-	Yes	
Barium			1 / 1	0 129	0 129	0 129	NA	2	1 5	No	Toxicity Screening[2]
Beryllium			1 / 1	0 00036	0 00036	0 00036	NA	0 004	-	Yes	
Calcium			1 / 1	106	106	106	NA	-	-	No	Essential Nutrient[4]
Chromium			1 / 1	0 208	0 208	0 208	NA	0 1	0 1	Yes	
Copper			1 / 1	0 0673	0 0673	0 0673	NA	1 3 T	-	No	Toxicity Screening[2]
Iron			1 / 1	54 7	54 7	54 7	NA	0 3 #	-	Yes	
Lead			1 / 1	0 046	0 046	0 046	NA	0 015 T	0 02	Yes	State[3]
Magnesium			1 / 1	20 2	20 2	20 2	NA	-	-	No	Essential Nutrient[4]
Manganese			1 / 1	1 23	1 23	1 23	NA	0 05 #	0 2	Yes	
Nickel			1 / 1	0 0786	0 0786	0 0786	NA	0 1	0 15	No	Toxicity Screening[2]
Potassium			1 / 1	2 87	2 87	2 87	NA	-	-	No	Essential Nutrient[4]
Sodium			1 / 1	3 61	3 61	3 61	NA	-	-	No	Essential Nutrient[4]
Vanadium			1 / 1	0 0221	0 0221	0 0221	NA	-	-	No	Toxicity Screening[2]
Zinc			1 / 1	0 173	0 173	0 173	NA	5 #	-	No	Toxicity Screening[2]

TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

	Range of SQLs		Frequency of Detection		Minimum Detected Concentration	Maximum Detected Concentration	Mean of all Samples*	Back-Ground**	MCL	MEG	CPC?	Notes
Areas B-F, 1993 Overburden Groundwater[a] (mg/L)												
VOLATILE ORGANIC COMPOUNDS												
Tetrachloroethene			1 /	1	0 003	0 003	0 003	NA	0 005	0 003	No	Toxicity Screening[2]
Toluene			1 /	1	0 001	0 001	0 001	NA	1	1 4	No	Toxicity Screening[2]
Total Xylenes			1 /	1	0 003	0 003	0 003	NA	10	0 6	No	Toxicity Screening[2]
SEMIVOLATILE ORGANIC COMPOUNDS												
4-Nitrophenol			1 /	1	0 002	0 002	0 002	NA	–	0 083	No	Toxicity Value[6]
PESTICIDES/PCBs												
gamma-BHC (Lindane)			1 /	1	0 0000015	0 0000015	0 0000015	NA	0 0002	0 0002	No	Toxicity Screening[2]
INORGANIC ANALYTES												
Aluminum			1 /	1	124	124	124	NA	0 05 #	1 43	No	Toxicity Value[6]
Arsenic			1 /	1	0 011	0 011	0 011	NA	0 05	–	Yes	
Barium			1 /	1	0 468	0 468	0 468	NA	2	1 5	No	Toxicity Screening[2]
Calcium			1 /	1	192	192	192	NA	–	–	No	Essential Nutrient[4]
Chromium			1 /	1	0 19	0 19	0 19	NA	0 1	0 1	Yes	
Cobalt			1 /	1	0 0922	0 0922	0 0922	NA	–	–	No	Toxicity Screening[2]
Copper			1 /	1	0 119	0 119	0 119	NA	1 3 T	–	No	Toxicity Screening[2]
Iron			1 /	1	176	176	176	NA	0 3 #	–	Yes	
Lead			1 /	1	0 0681	0 0681	0 0681	NA	0 015 T	0 02	Yes	State[5]
Magnesium			1 /	1	58 2	58 2	58 2	NA	–	–	No	Essential Nutrient[4]
Manganese			1 /	1	3 43	3 43	3 43	NA	0 05 #	0 2	Yes	
Mercury			1 /	1	0 00026	0 00026	0 00026	NA	0 002	0 002	No	Toxicity Screening[2]
Nickel			1 /	1	0 244	0 244	0 244	NA	0 1	0 15	Yes	Exceeds MCL and MEG[8]
Potassium			1 /	1	12 4	12 4	12 4	NA	–	–	No	Essential Nutrient[4]
Sodium			1 /	1	5 18	5 18	5 18	NA	–	–	No	Essential Nutrient[4]
Vanadium			1 /	1	0 108	0 108	0 108	NA	–	–	Yes	
Zinc			1 /	1	0 346	0 346	0 346	NA	5 #	–	No	Toxicity Screening[2]
Area G 1994 Groundwater[a] (mg/L)												
VOLATILE ORGANIC COMPOUNDS												
1,2-Dichloroethene (total)	0 002 –	0 002	2 /	4	0 0007	0 001	0 0009	NDB	–	–	No	Toxicity Screening[2]
2-Hexanone	0 002 –	0 002	1 /	4	0 011	0 011	0 00225	NDB	–	–	No	Toxicity Value[6]
Acetone	0 002 –	0 004	1 /	4	0 007	0 007	0 00275	NDB	–	–	No	Toxicity Screening[2]
Benzene	0 002 –	0 002	1 /	4	0 0002	0 0002	0 0008	NDB	0 005	0 005	No	Toxicity Screening[2]
Bromoform	0 002 –	0 002	1 /	4	0 0002	0 0002	0 0008	NDB	0 1	–	No	Toxicity Screening[2]
Chloromethane	0 002 –	0 002	1 /	4	0 0002	0 0002	0 0008	NDB	–	0 003	No	Toxicity Screening[2]
Ethylbenzene	0 002 –	0 002	2 /	4	0 0002	0 0004	0 00065	NDB	0 7	0 7	No	Toxicity Screening[2]
Total Xylenes	0 002 –	0 002	1 /	4	0 0009	0 0009	0 000925	NDB	10	0 6	No	Toxicity Screening[2]
Trichloroethene	0 002 –	0 002	2 /	4	0 002	0 004	0 002	NDB	0 005	0 005	No	Toxicity Screening[2]
SEMIVOLATILE ORGANIC COMPOUNDS												
2-Methylnaphthalene	0 01 –	0 01	1 /	4	0 002	0 002	0 00425	NDB	–	–	No	Toxicity Screening[2]
Acenaphthene	0 01 –	0 01	1 /	4	0 004	0 004	0 004875	NDB	–	–	No	Toxicity Screening[2]
Anthracene	0 01 –	0 01	1 /	4	0 0009	0 001	0 0039875	NDB	–	–	No	Toxicity Screening[2]
Dibenzofuran	0 01 –	0 01	1 /	4	0 002	0 002	0 004625	NDB	–	–	No	Toxicity Screening[2]
Fluorene	0 01 –	0 01	1 /	4	0 005	0 005	0 005	NDB	–	–	No	Toxicity Screening[2]
Naphthalene	0 01 –	0 01	1 /	4	0 003	0 004	0 004625	NDB	–	–	No	Toxicity Screening[2]
Phenanthrene	0 01 –	0 01	1 /	4	0 006	0 007	0 005375	NDB	–	–	No	Toxicity Screening[2]
Phenol	0 01 –	0 01	1 /	4	0 001	0 001	0 004	NDB	–	–	No	Toxicity Screening[2]
PESTICIDES/PCBs												
Aldrin	0 000005 –	0 000005	1 /	4	0 000006	0 000006	0 000002938	NDB	–	–	Yes	
Endosulfan Sulfate	0 00001 –	0 00001	1 /	4	0 000015	0 000015	0 00000525	NDB	–	–	No	Toxicity Screening[2]
Endrin Aldehyde	0 00001 –	0 00001	1 /	4	0 000018	0 000018	0 000006625	NDB	–	–	No	Toxicity Screening[2]
Heptachlor	0 000005 –	0 000005	1 /	4	0 000011	0 000015	0 000005125	NDB	0 0004	0 00008	No	Toxicity Screening[2]
alpha-BHC	0 000005 –	0 000005	1 /	4	0 000007	0 000007	0 000003063	NDB	–	–	No	Toxicity Screening[2]
INORGANICS												
Aluminum			4 /	4	0 323	3 18	2 09075	0 145	0 05 #	1 43	No	Toxicity Value[6]
Arsenic	0 0015 –	0 0015	2 /	4	0 0052	0 0056	0 003025	NDB	0 05	–	Yes	
Barium			4 /	4	0 0104	0 112	0 0592375	0 0639	2	1 5	Yes	
Calcium			4 /	4	53	149	100 175	163 897	–	–	No	Essential Nutrient[4]
Chromium	0 0074 –	0 0074	1 /	4	0 0156	0 0156	0 006675	NDB	0 1	0 1	Yes	
Copper	0 0086 –	0 0086	1 /	4	0 0134	0 0134	0 0054375	NDB	1 3 T	–	No	Toxicity Screening[2]
Iron			4 /	4	0 226	9 87	3 34575	0 313	0 3 #	–	Yes	
Lead	0 0007 –	0 0007	3 /	4	0 00098	0 0038	0 00202	NDB	0 015 T	0 02	No	State[5]
Magnesium			4 /	4	4 76	12 6	7 1975	22 91	–	–	No	Essential Nutrient[4]
Manganese			4 /	4	0 0099	0 29	0 0948	0 0249	0 05 #	0 2	Yes	
Potassium			4 /	4	0 418	23	6 379	0 314	–	–	No	Essential Nutrient[4]
Sodium			4 /	4	3 35	92 5	26 16625	15 213	–	–	No	Essential Nutrient[4]

TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean of all Samples*	Back-Ground**	MCL	MEG	CPC?	Notes
Area G 1993 Groundwater[a] (mg/L)											
VOLATILE ORGANIC COMPOUNDS											
2-Hexanone			1 / 1	0 032	0 032	0 032	NDB	–	–	No	Toxicity Value[6]
Chloroform	0 001 –	0 001	1 / 4	0 001	0 001	0 000625	NDB	0 1	–	No	Toxicity Screening[2]
Ethylbenzene	0 001 –	0 001	2 / 4	0 0006	0 001	0 0006875	NDB	0 7	0 7	No	Toxicity Screening[2]
Toluene	0 001 –	0 001	1 / 4	0 0008	0 0008	0 000575	NDB	1	1 4	No	Toxicity Screening[2]
Total Xylenes	0 001 –	0 001	2 / 4	0 002	0 003	0 001625	NDB	10	0 6	No	Toxicity Screening[2]
Trichloroethene	0 001 –	0 001	3 / 4	0 001	0 006	0 0025	NDB	0 005	0 005	Yes	Exceeds MCL and MEG[6]
cis-1,2-Dichloroethene	0 001 –	0 001	2 / 4	0 001	0 002	0 001	NDB	0 07	0 07	Yes	Class[1]
SEMIVOLATILE ORGANIC COMPOUNDS											
2-Methylnaphthalene	0 01 –	0 01	2 / 4	0 002	0 008	0 005	NDB	–	–	No	Toxicity Screening[2]
Acenaphthene	0 01 –	0 01	1 / 4	0 005	0 006	0 005125	NDB	–	–	No	Toxicity Screening[2]
Fluorene	0 01 –	0 01	1 / 4	0 007	0 007	0 0055	NDB	–	–	No	Toxicity Screening[2]
Naphthalene	0 01 –	0 01	1 / 4	0 005	0 005	0 005	NDB	–	–	No	Toxicity Screening[2]
Phenanthrene	0 01 –	0 01	1 / 4	0 012	0 013	0 008875	NDB	–	–	No	Toxicity Screening[2]
bis(2-Ethylhexyl)phthalate	0 024 –	0 046	1 / 4	0 15	0 15	0 05	NDB	0 006	0 025	Yes	
PESTICIDES/PCBs											
Aldrin	0 00001 –	0 00001	2 / 4	0 0000019	0 0000023	0 000003937	NDB	–	–	No	Toxicity Screening[2]
Dieldrin	0 00002 –	0 00002	2 / 4	0 000001	0 0000018	0 000006825	NDB	–	0 00002	No	Toxicity Screening[2]
Endosulfan II	0 00002 –	0 00002	1 / 4	0 0000013	0 0000013	0 000008912	NDB	–	–	No	Toxicity Screening[2]
Endrin Aldehyde	0 00002 –	0 00002	1 / 4	0 0000025	0 0000025	0 000009062	NDB	–	–	No	Toxicity Screening[2]
Heptachlor	0 00001 –	0 00001	1 / 4	0 0000024	0 0000024	0 00000435	NDB	0 0004	0 00008	No	Toxicity Screening[2]
alpha-BHC	0 00001 –	0 00001	1 / 4	0 0000015	0 0000015	0 000004125	NDB	–	–	No	Toxicity Screening[2]
alpha-Chlordane	0 00001 –	0 00001	1 / 4	0 0000025	0 0000025	0 000004687	NDB	0 002	0 00027	No	Toxicity Screening[2]
delta-BHC	0 00001 –	0 00001	2 / 4	0 0000021	0 0000081	0 000004562	NDB	–	–	No	Toxicity Value[6]
gamma-BHC (Lindane)	0 00001 –	0 00001	2 / 4	0 0000007	0 0000029	0 000003937	NDB	0 0002	0 0002	No	Toxicity Screening[2]
gamma-Chlordane	0 00001 –	0 00001	1 / 4	0 0000081	0 0000081	0 000005137	NDB	0 002	0 00027	No	Toxicity Screening[2]
INORGANIC ANALYTES											
Aluminum			4 / 4	1 15	32 7	13 65125	0 1450	0 05 #	1 43	No	Toxicity Value[6]
Arsenic	0 0052 –	0 0052	1 / 4	0 0064	0 0098	0 003975	NDB	0 05	–	Yes	
Barium	0 145 –	0 145	3 / 4	0 0289	0 16	0 0778125	0 0639	2	1 5	Yes	
Calcium			4 / 4	38 5	170	91 7	163 8970	–	–	No	Essential Nutrient[4]
Chromium			4 / 4	0 0112	0 0212	0 015125	NDB	0 1	0 1	Yes	
Cobalt	0 0136 –	0 0136	1 / 4	0 0165	0 0165	0 0087	NDB	–	–	No	Toxicity Screening[2]
Copper	0 0112 –	0 0112	2 / 4	0 0129	0 0173	0 0094375	NDB	1 3 T	–	No	Toxicity Screening[2]
Iron			4 / 4	0 489	18 3	10 52475	0 3130	0 3 #	–	Yes	
Lead	0 002 –	0 002	3 / 4	0 0025	0 0202	0 008175	NDB	0 015 T	0 02	Yes	State[5]
Magnesium			4 / 4	1 14	14 5	9 735	22 9100	–	–	No	Essential Nutrient[4]
Manganese			4 / 4	0 0139	0 455	0 2761	0 0249	0 05 #	0 2	Yes	
Nickel	0 0142 –	0 0142	1 / 4	0 0173	0 0185	0 0098	NDB	0 1	0 15	No	Toxicity Screening[2]
Potassium			4 / 4	2 21	15 5	5 72625	0 3140	–	–	No	Essential Nutrient[4]
Sodium			4 / 4	4 85	58 2	22 28	15 2130	–	–	No	Essential Nutrient[4]
MISCELLANEOUS PARAMETERS											
Low Detection Limit Vinyl Chloride	0 0001 –	0 0001	1 / 4	0 0001	0 0001	0 0000625	NDB	0 002	0 00015	Yes	Class[1]
Area G 1992 Groundwater[a] (mg/L)											
VOLATILE ORGANIC COMPOUNDS											
1,2-Dichloroethene (total)			1 / 1	0 005	0 005	0 005	NDB	–	–	Yes	
Acetone			1 / 1	0 018	0 018	0 018	NDB	–	–	Yes	
Ethylbenzene			1 / 1	0 001	0 001	0 001	NDB	0 7	0 7	Yes	
Total Xylenes			1 / 1	0 003	0 003	0 003	NDB	10	0 6	Yes	
Trichloroethene			1 / 1	0 002	0 002	0 002	NDB	0 005	0 005	Yes	
INORGANIC ANALYTES											
Uranium (total U-234, U-235, U-238)			1 / 1	1 167	1 167	1 167	NDB	20	–	Yes	

TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean of all Samples*	Back-Ground**	MCL	MEG	CPC?	Notes
Area A: Surface Water (mg/L)											
PESTICIDES/PCBs											
Heptachlor			1 / 1	0 0000011	0 0000011	0 0000011	0 0003	–	–	Yes	
INORGANIC ANALYTES											
Calcium			1 / 1	52 6	52 6	52 6	67200	–	–	No	Background[3], Essential Nutrient[4]
Copper			1 / 1	0 0123	0 0123	0 0123	2 7	–	–	Yes	
Iron			1 / 1	0 486	0 486	0 486	961	–	–	No	Background[3]
Magnesium			1 / 1	2 85	2 85	2 85	5280	–	–	No	Background[3], Essential Nutrient[4]
Manganese			1 / 1	0 0453	0 0453	0 0453	62 6	–	–	No	Background[3]
Sodium			1 / 1	4 3	4 3	4 3	6520	–	–	No	Background[3], Essential Nutrient[4]
Area A: Sediment (mg/kg)											
SEMIVOLATILE ORGANIC COMPOUNDS											
2-Methylphenol	0 4 –	0 46	2 / 3	0 097	0 13	0 147		–	–	No	Toxicity Screening[2]
Acenaphthene	0 4 –	0 51	1 / 3	0 16	0 16	0 210		–	–	Yes	Class[1]
Anthracene	0 4 –	0 51	1 / 3	0 21	0 21	0 227		–	–	Yes	Class[1]
Benzo(a)Anthracene	0 4 –	0 46	2 / 3	0 072	0 47	0 252		–	–	Yes	
Benzo(a)Pyrene	0 4 –	0 51	1 / 3	0 36	0 36	0 277		–	–	Yes	
Benzo(b,k)Fluoranthene			3 / 3	0 047	0 67	0 331		–	–	Yes	
Benzo(g,h,i)perylene	0 4 –	0 51	1 / 3	0 13	0 13	0 200		–	–	Yes	Class[1]
Carbazole	0 4 –	0 51	1 / 3	0 2	0 2	0 223		–	–	No	Toxicity Screening[2]
Chrysene	0 4 –	0 4	3 / 3	0 048	0 46	0 225		–	–	Yes	Class[1]
Dibenzofuran	0 4 –	0 51	1 / 3	0 072	0 072	0 181		–	–	No	Toxicity Screening[2]
Fluoranthene	0 4 –	0 4	3 / 3	0 091	1 3	0 549		–	–	Yes	Class[1]
Fluorene	0 4 –	0 51	1 / 3	0 11	0 11	0 193		–	–	Yes	Class[1]
Indeno(1,2,3-c,d)Pyrene	0 4 –	0 51	1 / 3	0 21	0 21	0 227		–	–	Yes	
Phenanthrene	0 4 –	0 4	3 / 3	0 063	0 94	0 401		–	–	Yes	Class[1]
Pyrene			3 / 3	0 069	0 72	0 315		–	–	Yes	Class[1]
PESTICIDES/PCBs											
4,4'-DDE	0 0052 –	0 0052	2 / 3	0 0007	0 012	0 0033	0 077	–	–	No	Toxicity Screening[2]
4,4'-DDT			3 / 3	0 0005	0 0018	0 0013	0 2	–	–	No	Toxicity Screening[2]
Aldrin	0 0021 –	0 0033	1 / 3	0 0051	0 0051	0 002	0 0003	–	–	No	Toxicity Screening[2]
Aroclor-1254	0 045 –	0 064	1 / 3	0 22	0 22	0 0598	0 33	–	–	Yes	
Aroclor-1260	0 052 –	0 052	2 / 3	0 14	0 74	0 2387	0 14	–	–	Yes	
Dieldrin	0 0045 –	0 0052	2 / 3	0 0003	0 0059	0 0033	0 0007	–	–	No	Toxicity Screening[2]
Endosulfan Sulfate	0 004 –	0 004	3 / 3	0 0016	0 0046	0 0033	0 0051	–	–	No	Toxicity Screening[2]
Endrin	0 004 –	0 0064	2 / 3	0 0004	0 0025	0 0019	0 0008	–	–	No	Toxicity Screening[2]
Endrin Aldehyde	0 0052 –	0 0052	2 / 3	0 0036	0 014	0 0085	0 0058	–	–	No	Toxicity Screening[2]
Heptachlor Epoxide	0 002 –	0 0027	1 / 3	0 0004	0 0004	0 0009	0 0006	–	–	No	Toxicity Screening[2]
Methoxychlor	0 021 –	0 027	1 / 3	0 002	0 002	0 0088	0 0013	–	–	No	Toxicity Screening[2]
alpha-Chlordane	0 0027 –	0 0033	1 / 3	0 0016	0 015	0 0038	0 0006	–	–	No	Toxicity Screening[2]
delta-BHC	0 0021 –	0 0033	1 / 3	0 0004	0 0004	0 0012	NDB	–	–	No	Toxicity Value[6]
gamma-Chlordane	0 0027 –	0 0033	1 / 3	0 0011	0 004	0 0019	0 0018	–	–	No	Toxicity Screening[2]
INORGANIC ANALYTES											
Aluminum			3 / 3	14700	18800	16950	23000	–	–	No	Background[3]
Arsenic			3 / 3	7 6	10 4	9 1667	16 7	–	–	No	Background[3]
Barium			3 / 3	46 1	150	96 2	114	–	–	No	Toxicity Screening[2]
Beryllium	1 2 –	1 6	1 / 3	0 46	0 48	0 6233	0 63	–	–	No	Background[3]
Calcium			3 / 3	1830	7060	4678 3333	17100	–	–	No	Background[3], Essential Nutrient[4]
Chromium			3 / 3	30 6	48 4	38 5833	50 2	–	–	No	Background[3]
Cobalt			3 / 3	11 6	22 3	16 2167	27 8	–	–	No	Background[3]
Copper			3 / 3	43 2	1200	371 9	43 8	–	–	Yes	
Iron			3 / 3	25800	56500	38883 3333	42600	–	–	Yes	
Lead			3 / 3	24 5	256	84 4667	24	–	–	Yes	State[5]
Magnesium			3 / 3	7280	10000	8580	16800	–	–	No	Background[3], Essential Nutrient[4]
Manganese			3 / 3	225	5070	2555	2990	–	–	Yes	
Mercury	0 12 –	0 16	2 / 3	0 27	0 67	0 2383	0 13	–	–	No	Toxicity Screening[2]
Nickel			3 / 3	40 1	63 6	49 55	16	–	–	No	Toxicity Screening[2]
Potassium	892 –	892	2 / 3	958	1140	858 3333	1140	–	–	No	Background[3], Essential Nutrient[4]
Sodium			3 / 3	86 7	138	102 7333	84 8	–	–	No	Essential Nutrient[4]
Uranium (total U-234, U-235, U-236)			1 / 3	0 0078	0 05	NC	NDB	–	–	No	Toxicity Screening[2]
Vanadium			3 / 3	19 7	54 6	33 4	39 4	–	–	Yes	
Zinc			3 / 3	78 9	655	286 3167	120	–	–	No	Toxicity Screening[2]

NOTES

Class[1] – Although the toxicity screening ratio was less than 0 01, this compound belongs to a class of compounds where at least one compound within this class has a risk ratio greater than 0 01
Toxicity Screening[2] – Chemicals with low ratios (i e , less than 0 01) are not considered chemicals of potential concern (CPCs)
Background[3] – Sample concentrations detected are below background concentrations.
Essential Nutrient[4] – Analyte is an essential human nutrient (magnesium, calcium, potassium, sodium) and is not considered a CPC
State[5] – The Maine Department of Environmental Protection (MEDEP, 1990) guidance states lead concentrations less than 15 µg/L in groundwater and 125 mg/kg in soil are not evaluated quantitatively
Toxicity Value[6] – Compound cannot be evaluated quantitively because toxicity values are not available
Frequency[7] – Frequency of detection is less than 5 percent
Exceeds MCL/MEG[8] – Maximum concentration is greater than MCL and/or MEG

T – Action Level
* – If the mean exceeds the maximum concentration, only the maximum concentration will be used in a quantitative evaluation
** – Background for pesticides/PCBs provided for information only Concentrations of pesticides/PCBs were not screened against background concentrations
# – Secondary Standard
SQL – Sample Quantitation Limit
MCL – Maximum Contaminant Level, Drinking Water Regulations and Health Advisories, U S Environmental Protection Agency Office of Water, May 1995
MEG – Maximum Exposure Guideline, Maine Department of Human Services, September 1992
mg – milligram
kg – kilogram
L – liter
µg – microgram
bgs – below ground surface
NC – mean not calculated
– – = No MCL or MEG available

NA – Background groundwater concentrations are not available for overburden wells
NDB – Background not determined

TABLE 6-2
SUMMARY OF RADIOLOGICAL ISOTOPES FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

Radiological Analyte	Range of SQLs	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Background	MCL	MEG	CPC? [1]	Notes
SURFACE SOIL (0-2 feet): AREA A [a]									
GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)									
Americium-241	0 138 -0 155	1 / 3	0 577	0 577	0 081	-	-	Yes	
Radium-226	700 -700	2 / 3	1 44	1 89	0 94	-	-	Yes	
SURFACE SOIL (0-2 feet): AREAS B-G [b]									
GAMMA SPECTROSCOPY - 1-Hour Counts (pCi/g)									
Radium-226	0 7 -1 41	3 / 9	1 86	2 67	0 94	-	-	Yes	
SUBSURFACE SOIL (0-10 feet): AREA A [a]									
GAMMA SPECTROSCOPY - 1-Hour Counts (pCi/g)									
Americium-241	0 138 -0 155	1 / 3	0 577	0 577	0 081	-	-	Yes	
Radium-226	700 -700	2 / 3	1 44	1 89	0 94	-	-	Yes	
SUBSURFACE SOIL SAMPLES (0-10 feet): AREAS B-G [c]									
GAMMA SPECTROSCOPY - 1-Hour Counts (pCi/g)									
Radium-226	0 066 -1 41	49 / 61	0 246	2.67	0 94	-	-	Yes	
Radium-228	0 172 -0.192	42 / 46	0.666	1 11	0 95	-	-	Yes	
ALPHA SPECTROSCOPY (pCi/g)									
Plutonium-239/240	0 013 -0 07	4 / 46	0 02	0 034	0 29	-	-	No	Background[2]
Protactinium-234		46 / 46	0.52	0 83	1.3	-	-	No	Background[2]
Thorium-227	0 015 -0 21	25 / 46	0 018	0 09	1 6	-	-	No	Background[2]
Thorium-228		46 / 46	0 838	1 34	1.2	-	-	Yes	
Thorium-230	0 676 -0 941	31 / 46	0 61	1 703	1 4	-	-	Yes	
Thorium-231	0 02 -0 1	30 / 46	0 01	0 08	0 05	-	-	Yes	
Thorium-232		46 / 46	0 804	1 227	1 1	-	-	Yes	
Thorium-234		46 / 46	0 52	0 83	1.3	-	-	No	Background[2]
Uranium-234		46 / 46	0 47	1 38	1 4	-	-	No	Background[2]
Uranium-235	0 02 -0.1	30 / 46	0.01	0 08	0 05	-	-	Yes	
Uranium-238		46 / 46	0 52	0 83	1.3	-	-	No	Background[2]
COMPOSITE SAMPLES (0-14 feet): AREAS B-G [d]									
GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)									
Radium-226	0 901 -1 08	8 / 14	0 938	1 94	0 94	-	-	Yes	
GROUNDWATER: AREA A, 1994 [e]									
GROSS BETA (pCi/L)		1 / 1	18	18	459	50	NA	No	Below MCL[3]
TRITIUM (pCi/L)		1 / 1	538	538	NDB	20000	NA	Yes	Below MCL[3]
GROUNDWATER: AREA A, 1993 [e]									
GROSS ALPHA (pCi/L)		1 / 1	24	24	1655	15	NA	Yes	Exceeds MCL[4]
GROSS BETA (pCi/L)		1 / 1	34	34	459	50	NA	No	Below MCL[3]
ALPHA SPECTROSCOPY (pCi/L)									
Thorium-230		1 / 1	2 1	2 1	0 625	NA	NA	Yes	
Uranium-234		1 / 1	2	2	1 096		NA	Yes	
Uranium-238		1 / 1	1 86	1 86	0 743		NA	Yes	

TABLE 6-2
SUMMARY OF RADIOLOGICAL ISOTOPES FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

Radiological Analyte	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Background	MCL	MEG	CPC? [1]	Notes
GROUNDWATER: AREAS B-G, 1994 [1]										
GROSS ALPHA (pCi/L)	1 -	3 8	7 / 16	1	61	20.91	15	NA	Yes	Exceeds MCL[4]
GROSS BETA (pCi/L)	3 -	3	12 / 16	3 7	55	6	50	NA	Yes	Exceeds MCL[4]
TRITIUM (pCi/L)	400 -	400	3 / 16	400	497	NDB	20000	NA	Yes	Below MCL[3]
EPA METHOD 9320 (pCi/L)										
Radium-226	0 5 -	0.5	3 / 4	0.69	1 37	1 767	5	NA	No	Background[2], Below MCL[3]
ALPHA SPECTROSCOPY (pCi/L)										
Protactinium-234			4 / 4	0 07	0 33	0 376	NA	NA	No	Background[2]
Thorium-228	0 05 -	0.4	1 / 4	1 28	1 69	0 241	NA	NA	Yes	
Thorium-230	0.14 -	0.14	3 / 4	0.42	1.79	1.159	NA	NA	Yes	
Thorium-232	0 05 -	0 05	3 / 4	0 05	1 37	0.05	NA	NA	Yes	
Thorium-234			4 / 4	0 07	0 33	0 376	NA	NA	No	Background[2]
Uranium-234			4 / 4	0 12	0.6	0.541		NA	Yes	
Uranium-238			4 / 4	0 07	0 38	0 376		NA	Yes	
GROUNDWATER: AREAS B-G, 1993 [1]										
GROSS ALPHA (pCi/L)			16 / 16	1 2	50	20.91	15	NA	Yes	Exceeds MCL[4]
GROSS BETA (pCi/L)	3 -	12	9 / 16	9 3	52	6	50	NA	Yes	Exceeds MCL[4]
EPA METHOD 9320 (pCi/L)										
Radium-226	0 4 -	1 1	1 / 7	1.6	1.6	1 767	5	NA	No	Background[2], Below MCL[3]
ALPHA SPECTROSCOPY (pCi/L)										
Thorium-230			7 / 7	0.9	6.3	1.159	NA	NA	Yes	
Uranium-234	0 6 -	0 6	7 / 7	0 7	6 65	0 54		NA	Yes	
Uranium-238	0 65 -	0 65	6 / 7	0 62	6 73	0 376		NA	Yes	
GROUNDWATER: AREAS B-G, 1992 [9]										
GROSS BETA	2 -	2	1 / 5	14 19	14 19	6	50	NA	No	Below MCL[3]
	-									
ALPHA-SCAN	-									
Radium-226	0.5 -	0 5	2 / 5	1 32	2.01	1.767	5	NA	Yes	
Uranium-234	1 -	1	4 / 5	3.8	10 78	0 54		NA	Yes	
Uranium-235	1 -	1	4 / 5	1 15	4.56	0.05		NA	Yes	
Uranium-238	1 -	1	1 / 5	3.04	3 04	0 376		NA	Yes	
SURFACE WATER: AREA A and OU 13[h]										
GROSS ALPHA (pCi/L)	1 -	2 6	1 / 5	2.8	2 8	NC	15	NA	No	Below MCL[3]
GROSS BETA (pCi/L)	3 -	3	3 / 5	6 1	18	5 1	50	NA	No	Below MCL[3]
SEDIMENT: AREA A [1]										
GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)										
Neptunium-237	0.45 -	0.5	1 / 3	0.509	0 509	NC	-	-	Yes	
Radium-226	0 7 -	1 28	1 / 3	2 43	2 43	3.16	-	-	Yes	
Thorium-234	0 78 -	1.48	1 / 3	2 09	2 09	NC	-	-	Yes	
Uranium-235	0 289 -	0 316	1 / 3	0.0168	0 11	NC	-	-	Yes	

TABLE 6-2
SUMMARY OF RADIOLOGICAL ISOTOPES FOR HUMAN HEALTH RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

Radiological Analyte	Range of SQLs	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Background	MCL	MEG	CPC? [1]	Notes
SEDIMENT: OU 13 [l]									
GAMMA SPECTROSCOPY -24-Hour Counts (pCi/g)									
Radium-226		4 / 4	0 972	1 51	1 4 [5]	-	-	Yes	
Thorium-234	0 37 - 0 486	1 / 4	0 92	0 92	NC	-	-	Yes	
Uranium-235	0 0791 - 0 0966	2 / 4	0 112	0 207	NC	-	-	Yes	
ALPHA SPECTROSCOPY (pCi/g)									
Neptunium-237	0.007 - 0 015	1 / 4	0.072	0 072	ND	-	-	Yes	
Uranium-234	0 304 - 0 531	3 / 4	0 568	0 733	NC	-	-	Yes	
Uranium-238	0 335 - 0 567	2 / 4	0 704	0 753	NC	-	-	Yes	
SEDIMENT: WASTEWATER TREATMENT PLANT [k]									
ALPHA SPECTROSCOPY (pCi/g)									
Neptunium-237		1 / 1	0 033	0 033	ND	-	-	Yes	

NOTES
[1] - For radiological analytes selected as CPCs each detection above background will be quantitatively evaluated, with the exception of gross alpha and gross beta results in groundwater for which toxicity values are not available
[2] - Detected concentration does not exceed associated background concentration
[3] - Concentration of isotope or gross radiation does not exceed the associated MCL
[4] - Concentration of isotope or gross radiation exceeds the associated MCL
[5] - Highest 24-hour gamma spectroscopy result for Radium-226 in sediment, data inadequate for a statistical calculation

Sample Locations
[a] - Based on data from sample locations JSS-2081, -2082, JTB-2060
[b] - Based on data from sample locations JDT-2480, -2481, JSD-2560, JSS-2680, -2681, -2682, JTB-2260, -2660, JTP-2401
[c] - Based on data from sample locations JDT-2480 -2481, JSD-2560, JSS-2680, -2681, -2682, JTB-2260 -2660, JTP-2401, TRC01C through TRC23C TRE01C through TRE23C
[d] - Based on data from sample locations MTB-2180 -2181, -2280, -2281, -2282, -2380, -2381, -2480, -2481, -2482, -2580, -2680, -2681, -2682
[e] - Based on data from sample location JMW-2060
[f] - Based on data from sample locations JMW-2180 -2181, -2280, -2281, -2282, -2360, -2381 -2480, -2481, -2482 -2580, -2660, -2681, -2682
[g] - Based on data from sample locations JMW-2180, -2280, -2360, -2480, -2682
[h] - Based on data from sample locations JSW-0041, -0042 -0043, -0073, -2080
[i] - Based on data from sample locations JDT-2060, 2061, JSD-2060
[j] - Based on data from sample locations JSD-0041, -0042, -0043, -0073
[k] - Based on data from sample location JSD-0066

Acronyms
SQL - Sample Quantitation Limit
MCL - Maximum Contaminant Level
MEG - Maximum Exposure Guideline
CPC - Chemical of Potential Concern
mg - milligram
kg - kilogram
L - liter
µg - microgram
bgs - below ground surface
ND - not detected
NA - no MCL/MEG available
- - MCL/MEG not relevent for this medium
NDB - not detected in background

Potential human health risks associated with exposure to the CPCs were estimated quantitatively or qualitatively through the development of hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on present and potential future land uses. Current use exposure scenarios included older child trespasser and groundskeeper. Future use exposure scenarios included resident, construction worker, older child trespasser, groundskeeper, commercial/industrial worker, and forestry worker.

For each pathway evaluated, an average and a reasonable maximum exposure (RME) estimate was generated, corresponding to exposure to the average and the maximum contaminant concentrations detected in that particular medium.

Excess lifetime cancer risks were determined for each exposure pathway by multiplying the exposure level with the chemical-specific cancer factor. Cancer potency factors have been developed by USEPA from epidemiological and animal studies to reflect a conservative upper bound of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the estimated risk. The resulting risk estimates are expressed in scientific notation as a probability (e.g., $1x10^{-6}$ or one in a million) and indicate (using this example) that an average individual is not likely to have greater that a one in a million chance of developing cancer over a lifetime of site-related exposure to the compound at the stated concentration. Current USEPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

The hazard quotient (HQ) was also calculated for each pathway as a measure of the potential for noncarcinogenic health effects. An HQ is calculated by dividing the exposure level by the reference dose (RfD) or other suitable benchmark for non-carcinogenic health effects for an individual compound. RFDs have been developed by USEPA to protect sensitive individuals over the course of a lifetime and they reflect a daily exposure level that is likely to be without an appreciable risk of an adverse health effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. The HQ is often expressed as a single value (e.g., 0.3) indicating the ratio of the stated exposure to the reference dose value (in this example, the exposure as characterized is approximately one third of an acceptable exposure level for the given compound). The HQ is only considered additive for compounds that have the same or similar toxic effect (e.g., the HQ for a compound known to produce liver damage should not be added to a second compound whose toxic effect is kidney damage). The sum is referred to as the hazard index (HI).

The results of the human health risk assessment are summarized in Subsection 6.4.

6.2 ECOLOGICAL RISK ASSESSMENT

Following a methodology similar to the human health risk assessment, the ecological risk assessment evaluates potential ecological effects resulting from plant and wildlife exposures to contaminants at OU 1. Ecological CPCs were selected for both non-radiological and radiological analytes detected in surface soil, sediment, and surface water. The rationale for exclusion of selected compounds are included in Tables 6-3 through 6-7.

Representative ecological receptor species were selected for the habitat associated with OU 1. For Area A, five representative wildlife species were selected to quantitatively evaluate the magnitude of potential ecological exposures that may occur. The receptors include:

- short-tailed shrew (*Blarina brevicauda*); small mammal, omnivore
- American woodcock (*Scolopax minor*); small bird, omnivore
- maritime garter snake (*Thamnophis sirtalis pallidula*); reptile, omnivore
- red fox (*Vulpes vulpes*); predatory mammal, carnivore
- barred owl (*Strix varia*); predatory bird, carnivore

In addition, potential impacts to terrestrial plants and earthworms, representative of potential exposure to other soil invertebrates, were also selected for risk evaluation.

Based on a habitat evaluation for Areas B through G, the following five representative species were selected for the ecological exposure evaluation:

- meadow vole (*Microtus pennsylvanicus*); small mammal, herbivore
- American robin (*Turdus migratorius*); small bird, omnivore
- maritime garter snake; reptile, omnivore
- red fox; predatory mammal, carnivore
- American kestrel (*Falco sparverius*); predatory bird, carnivore

Five representative species were also selected to evaluate the risks associated with potential exposure of wildlife to radiological contaminants in sediment, including:

TABLE 6-3
CHEMICALS OF POTENTIAL CONCERN FOR THE AREA A SURFACE SOIL [a] ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

ANALYTE	CONCENTRATION AVERAGE (mg/kg) [b]	CONCENTRATION MAXIMUM (mg/kg)	FREQUENCY OF DETECTION	MAXIMUM BACKGROUND CONCENTRATION (mg/kg) [c]	CPC ?	NOTES
SEMIVOLATILES						
Acenaphthene	0 150 *	0.065	1 / 3	NA	Yes	
Anthracene	0.150 *	0.065	1 / 3	NA	Yes	
Benzo(a)Anthracene	0.129	0.160	2 / 3	NA	Yes	
Benzo(a)Pyrene	0.161 *	0 099	1 / 3	NA	Yes	
Benzo(b,k)Fluoranthene	0.329 *	0.218	1 / 3	NA	Yes	
Carbazole	0.147 *	0.056	1 / 3	NA	Yes	
Chrysene	0.124	0.150	2 / 3	NA	Yes	
Fluoranthene	0.237	0.420	2 / 3	NA	Yes	
Fluorene	0.145 *	0.050	1 / 3	NA	Yes	
Indeno(1,2,3-c,d)Pyrene	0.145 *	0.049	1 / 3	NA	Yes	
Phenanthrene	0.210	0.360	2 / 3	NA	Yes	
Pyrene	0.178	0.280	2 / 3	NA	Yes	
PESTICIDES/PCBs						
Aroclor-1260	0 0327	0.0610	1 / 3	NA [d]	Yes	
gamma-Chlordane	0.0010 *	0.0009	1 / 3	NA	Yes	
4,4'-DDE	0.0009	0 0019	3 / 3	NA [d]	Yes	
4,4'-DDT	0.0019	0.0035	2 / 3	NA [d]	Yes	
Dieldrin	0.0016 *	0.0008	1 / 3	NA [d]	Yes	
Endosulfan Sulfate	0.0025	0.0031	2 / 3	NA [d]	Yes	
Endrin	0.0013 *	0.0002	1 / 3	NA [d]	Yes	
Endrin Aldehyde	0.0028	0.0046	1 / 3	NA [d]	Yes	
Endrin Ketone	0.0014 *	0.0005	1 / 3	NA [d]	Yes	
Methoxychlor	0.0045 *	0 0028	2 / 3	NA	Yes	
INORGANICS						
Aluminum	13,933	16,100	3 / 3	25,400	No	[e]
Arsenic	5 37	6.20	3 / 3	16 2	No	[e]
Barium	30 4	36 6	3 / 3	93 3	No	[e]
Beryllium	0 40 *	0 23	1 / 3	1.8	No	[e]
Calcium	2,127	2,830	3 / 3	69,700	No	[e,f]
Chromium	27 9	33,1	3 / 3	56 9	No	[e]
Cobalt	9 97	11.6	3 / 3	18.5	No	[e]
Copper	18 3	22 1	3 / 3	65 6	No	[e]
Iron	26,167	30,200	3 / 3	47,100	No	[e,f]
Lead	16.2	23,4	3 / 3	22,6	Yes	
Magnesium	6,460	7,490	3 / 3	12,700	No	[e,f]
Manganese	430	504	3 / 3	1400	No	[e]
Nickel	35 4	44 1	3 / 3	73	No	[e]
Potassium	831	986	3 / 3	2,900	No	[e,f]
Sodium	57 3	85 4	3 / 3	110	No	[e,f]
Vanadium	18 6	21 0	3 / 3	40	No	[e]
Zinc	65.0	89,9	3 / 3	83 9	Yes	

[a]Based on samples JSS-2081, JSS-2082 and JTB-2060
[b]Average concentration is the arithmetic mean of all sample results with 1/2 the SQL used for non-detects Some averages may exceed maximum concentrations due to elevated SQLs
[c]Base-wide surface soil background concentrations
[d]Analyte has been detected in background samples, however, these concentrations are not being used to screen for CPCs Consideration of background levels of pesticides will be discussed in the risk uncertainty section
[e]Maximum concentration of analyte is below maximum surface soil background concentration
[f]Analyte is an essential nutrient, and is considered to be hazardous via ingestion in the terrestrial food web only at very high concentrations
*Average concentration exceeds maximum due to elevated SQLs
NA = not available
Shaded analytes are CPCs

TABLE 6-4
CHEMICALS OF POTENTIAL CONCERN FOR THE AREAS B-F SURFACE SOIL [a] ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

ANALYTE	CONCENTRATION AVERAGE (mg/kg) [b]	CONCENTRATION MAXIMUM (mg/kg)	FREQUENCY OF DETECTION	MAXIMUM BACKGROUND CONCENTRATION (mg/kg) [c]	CPC ?	NOTES
SEMIVOLATILES						
Benzo(b,k)Fluoranthene	0.341 *	0.082	1 / 4	NA	Yes	
bis(2-Ethylhexyl)phthalate	0.145 *	0.044	2 / 5	NA	Yes	
Chrysene	0 172 *	0.054	1 / 5	NA	Yes	
Fluoranthene	0.178 *	0 077	1 / 5	NA	Yes	
Phenanthrene	0.188 *	0.048	1 / 5	NA	Yes	
Pyrene	0.174 *	0 057	1 / 5	NA	Yes	
PESTICIDES/PCBs						
Aroclor-1260	0.0191 *	0.0090	1 / 5	NA [d]	Yes	
delta-BHC	0.0009 *	0 0002	1 / 5	NA [d]	Yes	
4,4'-DDD	0.0012 *	0.0010	3 / 5	NA [d]	Yes	
4,4'-DDE	0.0024	0.0045	5 / 5	NA [d]	Yes	
4,4'-DDT	0.0044	0.0095	4 / 5	NA [d]	Yes	
Dieldrin	0.0016 *	0 0006	2 / 5	NA [d]	Yes	
Endosulfan Sulfate	0.0019 *	0 0005	1 / 5	NA [d]	Yes	
Endrin	0.0018 *	0 0007	1 / 5	NA [d]	Yes	
Endrin Aldehyde	0.0017 *	0.0005	1 / 5	NA [d]	Yes	
Heptachlor Epoxide	0.0009 *	0 0002	1 / 5	NA [d]	Yes	
INORGANICS						
Aluminum	16,020	17,800	5 / 5	25,400	No	[e]
Arsenic	7 21	10 1	5 / 5	16 2	No	[e]
Barium	44 4	59 9	5 / 5	93 3	No	[e]
Beryllium	0 52	0 54	3 / 5	1 80	No	[e]
Calcium	4,394	17,800	5 / 5	69,700	No	[e,f]
Chromium	31 4	33 9	5 / 5	56 9	No	[e]
Cobalt	12 6	16 1	5 / 5	18 5	No	[e]
Copper	20 3	27 2	5 / 5	65 6	No	[e]
Iron	29,430	32,300	5 / 5	47,100	No	[e,f]
Lead	21.7	32.1	5 / 5	22.6	Yes	
Magnesium	7,680	8,950	5 / 5	12,700	No	[e,f]
Manganese	735	998	5 / 5	1,400	No	[e]
Mercury	0.57	2.60	1 / 5	0.17	Yes	
Nickel	40 7	46 5	5 / 5	73 0	No	[e]
Potassium	823	1,110	5 / 5	2,900	No	[e,f]
Silver	0.767	1.20	1 / 5	0.090	Yes	
Sodium	100	124	5 / 5	110	No	[f]
Vanadium	22 0	24 8	5 / 5	40 0	No	[e]
Zinc	85 5	141	5 / 5	83.9	Yes	

[a]Based on samples JDT-2480, JDT-2481, JSD-2560, JTB-2260, JTP-2041
[b]Average concentration is the arithmetic mean of all sample results with 1/2 the SQL used for non-detects Some averages may exceed maximum concentrations due to elevated SQLs
[c]Base-wide surface soil background concentrations
[d]Analyte has been detected in background samples, however, these concentrations are not being used to screen for CPCs Consideration of background levels of pesticides will be discussed in the risk uncertainty section
[e]Maximum concentration of analyte is below maximum surface soil background concentration
[f]Analyte is an essential nutrient, and is considered to be hazardous via ingestion in the terrestrial food web only at very high concentrations
*Average concentration exceeds maximum due to elevated SQLs
NA = not available
Shaded analytes are CPCs

TABLE 6-5
CHEMICALS OF POTENTIAL CONCERN FOR THE AREA G SURFACE SOIL [a] ECOLOGICAL RISK ASSESSMENT
OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

ANALYTE	CONCENTRATION AVERAGE (mg/kg) [b]	CONCENTRATION MAXIMUM (mg/kg)	FREQUENCY OF DETECTION	MAXIMUM BACKGROUND CONCENTRATION (mg/kg) [c]	CPC ?	NOTES
SEMIVOLATILES						
2-Methylnaphthalene	6.16	36.0	1 / 6	NA	Yes	
Anthracene	4.33	25.0	1 / 6	NA	Yes	
Benzo(a)Anthracene	0.935 *	0.110	1 / 6	NA	Yes	
Benzo(a)Pyrene	0.923 *	0.038	1 / 6	NA	Yes	
Benzo(b,K)Fluoranthene	1.86 *	0.145	1 / 6	NA	Yes	
bis(2-Chloroisopropyl)ether	0.924 *	0.076	1 / 6	NA	Yes	
Butylbenzylphthalate	0.912 *	0.140	2 / 6	NA	Yes	
Chrysene	0.937 *	0.120	1 / 6	NA	Yes	
Di-n-butylphthalate	0.923 *	0.043	1 / 6	NA	Yes	
Fluoranthene	0.631	3.10	3 / 6	NA	Yes	
Naphthalene	1.83	10.0	1 / 6	NA	Yes	
Phenanthrene	2.16	12.0	1 / 6	NA	Yes	
Pyrene	1.49	8.200	3 / 6	NA	Yes	
PESTICIDES/PCBs						
Aldrin	0.0013	0.0036	2 / 6	NA	Yes	
Aroclor-1260	0.0480	0.1000	3 / 5	NA [d]	Yes	
beta-BHC	0.0048	0.0240	1 / 6	NA	Yes	
delta-BHC	0.0026	0.0110	2 / 6	NA [d]	Yes	
gamma-BHC (Lindane)	0.0048	0.0240	1 / 6	NA	Yes	
alpha-Chlordane	0.0032	0.0130	3 / 6	NA	Yes	
gamma-Chlordane	0.0035	0.0100	4 / 6	NA	Yes	
4,4'-DDD	0.0038	0.0110	1 / 5	NA [d]	Yes	
4,4'-DDE	0.0042	0.0140	2 / 5	NA [d]	Yes	
4,4'-DDT	0.0127	0.0420	4 / 6	NA [d]	Yes	
Dieldrin	0.0010 *	0.0004	3 / 5	NA [d]	Yes	
Endosulfan I	0.0009	0.0013	3 / 6	NA	Yes	
Endosulfan II	0.0214	0.1200	2 / 6	NA	Yes	
Endosulfan Sulfate	0.0055	0.0240	3 / 6	NA [d]	Yes	
Endrin	0.0018	0.0027	2 / 6	NA [d]	Yes	
Endrin Aldehyde	0.0018 *	0.0013	1 / 5	NA [d]	Yes	
Endrin Ketone	0.0025	0.0052	1 / 6	NA [d]	Yes	
Heptachlor	0.0008 *	0.0001	1 / 5	NA [d]	Yes	
Heptachlor Epoxide	0.0026	0.0110	3 / 6	NA [d]	Yes	
Methoxychlor	0.0062 *	0.0005	2 / 5	NA	Yes	
INORGANICS						
Aluminum	18,075	22,000	6 / 6	25,400	No	[e]
Arsenic	5.87	8.60	6 / 6	16.2	No	[e]
Barium	61.8	157	6 / 6	93.3	Yes	
Beryllium	0.54 *	0.30	1 / 6	1.80	No	[e]
Cadmium	2.46	11.8	1 / 6	0.21	Yes	
Calcium	6,775	23,500	6 / 6	69,700	No	[e,f]
Chromium	39.7	81.4	6 / 6	56.9	Yes	
Cobalt	11.9	19.3	6 / 6	18.5	Yes	
Copper	149	790	6 / 6	65.6	Yes	
Iron	28,633	34,400	6 / 6	47,100	No	[e,f]
Lead	97.7	493	4 / 6	22.60	Yes	
Magnesium	7,953	13,500	6 / 6	12,700	No	[f]
Manganese	597	999	6 / 6	1,400	No	[e]
Mercury	0.42	2.20	2 / 6	0.17	Yes	
Nickel	40.1	69.5	6 / 6	73.0	No	[e]
Potassium	1,053	2,170	6 / 6	2,900	No	[e,f]
Sodium	74.0	139	4 / 6	110	No	[f]
Vanadium	31.6	68.3	6 / 6	40.0	Yes	
Zinc	271	1,240	6 / 6	83.9	Yes	

[a]Based on samples JSS-2680, JSS-2681, JSS-2682, JTB-2660, JTB-2680, JTB-2681, and JTB-2683
[b]Average concentration is the arithmetic mean of all sample results with 1/2 the SQL used for non-detects Some averages may exceed maximum concentrations due to elevated SQLs
[c]Base-wide surface soil background concentrations
[d]Analyte has been detected in background samples, however, these concentrations are not being used to screen for CPCs Consideration of background levels of pesticides will be discussed in the risk uncertainty section
[e]Maximum concentration of analyte is below maximum surface soil background concentration
[f]Analyte is an essential nutrient, and is considered to be hazardous via ingestion in the terrestrial food web only at very high concentrations
*Average concentration exceeds maximum due to elevated SQLs
NA = not available
Shaded analytes are CPCs

TABLE 6–6
CHEMICALS OF CONCERN FOR THE AREA A (DRAINAGE DITCH) SURFACE WATER [a] ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

ANALYTE	DETECTED CONCENTRATION (ug/L)	FREQUENCY OF DETECTION	MAXIMUM BACKGROUND CONCENTRATION (ug/L) [b]	SCREENING BENCHMARK (ug/L)	CPC ?	NOTES
PESTICIDES/PCBs						
Heptachlor	0 0011	1 / 1	NA[d]	0 0038	No	[d]
INORGANICS						
Calcium	52,600	1 / 1	67,200	NA	No	[e,f]
Copper	12,3	1 / 1	2 7	0 205	Yes	
Iron	486	1 / 1	961	16	No	[e]
Magnesium	2,850	1 / 1	8,280	NA	No	[e,f]
Manganese	45 3	1 / 1	62 6	112	No	[d,e]
Sodium	4,300	1 / 1	6,520	85,049	No	[d,e]

NOTES
[a] Based on samples JSW–2080
[b] Base–wide surface water background concentrations
[c] Analyte has been detected in background samples, however, these concentrations were not used to screen for CPCs
Consideration of background levels of pesticides is discussed in the risk uncertainty section
[d] Maximum concentration of analyte below screening benchmark
[e] Maximum concentration of analyte below maximum surface water background concentration
[f] Analyte is an essential nutrient and is not known to adversely impact aquatic organisms except at very high concentrations
NA = Not available
Shaded analytes are CPCs

TABLE 6–7
CHEMICALS OF CONCERN FOR THE AREA A (DRAINAGE DITCH) SEDIMENT [a] ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

ANALYTE	CONCENTRATION AVERAGE (mg/kg) [b]	CONCENTRATION MAXIMUM (mg/kg)	FREQUENCY OF DETECTION	MAXIMUM BACKGROUND CONCENTRATION (mg/kg) [c]	SCREENING BENCHMARK (mg/kg)	CPC ?	NOTES
SEMIVOLATILES							
2–Methylphenol	0.147 *	0.130	2 / 3	NA	0.063	Yes	
Acenaphthene	0.210 *	0 160	1 / 3	NA	0 016	Yes	
Anthracene	0.227 *	0.210	1 / 3	NA	0 0853	Yes	
Benzo(a)Anthracene	0.252	0.470	2 / 3	NA	0.261	Yes	
Benzo(a)Pyrene	0.277	0 360	1 / 3	NA	0.43	No	[d]
Benzo(b,k)Fluoranthene	0 308	0 670	3 / 3	NA	4 5	No	[d]
Benzo(g,h,i)perylene	0 200 *	0 130	1 / 3	NA	0 78	No	[d]
Carbazole	0 223 *	0.200	1 / 3	NA	NA	Yes	
Chrysene	0 226	0.460	3 / 3	NA	0.384	Yes	
Dibenzofuran	0 181 *	0 072	1 / 3	NA	0 58	No	[d]
Fluoranthene	0.549	1.300	3 / 3	NA	0 6	Yes	
Fluorene	0.193 *	0.110	1 / 3	NA	0 019	Yes	
Indeno(1,2,3–c,d)Pyrene	0.227 *	0 210	1 / 3	NA	0 88	No	[d]
Phenanthrene	0.401	0 940	3 / 3	NA	0.24	Yes	
Pyrene	0.315	0 720	3 / 3	NA	0.665	Yes	
PESTICIDES/PCBs							
Aldrin	0 0020	0 0051	1 / 3	NA [f]	0 002	Yes	
Aroclor–1254	0 0598	0 2200	1 / 3	NA [f]	0.06	Yes	
Aroclor–1260	0.2387	0.7400	2 / 3	NA [f]	0.005	Yes	
delta–BHC	0.0012 *	0 0004	1 / 3	NA	0 003	No	[d]
alpha–Chlordane	0 0038	0 0150	1 / 3	NA [f]	0.007	Yes	
gamma–Chlordane	0 0019	0 0040	1 / 3	NA [f]	0 007	No	[d]
4,4'–DDE	0.0033	0.0120	2 / 3	NA [f]	0 005	Yes	
4,4'–DDT	0.0013	0 0018	3 / 3	NA [f]	0 007	No	[d]
Dieldrin	0 0033	0 0059	2 / 3	NA [f]	0 002	Yes	
Endosulfan Sulfate	0 0033	0 0046	3 / 3	NA [f]	0.002	Yes	
Endrin	0 0019	0 0025	2 / 3	NA [f]	0 003	No	[d]
Endrin Aldehyde	0.0065	0.0140	2 / 3	NA [f]	0.003	Yes	
Heptachlor Epoxide	0 0009 *	0 0004	1 / 3	NA [f]	0 005	No	[d]
Methoxychlor	0 0088 *	0.0020	1 / 3	NA [f]	0 005	No	[d]
INORGANICS							
Aluminum	16,950	18,800	3 / 3	23,000	NA	No	[f]
Arsenic	9 17	10 4	3 / 3	16 7	6	No	[f]
Barium	96 2	150	3 / 3	114	20	Yes	
Beryllium	0 62 *	0 48	1 / 3	0 63	0 5	No	[d,f]
Calcium	4,678	7,060	3 / 3	17,100	NA	No	[d,g]
Chromium	38 6	48 4	3 / 3	50 2	26	No	[f]
Cobalt	16 2	22 3	3 / 3	27 8	50	No	[d,f]
Copper	372	1,200	3 / 3	44	16	Yes	
Iron	38,883	56,500	3 / 3	42,600	20,000	Yes	[h]
Lead	84 5	256	3 / 3	24 0	31	Yes	
Magnesium	8,580	10,000	3 / 3	16,800	NA	No	[d,g]
Manganese	2,555	5,070	3 / 3	2,990	460	Yes	
Mercury	0 24	0 67	2 / 3	0,13	0 2	Yes	
Nickel	49.6	63 6	3 / 3	16 0	16	Yes	
Potassium	858	1,140	2 / 3	1,140	NA	No	[d,g]
Sodium	103	138	3 / 3	84 8	NA	No	[g]
Uranium	0.057 *	0 051	1 / 3	NA	NA	Yes	
Vanadium	33 4	54 6	3 / 3	39.4	NA	Yes	
Zinc	286	655	3 / 3	120	120	Yes	
Total Organic Carbon	3,400	3,400	1 / 1	NA	NA	NA	

TABLE 6-7
CHEMICALS OF CONCERN FOR THE AREA A (DRAINAGE DITCH) SEDIMENT [a] ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

NOTES

[a] Based on samples JDT-2080, JDT-2081 and JSD-2060

[b]Average concentration is the arithmetic mean of all sample results with 1/2 the SQL used for non-detects Some averages may exceed maximum concentrations due to elevated SQLs

[c] Base-wide sediment background concentrations

[d] Maximum concentration of analyte below screening benchmark

[e] Analyte has been detected in background samples, however, these concentrations were not used to screen for CPCs
Consideration of background levels of pesticides is discussed in the risk uncertainty section

[f] Maximum concentration of analyte below maximum sediment background concentration

[g] Analyte is an essential nutrient, and is not known to adversely impact aquatic organisms except at very high concentrations

[h] Analyte is a CPC for aquatic exposures only

*Average concentration exceeds maximum due to elevated SQLs

NA = Not available

Shaded analytes are CPCs

- muskrat (*Ondatra zibethicus*); small mammal, herbivore
- belted kingfisher (*Ceryle alcyon*); medium-sized bird, piscivore
- maritime garter snake; reptile, omnivore
- great blue heron (*Ardea herodias*); large bird, omnivore
- mink (*Mustela vison*); predatory mammal, omnivore

With the CPCs and receptors selected, the evaluation of exposure pathways, toxicity of CPCs, and resulting risks followed an approach similar to that of the human health risk assessment.

Results of the ecological risk assessment are summarized in Subsection 6.4.

6.3 UNCERTAINTY EVALUATION

Quantitative estimates of risk are based on numerous assumptions, which are intended to be protective of human health and the environment (i.e., conservative). The interpretation of risk estimates is subject to a number of uncertainties as a result of the multiple layers of conservative assumptions inherent in risk assessments. As such, risk estimates are not truly probabilistic estimates of risk, but are conditional estimates, given a series of conservative assumptions about exposure and toxicity. While it is true that there are some uncertainties inherent in the risk assessment methodology that might lead to an underestimation of true risks, most assumptions bias the evaluation in the direction of overestimation of risk. This results in more conservative clean-up criteria, more protective of human health and the environment.

The possibility of underestimation of true risks may be caused by the exclusion of exposure pathways from quantitative evaluation (i.e., ingestion of homegrown produce from backyard garden plots) or through the exclusion of compounds from the risk assessment through the CPC selection procedure. However, the CPC selection procedure evaluated compounds that constituted more than 99 percent of the risk; therefore it is unlikely that the risks will be underestimated by a substantial amount.

Other sources of uncertainty that could cause overestimation of risks include the use of purposive sampling (biased targeting of "hot spots" or visible contamination); the estimation of exposure concentrations by the use of maximum detections (while assuming no degradation or dilution); the use of the 95 percent (or upper-bound 90 percent) exposure parameter values such as contact rate and exposure frequency and

duration; the use of conservatively derived toxicity values such as RfDs (incorporating multiple safety factors); and cancer slope factors, which are based on experimental animal data used in a multi-stage model.

6.4 RISK ASSESSMENT CONCLUSIONS

Summaries of both human health and ecological risk assessments are presented in the following paragraphs. The discussion begins with the radiological USTs and waste disposal trenches and ends with conclusions for Area A and Areas B through G.

Radiological USTs. Based on the UST data, analysis of confirmatory soil samples, and downgradient groundwater quality, the USTs were not sources of radiological or non-radiological contamination.

Waste Disposal Trenches. No human health radiological risks above regulatory target risk levels were associated with the Trench C and E confirmatory soil samples following the removal action.

Arsenic was detected above background concentrations in only one out of 18 confirmatory soil samples at Trench E. Based on this result, subsurface soil non-radiological human health carcinogenic and non-carcinogenic risks were predominantly attributable to arsenic in combined Areas B through G. However, arsenic is not a documented contaminant associated with OU 1 strategic weapons maintenance, nor was there widespread detection of this analyte. The single detection of arsenic may be the result of rodenticide application at the former Trench E location.

Area A Soils, Surface Water, and Sediments. No human health non-radiological risks have been identified at Area A in soils, surface water, or sediments above the regulatory target risk levels. No ecological radiological risks have been identified in Area A soils and sediments.

Total maximum cancer risks associated with exposure to radionuclides detected in soil above established background concentrations range from $5x10^{-4}$ to $9x10^{-6}$. Maximum radiological risks identified for sediment ($1x10^{-5}$) are less than the established background risks for that medium ($2x10^{-5}$). These risks represent a minimal incremental cancer risk above the LAFB background risks of $2x10^{-4}$ to $8x10^{-6}$

and are less than published total natural radiological background risks for the United States of $1x10^{-2}$ to $3x10^{-3}$ (Shleien, 1992).

A portion of the radiological human health risks is attributable to Am-241 associated with a single surface soil sample adjacent to the former Area A radiological UST. As discussed in Section 5.0, this data is suspect due to analytical uncertainties in identifying and quantifying these radionuclides. To be conservative, this radionuclide was included in the risk assessments. It constitutes only a minimal risk as compared to total natural background levels for the United States ($1x10^{-2}$ to $3x10^{-3}$).

Elevated human health risks from Ra-226 (maximum cancer risk of $2x10^{-4}$) were also associated with surface soils and one ditch sediment. Ra-226 is above established 1994 background levels at these locations. Ra-226 is ubiquitous at OU 1 and is considered to be part of natural background. At LAFB background levels, naturally occurring Ra-226 alone contributes a maximum cancer risk of $2x10^{-4}$. Significant reduction of risk attributable to radioactive isotopes is not possible due to the high levels of naturally occurring radioactive isotopes.

Analytical data for the surface water collected from the Area A drainage ditch were evaluated, and only copper was detected at concentrations in excess of the aquatic benchmarks. A review of the toxicological data for copper suggests that organisms that would likely use this ephemeral habitat (such as amphibians) would not be impacted at the concentration reported. The data and rationale for this conclusion are presented in the OU 1 RI Report (ABB-ES, 1995a). No impacts to plants growing in Area A surface soil or to other terrestrial receptors were identified in the ecological risk assessment.

Area A Groundwater. No human health radiological risks above regulatory target risk levels have been identified associated with potential residential groundwater exposures at Area A.

Background concentrations of inorganics in overburden and bedrock groundwater are currently being revised as part of the OU 12 basewide groundwater RI. Concentrations of inorganics in groundwater detected at OU 1 will be compared to the OU 12 background concentrations upon approval and acceptance of those levels. Groundwater inorganic data for OU 1 will be addressed in the OU 12 ROD.

Areas B through G Soils. Total maximum cancer risks associated with exposure to detected radionuclides in soil at levels above established background concentrations

range from $5x10^{-4}$ to $2x10^{-5}$. These risks represent a minimal incremental cancer risk above the LAFB soil background risks of $2x10^{-4}$ to $6x10^{-6}$, and are well below published total natural radiological background risks of $1x10^{-2}$ to $3x10^{-3}$ (Shleien, 1992).

The maximum radiological human health risk of $5x10^{-4}$ is based on Ra-226 detected in surface, subsurface, and composite soil samples. As discussed in Subsection 5.1, Ra-226 is naturally occurring at OU 1. At LAFB off-site background levels, a cancer risk of $2x10^{-4}$ is associated with naturally occurring Ra-226. The radiological human health risks at Areas B through G are considered acceptable because they are a result of naturally occurring Ra-226.

No non-radiological human health carcinogenic or non-carcinogenic risks above regulatory target risk levels were identified in surface soils at Areas B through G, except for a single surface soil sample at Area G (JSS-2680). The surface soil sample analysis indicated a non-carcinogenic risk due to inhalation of barium for both the forestry worker and construction worker scenarios. JSS-2680 was the only surface soil sample location out of 17 collected at OU 1 in which barium was detected above background levels.

No ecological radiological risks were indicated at Areas B through G. Ecological non-radiological risks at Areas B through F were indicated due to an elevated mercury result in one Area C surface soil sample. The mercury concentration suggested risk to the red fox, and exceeded the screening benchmark for terrestrial plants. Mercury was detected only once out of six surface soil samples at Areas B through F. Zinc exceeded screening benchmarks to terrestrial invertebrates and to plants due to one surface soil result at Area G.

Ecological non-radiological risk at Area G was calculated for zinc and mercury in surface soil for lethal effects to the robin and red fox, respectively. Concentrations of 2-methylnaphthalene, chromium, copper, and zinc also exceeded the screening toxicological benchmarks for terrestrial invertebrates. Concentrations of cadmium, chromium, copper, lead, mercury, vanadium, and zinc exceeded the screening benchmarks for terrestrial plants. Maximum concentrations of all risk-contributing ecological CPCs were detected at sample location JSS-2680, which is located at the head of the drainage ditch at Area G. Potential ecological impacts are likely to be spatially limited, and it is unlikely that mobile wildlife would be impacted.

Area B through G Groundwater. A total maximum radiological risk of $1x10^{-5}$ was identified for potential residential exposure to overburden groundwater. The risk does not exceed USEPA's target risk range or MEDEP's cancer risk guidance value. The site-specific risk level represents a minimal incremental cancer risk above the LAFB groundwater background risk level of $9x10^{-7}$ and is below published total natural radiological background risks of $1x10^{-2}$ to $3x10^{-3}$ (Shleien, 1992).

Total maximum radiological risks of $4x10^{-5}$ to $4x10^{-6}$ were identified for potential residential exposure to bedrock groundwater. Groundwater samples from one well out of the four at Area G indicated radiological risk due to Ra-226. The site-specific Ra-226 concentration is only slightly above the LAFB background concentration and represents a minimal incremental cancer risk as compared to published total natural backgrounds risks.

Non-radiological Area G bedrock groundwater data were separated from Areas B through F during risk assessment because fuel oil USTs at Area G have influenced groundwater quality. Area G non-carcinogenic risks range from HIs of 0.06 to 7. Those above the target HI of 1 were attributable to arsenic, iron, and manganese. Bis(2-ethylhexyl)phthalate (BEHP) and arsenic were identified as the carcinogenic risk drivers from Area G groundwater with a maximum risk of $3x10^{-4}$ and $2x10^{-4}$. BEHP is a common laboratory contaminant, and not likely to be site-related.

Evaluation of Radionuclides and Inorganics Detected at OU 1. Two summary tables have been developed to present conclusions with respect to radionuclides and inorganics, Tables 6-8 and 6-9, respectively. These tables summarize the radionuclides and inorganics detected above background, the site areas where they were detected, and present discussion and conclusions. The purpose of these tables is to put into perspective the detections above background within OU 1.

TABLE 6 - 8
EVALUATION OF RADIONUCLIDES ABOVE BACKGROUND AT OU1

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

MEDIUM	ANALYTICAL METHOD	CPC	AREAS DETECTED > BKG	CONCLUSIONS
Subsurface Soil	ALPHA-SPEC	Thorium-228	C,D,E	Radium-226 was the primary radioisotope responsible for elevated radiological risks at OU 1 Radium-226 was detected at greater than the established background value in soils at all areas of OU 1 Radium-226 is one of the most abundant naturally occurring radionuclides on the OU 1 isotope list Radium-226 was added to the analyte list based on the possibility that radium paint associated with aircraft instrumentation dials might have been buried in the LLRWD trenches No dials were reported during the trench removals. The background value for Radium-226 was established in 1994 In 1993 background soil samples were also collected and analyzed but not used in establishing background values The 1993 background samples indicated levels of Radium-226 between 3 44 to 4 49 pCi/g, which are higher than the maximum detected site-related Radium-226 result The widespread detection of Radium-226 at OU 1 is indicative of natural occurrence. Americium-241 was detected in one Area A surface soil sample This result is highly questionable as to identification and quantification due to analytical interference (Note: The laboratory reported bad peak shape) In summary, subsequent to the LLRWD trench removals, soil results do not indicate a source of base-related radiological contamination No human health radiological risks above regulatory risk levels were identified for the LLRWD trench and tank confirmatory soil samples Target isotopes detected in soil are all naturally occurring with the exception of Americium-241 which is mentioned above
	ALPHA-SPEC	Thorium-230	C	
	ALPHA-SPEC	Thorium-231	C,E	
	ALPHA-SPEC	Thorium-232	A,C,E	
	ALPHA-SPEC	Uranium-235	C,E	
	GAMMA-SPEC	Radium-226	B,C,D,E,G	
	GAMMA-SPEC	Radium-228	A,B,C,D,E,F	
Surface Soil	GAMMA-SPEC	Americium-241	A	
	GAMMA-SPEC	Radium-226	A,E,G	
Surface water		NONE		There were no ecological or human health risks above regulatory thresholds indicated by radiological surface water or sediment results The isotopes associated with the sediments are all naturally occurring with the exception of Neptunium-237 Neptunium-237 results obtained by gamma-spectroscopy have a large degree of uncertainty due to analytical interferences Neptunium-237 was detected in sediment background samples by both gamma-spectroscopy and alpha-spectroscopy. A positive detection of Neptunium-237 by alpha spectroscopy was also identified at a background location Based on this information, Neptunium-237 is believed to be a false positive caused by the analytical procedures
Sediment	ALPHA-SPEC	Neptunium-237	OU13	
	GAMMA-SPEC	Neptunium-237	A,OU13	
	GAMMA-SPEC	Radium-226	A,OU13	
	GAMMA-SPEC	Thorium-234	A,OU13	
	ALPHA-SPEC	Uranium-234	OU13	
	GAMMA-SPEC	Uranium-235	A,OU13	
	ALPHA-SPEC	Uranium-238	OU13	
Groundwater	GROSS-ALPHA	Gross Alpha	C,D,E,G	Groundwater radiological results did not indicate risks of concern at OU 1, except for Radium-226 in one sample at Area G. This Radium-226 detection is believed to be attributable to turbidity in the groundwater sample Gross alpha and gross beta results were above MCLs, however these parameter are greatly influenced by turbidity This is supported by background data collected for both dissolved and total radioisotopes Gross alpha and gross beta parameters were not used in the risk assessment, however, when either of these parameters exceeded primary drinking water standards (MCLs), further isotope-specific analysis was performed The isotope-specific analyses were performed to determine what impact, if any, base-related activities may have had on local groundwater quality A risk assessment was performed using the target isotope-specific data In summary, groundwater radiological data do not indicate a base-related source of contamination All isotopes detected occur naturally at varying levels
	GROSS-BETA	Gross Beta	B,C,D,E,F,G	
	ALPHA-SCAN/SPEC	Radium-226	G	
	ALPHA-SPEC	Thorium-228	E	
	ALPHA-SPEC	Thorium-230	A,B,D,E,G	
	ALPHA-SPEC	Thorium-232	C,E,G	
	TRITIUM	Tritium	A,C,E,G	
	ALPHA-SPEC/SCAN	Uranium-234	A,B,C,D,E,G	
	ALPHA-SCAN/SPEC	Uranium-235	B,C,D,G	
	ALPHA-SPEC/SCAN	Uranium-238	B,D,E,G	
NOTES:				
MCL = Maximum Contaminant Level				
LLRWD = Low Level Radioactive Waste Disposal Sites				
ALPHA-SPEC = Alpha Spectroscopy				
GAMMA-SPEC = Gamma Spectroscopy				
CPC = Compound of Potential Concern				
pCi/g = Picocuries per gram				
>BKG = Greater than established background values				

TABLE 6 - 9
EVALUATION OF INORGANICS DETECTED ABOVE BACKGROUND AT OU 1

OPERABLE UNIT 1 RECORD OF DECISION
LORING AIR FORCE BASE

MEDIUM	ANALYTICAL METHOD	CPC	AREAS DETECTED >BKG	CONCLUSIONS
Subsurface Soil	CLP TAL-INOR	Arsenic	E,F	The inorganic analytes in soil contributing to the elevated risks at OU 1 are primarily arsenic, barium, mercury, and zinc Arsenic was detected at greater than the background value in only 2 out of 75 soil samples The maximum arsenic detection was in 1 out of 18 closely gridded (equally spaced) Trench E confirmatory soil samples Barium was detected at greater than the background concentration in only 1 out of 75 samples The sole elevated barium detection was located at the head of the drainage ditch at Area G. Mercury was detected at greater than the background value in 2 out of 75 soil samples The maximum mercury result is also located at the head of the drainage ditch at Area G A second Area G drainage ditch sample collected approximately 30 feet away (downslope) did not contain barium or mercury greater than background Zinc was detected at greater than the background concentration in 9 out of 75 soil samples These sporadic detections of inorganics are not indicative of source areas
		Lead	E	
Surface Soil	CLP TAL-INOR	Barium	G	
		Cadmium	G	
		Chromium	G	
		Cobalt	G	
		Copper	G	
		Lead	A,E,F,G	
		Mercury	C,G	
		Silver	E	
		Vanadium	G	
		Zinc	A,F,G	
Surface Water(Area A only)	CLP TAL-INOR	Copper	A	The inorganic analytes contributing to elevated ecological risks for surface water and sediment at Area A were primarily copper and zinc One surface water and three sediment samples were collected in the drainage ditch at Area A Copper in both surface water and sediment produced elevated ecological risks Zinc in the sediments was also responsible for an increased ecological risk A review of the toxicological data for copper suggests that organisms that are likely to use this habitat would not be impacted Zinc concentrations exceeded the screening benchmark associated with plant receptors However, the screening benchmarks used in the ecological risk assessment (ERA) were primarily below established LAFB background concentrations, and corresponding conservative assumptions used in the ERA suggest that impacts to wildlife are unlikely These inorganic analyte concentrations are attributable to overland runoff and accumulation
Sediment(Area A only)	CLP TAL-INOR	Barium	A	
		Copper	A	
		Iron	A	
		Lead	A	
		Manganese	A	
		Mercury	A	
		Nickel	A	
		Vanadium	A	
		Zinc	A	
Groundwater	CLP TAL-INOR	Arsenic	A,B,C,D,E,G	The inorganic analytes contributing to elevated risks for groundwater at OU 1 were arsenic, iron, manganese, chromium, and beryllium Each of these elements was likely detected at greater than background values due to the impacts of turbidity. These inorganic analytes are naturally occurring in the soil and can cause elevated groundwater concentrations when turbidity is present in samples This is supported by the background overburden groundwater samples collected under OU 12 Iron and manganese are responsible for up to 90% of the noncarcinogenic groundwater risk Neither iron or manganese have promulgated drinking water standards (MCLs) Arsenic and beryllium are responsible for up to 100% of the carcinogenic risks from groundwater Arsenic is ubiquitous in groundwater throughout the State of Maine and is a commonly detected groundwater element Arsenic concentrations found in OU 1 groundwater were all well below the MCL of 50ug/L. Beryllium was detected in 4 groundwater samples out of 40 collected All the detections were below or at the CRDL of 1 0 ug/L All detections of beryllium were below the MCL of 4 0 ug/L. In summary, these detections of inorganics do not indicate any base-related inorganic source areas at OU 1
		Barium	A,B,C,D,E,G	
		Beryllium	B,C,E	
		Chromium	A,B,C,D,E,F	
		Iron	A,B,C,D,E,F,G	
		Lead	A,B,C,D,E,F,G	
		Manganese	A,B,C,D,E,F,G	
		Nickel	A,B,C,D,E,G	
		Vanadium	B,C	

NOTES:

CPC = Compound of Potential Concern

>BKG = Greater than established background values

* = Background values are for bedrock groundwater only Overburden background concentrations have not been established to date for LAFB.
Some of the maximum concentrations listed may be from overburden groundwater samples and hence a proper comparison to background is not possible

CLP TAL-INOR = Contract Lab Program Target Analyte List of Inorganics

MCL = Maximum Contaminant Level

CRDL = Contract Required Detection Limit

ERA = Ecological Risk Assessment

LAFB = Loring Air Force Base

ug/L = Micrograms per liter

7.0 DESCRIPTION OF THE NO ACTION ALTERNATIVE

Sampling conducted after the removal actions were completed at the LLRWDS confirmed that no significant radiological or non-radiological contamination above background concentrations remained at the former UST or disposal trench locations. Analysis of groundwater sampled from monitoring wells installed downgradient of the USTs and disposal trenches did not consistently detect contamination above MCLs or MEGs, other than that attributable to background variation or sample turbidity.

In accordance with USEPA guidance, additional monitoring and five-year reviews are not necessary for sites where no hazardous substances, pollutants, or contaminants remain at levels that would necessitate restricted use or access (USEPA, 1991). Because the USTs and waste disposal trenches were removed during the removal action and results of the RI indicate no substantial contamination remains on-site, additional monitoring and five-year reviews will not be conducted.

Based on these results, and the baseline risk assessment, no further remedial action under CERCLA is considered necessary for OU 1 at LAFB. Areas A through F of OU 1 will be removed from the IRP. Area G will also be removed from the IRP and be redesignated as a non-CERCLA site that will be managed in accordance with the Maine UST regulations.

Remediation of the contaminated soil and groundwater associated with the former fuel oil UST and abandoned pipeline is best addressed as a non-CERCLA action conducted under Maine UST regulations. The authority of CERCLA is limited to the hazardous substances defined in Section 101(14) of the law. Under both Sections 101 and 104 of CERCLA, petroleum products are excluded from regulation under CERCLA. Remediation of the contaminated soil and groundwater associated with the former fuel oil UST and abandoned pipeline will be addressed as a non-CERCLA action conducted under the Maine UST regulations.

Section 12 of the Maine UST regulations (06-096 CMR 691) outlines requirements for leak investigation, response, and corrective action. Many of the requirements for response and investigation have been met during the course of replacing the Building 216 USTs and conducting the RI. Further response at Area G, in accordance with Section 12 requirements, potentially includes soil remediation, groundwater treatment, and monitoring.

If during the course of the UST remedial response, CERCLA-regulated wastes are identified at concentrations that pose risk to human health or the environment, Area G of OU 1 will be managed under the IRP and CERCLA.

8.0 DOCUMENTATION OF NO SIGNIFICANT CHANGES

The USAF prepared a Proposed Plan for OU 1 (ABB-ES, 1995b). The Proposed Plan describes the USAF's recommendation to pursue no further action under CERCLA at OU 1. There have been no significant changes made to the No Action under CERCLA decision stated in the Proposed Plan.

9.0 STATE ROLE

MEDEP, on behalf of the State of Maine, reviewed the RI Report and Proposed Plan and indicated its support for the selected remedy. MEDEP concurs with the selected remedy for OU 1. A copy of the declaration of concurrence is included in Appendix C.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
Am	Americium
BEHP	bis(2-ethylhexyl)phthalate
CERCLA	Comprehensive Environmental Restoration, Compensation, and Liability Act
CPC	contaminants of potential concern
CRP	Community Relations Plan
DOD	Department of Defense
FFA	Federal Facilities Agreement
HI	hazard index
HQ	hazard quotient
IRP	Installation Restoration Program
LAFB	Loring Air Force Base
LLRWDS	Low Level Radioactive Waste Disposal Sites
MCL	Maximum Contaminant Levels
MEDEP	Maine Department of Environmental Protection
MEG	Maximum Exposure Guidelines
NCP	National Contingency Plan
Np	Neptunium
NPL	National Priorities List
OU	operable unit
Ogden	Ogden Environmental and Energy Services, Inc.
Pa	Protactinium
PA	Preliminary Assessment
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
Ra	Radium

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

RAB	Restoration Advisory Board
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SI	Site Inspection
SVOC	semivolatile organic compounds
Th	Thorium
TCE	trichloroethene
U	Uranium
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compounds
WSA	weapons storage area

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APPENDIX A

TRANSCRIPT OF THE PUBLIC MEETING (AUGUST 2, 1995)

STATE OF MAINE AROOSTOOK, ss.

LORING AIR FORCE BASE
OPERABLE UNIT 1

CARY MEDICAL CENTER
VAN BUREN ROAD
CARIBOU, MAINE
8:03 P.M.

Philip R. Bennett, Jr.,
Court Reporter
13 Vaughn Street
Caribou, Maine 04736
(207)498-2729

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EXHIBITS

LORING AIR FORCE BASE, OPERABLE UNIT # 1

August 2, 1995

PETER FORBES: Good evening. Welcome to the public hearing to receive comments on the proposed plan for Operable Unit 1 at Loring Air Force Base, the Low Level Radioactive Waste Disposal Sites.

Today's date is August 2nd, 1995. My name is Peter Forbes, the Remedial Project Manager for the Installation Restoration Program at Loring. And seated with me are Michael Nalipinski of the U.S. Environmental Protection Agency and Naji Akladiss of the Maine Department of Environmental Protection. They will assist me in receiving your comments tonight.

This hearing is being held in accordance with the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended in 1986, also known as Superfund. The act requires federal facilities on the National Priorities List to present clean up proposals to the local community for comment and consideration before the final clean up decisions are made. The purpose of this hearing is to receive comments on the Proposed Plan for Operable Unite 1.

Mr. Phil Bennett from Aroostook Legal Reporters will

serve as the court reporter tonight, preparing a verbatim record of the proceedings. The verbatim record will become a part of the final clean up plan. The court reporter will be able to make a complete record only if he is able to hear and understand what you say. With that in mind, please follow a few ground rules. Speak only after I recognize you and please address your remarks to me. State your name and the organization you represent and present your statement. Please do not state your address or any other personal information which you do not want to become a matter of the public record. Do not begin speaking until you have reached the podium. Speak slowly and clearly into the microphone. If you have prepared a statement beforehand, you may read it aloud or you may describe it and place it on this table.

Now are there any individuals who would like to make a comment or question or statement at this time?

Okay. Well, ladies and gentlemen, it's 8:05 p.m., August 2nd, 1995. I declare the public hearing to receive comments on the Proposed Plan for Operable Unit 1 at Loring Air Force Base closed. Thank you for coming.

- END OF HEARING

C E R T I F I C A T I O N

I HEREBY CERTIFY THAT the foregoing is a true and correct transcript of the record of proceedings held on the aforementioned date.

Philip R. Bennett, Jr.,
Court Reporter

STATE OF MAINE AROOSTOOK, ss.

APPENDIX B

RESPONSIVENESS SUMMARY

FINAL

Loring Air Force Base

OU 1 RESPONSIVENESS SUMMARY

AUGUST 1995

Prepared for:

Air Force Base Conversion Agency
Limestone, Maine
(207) 328-7109

Prepared by:

Service Center: Hazardous Waste Remedial Actions Program
Oak Ridge, Tennessee

Contractor: ABB Environmental Services, Inc.
Portland, Maine

Project No. 7656-16

OU 1 RESPONSIVENESS SUMMARY
LORING AIR FORCE BASE

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PREFACE

The U.S. Air Force (USAF) held a 30-day comment period from July 17 to August 16, 1995, to provide an opportunity for the public to comment on the Proposed Plan and other documents developed for Operable Unit No. 1 (OU 1) at Loring Air Force Base, Maine. The Proposed Plan is the document that identifies remedial action objectives, evaluates remedial alternatives, and recommends the alternative that best meets the evaluation criteria for OU 1. The USAF made preliminary recommendations of its preferred alternative for remedial action at OU 1 in Section 6.0 of the Proposed Plan, which was issued on July 17, 1995. All documents on which the preferred alternative was based were placed in the administrative record for review. The administrative record is a collection of the documents considered by the USAF while choosing the remedial action for OU 1. It is available to the public at the following location:

Air Force Base Conversion Agency
5100 Texas Road
Limestone, ME 04751
(207) 328-7109

The purpose of this Responsiveness Summary is to document USAF responses to the questions and comments raised during the public comment period regarding the proposed OU 1 preferred alternative. The USAF considered all comments in this document before finalizing the preferred remedy for OU 1.

This Responsiveness Summary is organized into the following sections:

1.0 Overview of the Preferred Alternative. This section briefly outlines the preferred alternative presented in the Proposed Plan for OU 1.

2.0 Background on Community Involvement and Concerns. This section provides a brief history of community interest in OU 1 and concerns regarding these areas.

3.0 Summary of Comments Received During the Public Comment Period and USAF Responses. This section summarizes and provides the USAF's responses to all written and oral comments received from the public during the public comment period.

1.0 OVERVIEW OF THE PREFERRED ALTERNATIVE

The following paragraphs outline the preferred alternative presented in the Proposed Plan OU 1.

Based on the results of the RI, no further remedial action under CERCLA is considered necessary for OU 1 at LAFB.

Areas A through F: In 1994, removal actions were conducted for the five radiological USTs and the contents of the former waste disposal trenches. Completion of these removal actions has eliminated the need for any further remedial action at Areas A through F.

Area G: The contamination detected at Area G is primarily attributed to a former leaking UST and possibly the fuel oil pipeline. The tanks were replaced and the pipe was abandoned. Because the release involved only petroleum product, the USAF will address the petroleum contamination as a non-CERCLA action under the Maine UST regulations.

Section 12 of the Maine UST regulations (06-096 CMR 691) outlines requirements for leak investigation, response, and corrective action. Many of the requirements for response and investigation have been met during the course of replacing the Building 216 USTs and conducting the RI. Further response at Area G, in accordance with Section 12 requirements, potentially includes soil remediation, groundwater treatment, and monitoring.

If during the course of the UST remedial response, CERCLA-regulated wastes are identified at concentrations that pose risk to human health or the environment, Area G of OU 1 will be managed under the IRP and CERCLA.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Throughout LAFB's history, the community has been involved in base activities. The USAF, USEPA, and MEDEP have kept the community and other interested parties apprised of LAFB IRP activities through informational meetings, fact sheets, press releases, public meetings, site tours, and open houses.

In addition to these activities, during the course of IRP activities at LAFB, there have been regular meetings of the Restoration Advisory Board (RAB) (formerly the Technical Review Committee). The RAB, chaired by the USAF and a representative of the community, is composed of representatives of the USEPA, MEDEP, the community, and local officials. The purpose of the RAB meetings has been to ensure clear communication with the public, timely transfer of information, and opportunity for public comment.

A Federal Facilities Agreement (FFA) between USEPA Region I, MEDEP, and USAF, signed January 30, 1991, governs environmental activities being conducted at LAFB. The FFA provides the framework for addressing environmental effects associated with past and present activities so that appropriate investigations and remedial actions are implemented to protect human health, welfare, and the environment. Since the signing of this agreement, LAFB was placed on Congress' Base Closure List and closed in September 1994. The FFA was amended in December 1993 to address base closure-related issues such as transfer of real property. The FFA was further modified in January 1995 to allow Remedial Project Managers to make minor modifications to the FFA, such as schedule adjustments or removal of petroleum-contaminated sites from the agreement.

The framework for the USAF's approach to community involvement is the LAFB Community Relations Plan (CRP), which was released in August 1991 and subsequently revised in May 1995. The CRP outlines the USAF's program for addressing community concerns and keeping citizen informed and involved during remedial activities. To ensure the public was informed about the IRP program, the USAF held three public information meetings in the towns of Limestone, Caribou, and Fort Fairfield in February and March, 1993. The purpose of the meetings was to introduce the IRP program and respond to any questions from the public.

Documentation of the reports, memoranda, and correspondence that are the basis for IRP remedial response decisions are kept in an Administrative Record. The

Administrative Record is open and available for public review at the Air Force Base Conversion Agency Office, 5100 Texas Road, Limestone, Maine.

The following is a summary of the activities the USAF has undertaken to keep the public informed and involved regarding the remedial response at OU 1.

- On June 2, 1994, a RAB meeting was held to discuss the results of the OU 1 investigations and the approach for conducting the UST and radioactive waste disposal trench removal action.

- An IRP Fact Sheet, explaining activities planned for OU 1, was issued in July 1994.

- The USAF published a notice and brief discussion of the proposed removal action in the Aroostook Republican on July 6, 1994 and the Bangor Daily News on July 7, 1994.

- From July 11 through August 10, 1994, the USAF held a 30-day public comment period to accept public input on the Action Memorandum outlining the proposed removal action, and on any other OU 1 documents in the Administrative Record. On July 28, 1994, USAF personnel and regulatory representatives held a public meeting to discuss the Action Memorandum and to accept oral comments.

- During the removal action, the USAF invited the local press to cover the trench removal activities. Information regarding both the trench and UST tank removals was made available to representatives of local media.

- The USAF published a notice and brief analysis of the Proposed Plan in the Bangor Daily News, Aroostook Republican, Fort Fairfield Review, and Presque Isle Maine Star-Herald on July 12, 1995, recommending No Action under CERCLA as the preferred alternative for OU 1.

- On July 17, 1995, the Proposed Plan for OU 1 was made available for public review at the Air Force Base Conversion Agency Office, 5100 Texas Road, Limestone, Maine.

- From July 17 through August 16, 1995, the USAF held a 30-day public comment period to accept public input on the recommendations in the

RI/Baseline Risk Assessment and the No Action preferred alternative presented in the Proposed Plan, and on any other documents included in the Administrative Record. On August 2, 1995, USAF personnel and regulatory representatives held a public meeting and hearing to discuss the OU 1 RI and Proposed Plan. During the public meeting, the USAF answered questions informally from the public. Immediately following the public meeting, a public hearing was held to accept oral comments. Based on the public comments, the public is in agreement regarding the preferred alternative for OU 1 as presented in the Proposed Plan.

3.0 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND USAF RESPONSES

This Responsiveness Summary addresses comments received by the USAF and USEPA during the public comment period from July 17 to August 16, 1995 relative to the Proposed Plan for OU 1. The only comments received were those received in writing from a RAB member. The comments and corresponding responses are included herein.

1. Comment: The commenter asked what was the purpose of the five (5) radiological USTs attached to weapon maintenance facilities.

   Response: The purpose of the five radiological USTs was to receive and contain potentially radioactive liquids in the event of a release in one of the buildings. Further information can be obtained from the OU 1 Remedial Investigation Report which is part of the Administrative Record.

2. Comment: The commenter asked what radioactive isotopes were to be transported to these radiological USTs.

   Response: The radiological USTs at Areas A and F supported Buildings 365 and 232, respectively. Strategic weapons components were reportedly installed and inspected within these buildings, with the UST backups in the event of a release of radioactive materials. A radioactive release from these buildings could have potentially been composed of enriched uranium, plutonium, americium, or tritium. There were no documented releases to these tanks, which is supported by the analysis of the tank liquids, sediments, and scrape samples. Further information can be obtained from the OU 1 Remedial Investigation Report which is part of the Administrative Record.

   The remaining three radiological USTs at Areas B, C, and D supported the "short igloos" where the tritium containers were stored. The "short igloos" contained floor drains which were connected to the USTs to receive washdown liquids in the event of a tritium release. There were no documented releases to these radiological USTs, which is supported by the analysis of the tank liquids.

3. Comment: The commenter asked if there are no documents showing release of any radioactive isotopes into these radiological USTs, why were these tanks tested.

   Response: The tanks were sampled because they did contain liquid and documentation on the origin of the liquid could not be located. To confirm that the tanks did not contain chemical or radioactive contaminants, liquid, sediments, interior scrape samples, and soil samples from beneath the tanks were collected and analyzed for the target radioisotopes for all five USTs prior to their removal in 1994. Further information can be obtained from the OU 1 Remedial Investigation Report which is part of the Administrative Record.

4. Comment: The commenter asked if any radioactive isotopes had been found in the UST, would it have been necessary to have disposed of these at the Repository in Utah.

   Response: Depending on the levels and radioisotopes found, it might have been necessary to have disposed of these USTs in Utah. However, based on the lack of contamination in the tanks, they were simply disposed of as scrap metal.

5. Comment: The commenter asked why tritium is found all over the Loring WSA if tritium is a very light gas and, when released either by accident or purposeful venting, should have risen into the Stratosphere and Ionosphere.

   Response: Tritium is found in background due to atmospheric weapons testing in the 1960s, more recently from nuclear power plant releases, and naturally occurring interactions with cosmic rays and gases in the upper atmosphere. The tritium detections in the University of Maine and ABB-ES analyses indicated levels of tritium at the Weapons Storage Area (WSA) which are consistent with background levels. Further information can be obtained from the OU 1 Remedial Investigation Report which is part of the Administrative Record.

6. Comment: The commenter asked why are the areas of tritium concentration at the WSA not related to the weapon maintenance facilities.

Response: As discussed, the tritium detected at the WSA is at background levels with normal local variation. There are no significant areas of "tritium concentration" at the WSA.

7. Comment: The commenter asked why tritium radiation background was not established at Loring, since a great deal of effort was made to establish background radiation of certain isotopes around the Loring WSA.

Response: Tritium background was not established due to the low levels detected and because of tritium's relatively low health risks. Tritium detections from within the WSA were what would be expected in background. Detections of tritium in groundwater and surface water were all less than USEPA's drinking water standard for tritium.

8. Comment: The commenter asked whether the southern area was mentioned in the plan, with reference to tritium, around the Nuclear Power Plant, at Wiscasset.

Response: No reference to the "southern area" was made in the Proposed Plan. However, in the University of Maine report, there is a discussion of samples collected from Southern Maine. In 1972, tritium analyses were performed around the "then being constructed" nuclear power plant at Wiscasset (which is in Southern Maine). The data were collected prior to the power plant receiving any nuclear fuel to establish a baseline against which future monitoring data could be compared.

9. Comment: The commenter asked why tritium would be defined as a contaminant at Area D, and, when found at other areas, not be acknowledged as a contaminant.

Response: Tritium is acknowledged as a potential contaminant at Areas B, C and Area D, based on known site history.

10. Comment: The commenter asked why there is such a reluctance to acknowledge tritium as a radioactive substance throughout this whole plan.

Response: It was certainly not the intent of the Air Force to appear reluctant to address tritium. Tritium has been carefully addressed throughout the RI process by the USAF, the University of Maine, the MEDEP, and USEPA.

Tritium was identified as one of the WSA's target radioactive isotopes and therefore was included in analyses of OU 1 environmental samples. There is no detailed discussion of tritium, in particular, because (1) the purpose of the Proposed Plan is to present the Air Force's preferred alternative and a general overview of the IRP activities conducted to date, and (2) the results of the radiological investigation did not identify tritium at other than naturally occurring levels.

11. Comment: The commenter asked whether the following is a correct paraphrase of the last paragraph on Pages 4-5 and 4-6:

(1) Background radiation at Loring and its Weapon Storage Area (WSA) may pose a natural health risk.

(2) Background radiation at Loring and its WSA is lower than other areas throughout the United States.

(3) That even though the WSA at Loring is contaminated with weapons-grade radioactive isotopes, tritium, the human health risk here due to radiation is still lower than risk typically associated with naturally occurring radiation throughout the United States.

Response: There are several inaccuracies in this interpretation of the referenced paragraph. To clarify, risk calculations were performed using (1) concentrations of naturally occurring radiation throughout the United States, (2) background concentrations of radioactive isotopes established for Loring, and (3) concentrations of radioactive isotopes detected at the WSA. The risks associated with background radiation at Loring and at the WSA were lower than risks associated with published naturally occurring levels of radiation throughout the U.S. Further information can be obtained from the OU 1 Remedial Investigation Report which is part of the Administrative Record.

These comparisons were made to illustrate that while the human health risks calculated for the radioactive isotopes at the WSA are higher than the USEPA target risk range ($1x10^{-4}$ to $1x10^{-6}$), naturally occurring radiation also has a risk higher than the USEPA target risk level. Following the trench removal action, the risks associated with radioactivity at the WSA are consistent with naturally occurring radiation.

The statement that "Loring is contaminated with weapons-grade radioactive isotope, tritium", is somewhat misleading. Tritium is tritium, whether it is included in a weapon or a result of natural reactions in the atmosphere, and the levels of tritium detected are consistent with background levels in Maine.

APPENDIX C

LETTERS OF CONCURRENCE

(TO BE INCLUDED IN ROD FOR SIGNATURE)

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

ANGUS S. KING, JR.
GOVERNOR

EDWARD O. SULLIVAN
COMMISSIONER

August 16, 1995

Mr. Peter Forbes
Air Force Base Conversion Agency
Operation Location "M"
RR # 1 Box 1719
Limestone, Maine 04750

RE: Loring Air Force Base Superfund Site, Maine

Dear Mr. Forbes:

The Maine Department of Environmental Protection (MEDEP) has reviewed the May 1995 Draft Record of Decision (ROD) regarding Operable Unit 1 (OU1) for the Loring Air Force Base Superfund Site located in Limestone, Maine.

Based on that draft, the MEDEP concurs with the Air Force's determination that no action under CERCLA is necessary to address the contamination at OU1. The MEDEP also concurs with the following recommendations:

1. That Areas A through F of OU1 be removed from the U.S. Air Force's CERCLA response under Installation Restoration Program.

2. That Area G be redesignated a Non-CERCLA site to be managed in accordance with the State of Maine regulations for underground storage tanks.

Clean Up Levels

The remedial alternative selected for the site must achieve goals for reducing contamination at OU1. Clean-up goals for Area G have been set for contaminated soil, sediment, and groundwater based either on background concentration, analytical detection limits, or on risk calculation.

Compounds and elements for which remedial goals have been set are listed in Table 10-1 through 10-6 of this ROD.

Description of No Action Alternative

The following paragraph describes the no action remedial alternative developed for Operable Unit 1 at Loring:

Sampling conducted after the response actions were completed at the LLRWDS, Areas A through F of OU1, confirmed that essentially no radiological or non-radiological contamination, above background concentrations, remained at the former UST or disposal trench locations. Analysis of groundwater sampled from monitoring wells installed downgradient of the USTs and disposal trenches did not consistently detect radiological or non-radiological contamination above MCLs or MEGs, other than that attributable to background variation or sample turbidity.

Based on these results, no further remedial action under CERCLA is considered necessary for OU1 at LAFB and no further remedial action under State law is considered necessary for Areas A through F of OU1. Sampling has shown fuel-related contamination of soils and groundwater at Area G. It is, therefore, recommended that Areas A through F of OU1 be removed from the IRP for closure of federal facilities. It is further recommended that Area G also be removed from the IRP and be redesignated as a non-CERCLA site that will be remediated in accordance with the Maine UST Regulations. Because no significant residual contamination, attributable to the LLRWDS, remains on site, additional monitoring and five-year reviews are not recommended.

The State's concurrence in the selected remedy, as described above, should not be construed as the State's concurrence with any conclusions of law or findings of fact which may be set forth in the Record of Decision (for OU1). The State reserves any and all rights to challenge any such finding of fact or conclusion of law in any other context.

This concurrence is based upon the State's understanding that the MEDEP will continue to participate in the Federal Facilities Agreement and in the review and approval of operational, design and monitoring plans.

The MEDEP looks forward to working with the Department of the Air Force and the USEPA to resolve the environmental problems posed by this site. If you need additional information, do not hesitate to contact myself or members of my staff.

Sincerely,

Edward O. Sullivan, Commissioner
Department of Environmental Protection

pc: Mark Hyland, MEDEP
Mike Nalipinski, EPA
Hank Lowman, BCA

COMSUPER/dlb

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