Montana Department of
ENVIRONMENTAL QUALITY
Brian Schweitzer, Governor
P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.mt.gov

February 28, 2006

Todd Everts
Environmental Quality Council
Capitol Complex
Helena, MT 59620

Subject: Draft Environmental Assessment and Statement of Basis for the Malmstrom Air Force Base, Great Falls, Montana

Dear Mr. Everts:

Enclosed is a draft Environmental Assessment and Statement of Basis for the above-referenced facility. If you have any questions, please contact me at 406/444-2876 or the e-mail address listed below.

Sincerely,

Rebecca Holmes

Rebecca Holmes
Environmental Science Specialist
Waste and Underground Tank Management Bureau
Permitting and Compliance Division
e-mail: rholmes@mt.gov

Enclosure
cc: HW facility file: Malmstrom Air Force Base – Public Participation #1 (w/o enclosure)

Montana Department of Environmental Quality
Permitting and Compliance Division
Waste and Underground Tank Management Bureau
P.O. Box 200901
Helena, Montana 59620-0901

Draft Environmental Assessment

Montana Hazardous Waste Permit Number: MTHWP-01-01

Issued to: Malmstrom Air Force Base
39 78th Street North
Malmstrom AFB, Montana 59402-7536

Legal Description: Sections 1, 2, 3, 10-15, Township 20 North, Range 4 East; and Sections 6 and 7, Township 20 North, Range 5 East, Cascade County

Issued by: Hazardous Waste Section
Waste and Underground Storage Tank Management Bureau
Permitting and Compliance Division
Montana Department of Environmental Quality

Purpose of the Environmental Assessment
The Montana Department of Environmental Quality (MDEQ) is required under the Montana Environmental Policy Act (MEPA) to conduct an environmental assessment (EA) on the proposed permit action described in this document. An EA details: 1) all reasonable alternatives to MDEQ's action; and 2) outlines the potential impacts to the human environment resulting from MDEQ's permitting action and reasonable alternatives to that action.

Based on the impact analysis and professional judgment, MDEQ makes a decision on the proposed permit action and summarizes the decision in the EA. If the decision significantly impacts the human environment, a more detailed environmental review, called an environmental impact statement, must be conducted by MDEQ.

Public Comment Period
The public including interested citizens, MDEQ, EPA, other governmental agencies, and the permittee are provided forty-five (45) days to review and comment on the draft EA. **The comment period will extend from March 1 to April 14, 2006.** All persons wishing to comment on the draft EA should submit comments in writing to:

Rebecca Holmes
Environmental Science Specialist
Waste and Underground Tank Management Bureau
Montana Department of Environmental Quality
P.O. Box 200901

Helena, MT 59620-0901

All written comments must be received by the MDEQ on or before **April 14, 2006** for consideration. Please contact Rebecca Holmes at (406) 444-2876 or at the address listed above for further information.

Montana Hazardous Waste Regulations

Rules administering hazardous waste management in Montana are set forth in the Administrative Rules of Montana (ARM), Title 17, Chapter 53, Sub-Chapters 1 through 12. Federal regulations for hazardous waste management are set forth in the Code of Federal Regulations (CFR), Parts 124 and 260 through 279, and are incorporated by reference in ARM. For ease of reading this document, when federal regulations under Title 40 of the CFR have been incorporated by reference into ARM, only the federal citation is used.

Description of Project

MDEQ is proposing a modification to the hazardous waste permit issued to Malmstrom Air Force Base (Malmstrom) in Great Falls, Montana. The proposed modification is to include a cleanup remedy for shallow groundwater contamination at LF-19, a closed landfill located on the Malmstrom facility.

The Malmstrom Air Force Base is located on the eastern city limits of Great Falls, Montana. The base was established in 1942 and encompasses 3,500 acres. The Missouri River is approximately one mile north of the base. The State of Montana issued a hazardous waste permit to Malmstrom in 1989 to allow storage of hazardous waste in an on-site storage building. In addition, the Environmental Protection Agency (EPA) issued Malmstrom a permit under the Hazardous and Solid Waste Amendments to the federal law for management of hazardous waste, the Resource Conservation and Recovery Act (RCRA). The EPA permit required that Malmstrom conduct remedial investigation and cleanup of contaminated areas throughout the facility. Hazardous waste permits (both state and federal) are issued for a ten-year period and may be renewed at the end of that period. Because MDEQ was given oversight authority for facility-wide cleanup by EPA, the Malmstrom hazardous waste permit was reissued in 2001 to include requirements for both the operation of the on-site storage building and for facility-wide cleanup.

Malmstrom has identified 26 potentially contaminated areas which require some degree of investigation and cleanup. The areas are designated as Solid Waste Management Units (SWMUs) or Areas of Concern (AOCs). Twenty-five of these areas have been either remediated or referred to MDEQ's Petroleum Site Response Program for further action. The last SWMU requiring cleanup, SWMU #SW-3 (LF-19), is the subject of this EA.

Sample results indicate levels of chlorinated volatile organic compounds (CVOCs) are present in both shallow groundwater and, when present, surface water in a coulee adjacent to LF-19. In addition, shallow groundwater contamination has been detected in monitoring wells outside the LF-19 boundary. No contamination has been detected in the deep groundwater aquifer. Concentrations of CVOCs in shallow groundwater exceed Montana's numeric water quality standards, as published in Circular WQB-7.

MDEQ is proposing to select a remedy for LF-19 that will include enhanced in-situ bioremediation, monitored natural attenuation, source control, and institutional controls to address shallow groundwater contamination at the site. Enhanced reductive dechlorination (ERD) would be used as a biological treatment barrier to degrade chlorinated volatile organic compounds present in shallow groundwater. Groundwater would be monitored to determine effectiveness of the barrier system and to track natural attenuation of contaminants. Institutional controls would be put in place to limit or restrict land and water use to prevent potential exposure to contaminants in impacted areas. In addition, further investigation within the landfill trenches would be conducted, with the focus towards developing and installing an on-site source control technology.

Objectives of Proposed MDEQ Action

The objective of the proposed MDEQ action (selecting a remedy for LF-19 and modifying the permit to include the remedy) is to comply with the provisions of the Malmstrom hazardous waste permit, 40 CFR 264.101 and 40 CFR 270.41. As stated in 40 CFR 264.101, Malmstrom is required to institute corrective measures for all releases of hazardous waste or constituents from SWMUs at the facility. In addition, corrective action must be implemented for contamination found outside the facility boundary. Condition III.G. of the Malmstrom hazardous waste permit states that MDEQ will select remedial measures to be taken for areas of contamination at the facility, document the selected remedy in a Statement of Basis, and initiate a permit modification as set forth in 40 CFR 270.41.

Alternatives Considered

Alternative 1: No Action

The No Action alternative provides a baseline from which to analyze other alternatives. It does not include any active remediation or monitoring. Alternative 1, No Action, does not comply with Montana's hazardous waste laws and regulations which require corrective action for off-site contamination, or with Montana's water quality regulations, which require that surface and groundwater meet water quality standards under Circular WQB-7. Therefore, this alternative is not reasonable and not considered further.

Alternative 2: Institutional Controls (ICs)

Under this alternative, institutional controls would be implemented to prevent use of, or exposure to, contaminated shallow groundwater both on and off base. Environmental institutional controls are legal or administrative restrictions used to prevent and/or limit potential exposure to contaminants in impacted areas. Legal and/or administrative controls and physical restrictions would be applied to the LF-19 site to control or prevent present and future on-base and off-base use and access to contaminated shallow groundwater.

For on-base controls, Malmstrom's General Plan consolidates plans and programs related to management and development of Air Force lands, facilities, and resources. The General Plan is used to guide future growth and development of on-base activities. Updates to the General plan would be made to incorporate institutional controls to prohibit current and future use of ground and surface water, and to restrict land use of LF-19. Off-base institutional controls would

include easements and administrative agreements with adjacent landowners. Malmstrom currently has a perpetual easement for off-base properties within 1,000 feet of the base boundary that precludes human habitation and building for human occupancy.

Alternative 2, Institutional Controls, does not comply with Montana's hazardous waste laws and regulations which require corrective action for off-site contamination, or with Montana's water quality regulations, which require that surface and groundwater meet water quality standards under Circular WQB-7. Therefore, this alternative is not reasonable and not considered further.

Alternative 3: Monitored Natural Attenuation (MNA) with ICs
Under this alternative, routine groundwater monitoring would be conducted to evaluate progress towards meeting cleanup goals through natural attenuation processes. Institutional controls would also be implemented to prevent use of, or exposure to, contaminated shallow groundwater both on and off base.

Natural attenuation is the reduction in mass or concentration of a chemical compound in soil or groundwater over time or distance from the source due to naturally occurring physical, chemical or biological processes. Monitored natural attenuation (MNA) refers to the use of natural attenuation processes within the context of a carefully controlled and monitored site cleanup approach. To measure whether natural attenuation of compounds is occurring, a monitoring program must be designed to 1) demonstrate natural attenuation is occurring according to expectations, 2) detect changes in environmental and contaminant conditions, and 3) verify the contaminant plume is not expanding.

Reductive dechlorination is a natural attenuation process by which anaerobic microbes systematically reduce CVOCs to benign end products such as ethane and ethene. Malmstrom would monitor the existing groundwater monitoring system in areas where CVOC concentrations are above Circular WQB-7 standards. In addition, up to six additional monitoring wells would be installed and included in the monitoring program. Groundwater samples would be collected and analyzed for CVOCs, as well as geochemical parameters associated with natural attenuation. The data would be evaluated to ensure natural attenuation of the contaminants is occurring. MNA would end when concentrations of contaminants meet cleanup standards and remediation objectives.

Alternative 4: Enhanced Reductive Dechlorination (ERD) with MNA and ICs
Under this alternative, naturally occurring reductive dechlorination of CVOCs in shallow groundwater would be stimulated through the injection of substrates designed to further promote degradation. MNA and ICs would also be used in tandem with ERD.

Subsurface treatment barriers such as ERD form a zone where contaminants migrating in groundwater are intercepted and degraded or transformed into harmless end products. ERD involves addition of compounds to the subsurface that enhance the naturally-occurring reductive dechlorination of CVOCs. The ERD biological barrier would be installed along the northwestern edge of LF-19, perpendicular to the contaminant groundwater plume. To form the barrier, an organic substrate would be added to the subsurface through soil borings or a shallow trench. The installation of the treatment barrier at the leading edge of the contaminant plume is

designed to stop continued migration of CVOCs dissolved in the groundwater and to enhance degradation of the contaminants.

Malmstrom would install new monitoring wells within and downgradient of the contaminant plume to verify reduction of CVOCs in groundwater and monitor whether further substrate injections are necessary

Alternative 5 – Proposed Remedy: Source Control, ERD, MNA, and ICs
Malmstrom evaluated each alternative and recommended Alternative 4 as having the highest potential to meet the cleanup standards and corrective action objectives. MDEQ reviewed the results of the CMS and agreed in general with Malmstrom's evaluation and recommendation. However, MDEQ believes the recommended alternative does not adequately address source control within the waste trenches. Therefore, MDEQ is proposing to include further on-site investigation of the waste trenches to determine the most appropriate method for source control of hazardous constituents that are migrating or may migrate from the trenches to ground and surface water.

MDEQ is proposing a shallow groundwater remedy that will include a subsurface treatment barrier, monitored natural attenuation, and institutional controls, as outlined in Alternative 4. In addition, further investigation is proposed of the waste trenches to develop an on-site source control technology.

The focus of further investigation of the waste trenches would be to determine whether specific sources can be located and provide information necessary to select, design, and build a source control system. Investigation would include drilling potential source areas within the trenches to characterize groundwater and permeability of the waste to both air and water. Potential source control remedies could include limited waste excavation and disposal or treatment, passive venting, or in-situ treatment technologies such as air sparging, soil vapor extraction, or treatment barrier systems such as ERD.

Stipulations and Controls
As part of implementing the remedy for the LF-19 landfill, the Malmstrom hazardous waste permit requires that Malmstrom submit work plans, progress reports, and completion reports to MDEQ. Work plans will detail engineering requirements for treatment technologies and monitoring well installation, safety procedures, and quality assurance for sampling and analysis. Progress reports will include evaluation of progress towards meeting cleanup standards, as well as the efficacy of the remedy. All work plans and reports will be subject to MDEQ's review and approval. MDEQ has regulatory and permit authority to require changes to the remedy, if necessary.

Analysis of Regulatory Impacts on Private Property Rights
A Private Property Assessment Act Checklist was completed for MDEQ's proposed action on the remedy selection. The checklist is on file with MDEQ's Permitting and Compliance Division, Waste and Underground Tank Management Bureau. MDEQ determined that no taking or damaging implications exist requiring a further impact assessment.

Summary of Impacts

Tables 1 and 2 rate the potential human environmental impacts from implementing remedial action through Alternatives 3, 4, or 5. The human environment includes those attributes, such as biological, physical, social, economic, cultural, and aesthetic factors, that interrelate to form the environment. Impacts may be adverse, beneficial, or both. The following criteria are used to rate the impacts:

- The severity, duration, geographic extent, and frequency of occurrence;
- The probability the impact will occur if the proposed action occurs;
- Growth-inducing or growth-inhibiting aspects of the impact;
- The quantity and quality of each environmental resource or value effected;
- The importance to the State and society of each environmental resource or value effected;
- Any precedent set as a result of an impact from the proposed action that would commit MDEQ to future actions with significant impacts or a decision in principle about such future actions; and
- Potential conflict with local, state, or federal laws, requirements, or formal plans.

The following are definitions for major, moderate, minor, none, and unknown impacts on the human environment:

Major: A significant change from the present conditions of the human environment. Major impacts are serious enough to warrant preparing an environmental impact statement (EIS).

Moderate: Not a major or minor change from the present condition of the human environment. A single moderate impact may not warrant preparing an EIS; however, when considered with other impacts, an EIS may be required.

Minor: A slight change from the present condition of the human environment. Minor impacts are not serious enough to warrant preparing an EIS.

None: No change from the present conditions of the human environment.

Unknown: An EIS must be conducted to determine the effects on the human environment if impacts are unknown.

Table 1. Potential Impacts on Physical and Biological Environment

Alternative 3 = ■
Alternative 4 = ♦
Alternative 5 = ●

Resources		Major	Moderate	Minor	None	Unknown	Discussion Attached
A.	Air Quality			●	■ ♦		X
B.	Water Quality, Quantity, and Distribution			■ ♦ ●			X
C.	Geology and Soil Quality, Stability, and Moisture			♦ ●	■		X
D.	Historical and Archaeological Sites				■ ♦ ●		
E.	Aesthetics				■ ♦ ●		
F.	Terrestrial and Aquatic Life and Habitats				■ ♦ ●		X
G.	Vegetation Cover, Quantity, and Quality			■ ♦ ●			X
H.	Unique, Endangered, Fragile, or Limited Environmental Resources				■ ♦ ●		
I.	Demands on Environmental Resource of Water, Air, and Energy				■ ♦ ●		
J.	Cumulative and Secondary Impacts				■ ♦ ●		

A. Air Quality

Alternative 5 includes investigating and potentially developing an on-site source control system. Source control technologies may include passively venting contaminants from the subsurface to the air. This would be a minor impact.

B. Water Quality, Quantity, and Distribution

All three alternatives would have positive impacts on water quality. Biodegradation of contaminants in shallow groundwater will improve water quality in both surface and groundwater. The primary differences between the alternatives are timeframes for attaining cleanup standards; reduction in toxicity, mobility, and volume of contaminants; and source control. Alternatives 4 and 5 have greater potential to attain cleanup standards and corrective action goals than Alternative 3. Alternative 5, which contains requirements for on-site source control, has the potential for the shortest timeframe for attaining cleanup goals.

C. Geology and Soil Quality, Stability, and Moisture

Soil will be disturbed during installation of the ERD system for both Alternatives 4 and 5. Soil will be disturbed during drilling and investigation of the waste trenches for Alternative 5; and further disturbance may occur depending upon the source control technology developed. However, Malmstrom will be required to grade and revegetate the ground surface following field investigations and construction of the remedy technology. Therefore, impacts on soil quality and stability will be minor.

D. Vegetation Cover, Quantity, and Quality

The current vegetation cover will be disturbed during installation of monitoring wells for all three alternatives evaluated, and the ERD system for Alternatives 4 and 5. Soil will be disturbed during drilling and investigation of the waste trenches for Alternative 5; and further disturbance may occur depending upon the source control technology chosen. However, Malmstrom will be required to grade and revegetate the ground surface following field investigations and construction of the remedy technology. Therefore, impacts on vegetation cover, quality and quantity will be minor.

F. Terrestrial and Aquatic Life and Habitats

Malmstrom conducted a risk assessment to determine whether contaminants in shallow groundwater and surface water posed a risk to terrestrial and aquatic life/habitat. Conclusions of the risk assessment indicated that the risk to ecological receptors is at an acceptable level and no exposure pathway exists from contaminants to receptors.

Table 2. Potential Impacts on Social, Economic, and Cultural Environment

Alternative 3 = ■
Alternative 4 = ♦
Alternative 5 = ●

Resources		Major	Moderate	Minor	None	Unknown	Discussion Attached
A.	Social Structures and Mores				■ ♦ ●		
B.	Cultural Uniqueness and Diversity				■ ♦ ●		
C.	Local and State Tax Base and Tax Revenue				■ ♦ ●		
D.	Agricultural or Industrial Production				■ ♦ ●		
E.	Human Health				■ ♦ ●		X
F.	Access to and Quality of Recreational and Wilderness Activities				■ ♦ ●		
G.	Quantity and Distribution of Employment				■ ♦ ●		
H.	Distribution of Population				■ ♦ ●		
I.	Demands for Governmental Services			■ ♦ ●			X
J.	Industrial and Commercial Activity			■ ♦ ●			X
K.	Locally Adopted Environmental Plans and Goals			■ ♦ ●			X
L.	Cumulative and Secondary Impacts				■ ♦ ●		

E. Human Health

Malmstrom conducted a risk assessment to determine whether contaminants in shallow groundwater and surface water posed a risk to human health. Conclusions of the risk assessment indicated that the risk to human health is at an acceptable level and no exposure pathway exists from contaminants to receptors.

I. Demands for Governmental Services

The Malmstrom permit requires submittal of work plans, reports and completion certification documentation when a remedy is implemented. These submittals will be reviewed by MDEQ. Therefore, a minor impact to government services is anticipated. This impact would be the same for Alternatives 3, 4, and 5.

I. Industrial and Commercial Activity

Impacts on industrial and commercial activity will increase from those generated by the current permit. Malmstrom will hire environmental consulting firms to implement the remedy, sampling, technical evaluations, and work plan and report development. Samples for analytical evaluation will be sent to an external analytical laboratory for analysis. These impacts would be the same for Alternatives 3, 4, and 5.

K. Locally Adopted Environmental Plans and Goals

Alternatives 3, 4, and 5 require institutional controls to control or prevent present and future on-base and off-base use and access to contaminated shallow groundwater. For on-base controls, Malmstrom's General Plan consolidates plans and programs related to management and development of Air Force lands, facilities, and resources. The plan would be updated to incorporate institutional controls to prohibit current and future use of ground and surface water, and restrict land use of LF-19. Malmstrom currently has a perpetual easement for off-base properties within 1,000 feet of the base boundary that precludes human habitation and building for human occupancy. Further off-base institutional controls may be required, including easements and administrative agreements with adjacent landowners. Changes to the Malmstrom General Plan and agreements with adjacent landowners are expected to have minor impacts on local environmental plans and goals.

Individuals or Groups Contributing to EA

Montana Department of Environmental Quality

Draft EA Prepared

Rebecca Holmes
February 24, 2006

Recommendation

Based on the EA analysis, MDEQ recommends Alternative 5 as the remedy for the LF-19 landfill. Analysis of the remedial investigation conducted by Malmstrom, Montana hazardous waste and water quality regulations indicate this Alternative would best meet requirements for off-site corrective action and progress for attainment of water quality standards. To ensure protection of human health and the environment, the permit includes conditions which mitigate impacts of the remedy through departmental oversight and review of work plans and reports. MDEQ's final remedy decision will take into account all comments received during the public comment period.

The EA is an adequate level of environmental review; an EIS is not required. The EA analysis demonstrates that this State action will not be a major action significantly affecting the quality of the human environment.

STATEMENT OF BASIS

Malmstrom Air Force Base
39 78th Street North
Malmstrom AFB, MT 59402-7536

Prepared by:

Montana Department of Environmental Quality
Permitting and Compliance Division
Waste and Underground Tank Management Bureau
Hazardous Waste Section
1520 E. 6th Ave.
Helena, Montana 59620

PUBLIC COMMENT PERIOD

March 1, 2006 through April 14, 2006

SEND WRITTEN COMMENTS TO:

Rebecca Holmes
Environmental Science Specialist
Waste and Underground Tank Management Bureau
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Introduction

The Montana Department of Environmental Quality (MDEQ) has prepared this Statement of Basis (SB) to describe a proposed remedy for shallow groundwater contamination at LF-19, a closed landfill at Malmstrom Air Force Base (Malmstrom), Great Falls, Montana. The SB identifies the proposed remedy for the landfill and explains the rationale for selection. In addition, the document describes all other remedies considered during the remedy evaluation process. MDEQ will select a final remedy following consideration of public comments submitted during the public comment period and modify the Malmstrom hazardous waste permit (#MTHWP-01-01) to incorporate the remedy.

MDEQ is proposing to select a remedy that will include enhanced in-situ bioremediation, monitored natural attenuation, source control, and institutional controls to address groundwater contamination at the site. Enhanced reductive dechlorination (ERD) would be used as a biological treatment barrier to degrade chlorinated volatile organic compounds present in shallow groundwater. Groundwater would be monitored to determine effectiveness of the barrier system and to track natural attenuation of contaminants. Institutional controls would be put in place to limit or restrict land and water use to prevent potential exposure to contaminants in impacted areas. In addition, further investigation within the landfill trenches would be conducted, with the focus towards developing and installing an on-site source control technology.

MDEQ is issuing this SB as a part of its public participation requirements under the Montana Hazardous Waste Act (MHWA). In addition, this document includes the fact sheet requirements in 40 Code of Federal Regulations (CFR) 124.8 as incorporated by reference in the Administrative Rules of Montana (ARM), Title 17, Chapter 53.

For ease in reading this document, only the federal citations are used when federal regulations have been incorporated by reference in Montana hazardous waste regulations. The Montana Hazardous Waste Act (MHWA) is the state equivalent of the federal Resource Conservation and Recovery Act (RCRA), the law which requires proper management and disposal of hazardous waste. Title 40 Code of Federal Regulations (CFR) 260 through 279 and 40 CFR 124 are incorporated by reference in the Administrative Rules of Montana (ARM), Title 17, Chapter 53, Subchapters 1 through 14.

Background

The Malmstrom Air Force Base is located on the eastern city limits of Great Falls, Montana (Figure 1). The base was established in 1942 and encompasses 3,500 acres. The Missouri River is approximately one mile north of the base.

The State of Montana issued a hazardous waste permit to Malmstrom in 1989 to allow storage of hazardous waste in an on-site storage building. In addition, the Environmental Protection Agency issued Malmstrom a permit under the Hazardous and Solid Waste Amendments to RCRA. The EPA permit required that Malmstrom conduct remedial investigation and cleanup of contaminated areas throughout the facility, generally known as facility-wide corrective action. Hazardous waste permits (both state and federal) are issued for a ten-year period and may be renewed at the end of that period. The Malmstrom hazardous waste permit was reissued in 2001

and includes requirements for the operation of the on-site storage building and for facility-wide corrective action. MDEQ now has oversight for both the storage building and facility-wide corrective action.

Malmstrom has identified 26 potentially contaminated areas which require some degree of investigation and remediation. The areas are designated as Solid Waste Management Units (SWMUs) or Areas of Concern (AOCs). Twenty-five of these areas have been either remediated or referred to MDEQ's Petroleum Site Response Program for further action. The last SWMU requiring cleanup, SWMU #SW-3 (LF-19), is the subject of this SB.

LF-19, Landfill Northeast of the Weapons Storage Area

The LF-19 landfill is located northeast of the Weapons Storage Area (Figure 2). The site served as the primary base landfill from 1950 until 1991 and is approximately 31 acres in size. It is bounded on the north by the base boundary and on the west by an unnamed drainage coulee. Materials reportedly disposed in the landfill include residential garbage, residual munitions, petroleum-contaminated soils, and barrels of solvents, pesticides, oils, and acids. Coal ash was also disposed in the landfill. Waste disposal was primarily accomplished through trench-and-fill operations. Trenches were excavated up to 20 feet deep by 20 feet wide by 50 to 300 feet long. Waste was then placed in the trenches to within 2 to 3 feet of the original ground surface and covered with compacted, native soils. Trenching began in the southern part of the landfill and progressed northward.

The State of Montana issued a Class II Sanitary Landfill license to Malmstrom in 1978 for operation of the landfill. After waste disposal ended in 1991, Malmstrom closed the landfill by grading the surface to enhance drainage and seeding the native cap with native grasses. MDEQ gave final approval of closure to Malmstrom for the landfill in January 1998.

Conclusions of the Remedial Investigation

Environmental investigations were initiated at LF-19 in 1986 and consisted of seven major evaluations and assessments. EPA Region 8 performed primary oversight for corrective action at Malmstrom, including the LF-19 site, until 2001 when responsibility for oversight was transferred to MDEQ.

Site Conditions: Geology of the LF-19 site is dominated by thick sequences of glacial till composed of clay, silt, and some sand and scattered gravels. Thin laterally discontinuous shallow groundwater zones have been encountered in borings and monitoring wells installed within the coulee bottom and in the northwestern portion of the landfill. Shallow groundwater flow in the northwestern portion of the landfill appears to be northwesterly towards the coulee and flow velocity is estimated to be less than 1 foot per year. A deep aquifer is present at approximately 260 feet below ground surface. Sampling data indicates no contamination is present in the deep aquifer. Surface water is present in the coulee bounding the western edge of the landfill, but only during periods of significant snowmelt and/or rainfall events.

Soil and Water Contamination: As part of the investigation efforts, Malmstrom installed a system of monitoring wells and piezometers within the landfill and the adjacent coulee to determine whether contaminants were present in groundwater. In addition, Malmstrom sampled

the coulee when surface water was present. Soil sampling and passive soil gas monitoring was also conducted.

Sample results indicate levels of chlorinated volatile organic compounds (CVOCs) are present in both shallow groundwater and, when present, surface water in the coulee. Concentrations of CVOCs in shallow groundwater have exceeded Montana's numeric water quality standards, as published in Circular WQB-7. The following table shows the WQB -7 standard and the maximum concentrations of the CVOC compounds of concern detected in shallow groundwater at LF-19.

Contaminant	Circular WQB-7 Standard (concentrations in µg/L)	Maximum Concentrations Detected in Shallow Groundwater (concentrations in µg/L)
Trichloroethene (TCE)	5	200
cis-1,2-dichloroethene (cis 1,2-DCE)	70	1350
trans-1,2-dichloroethene (trans 1,2-DCE)	100	1270
Vinyl chloride.	2	5.57

Shallow groundwater contamination appears to be restricted to the northwestern portion of the landfill and to the adjacent reach of the coulee, extending approximately 350 feet downgradient of the base boundary. Historical surface water sampling data indicate water quality standards have only been exceeded in the portions of the coulee within the base boundary. Surface water sampled at a downstream station 250 feet to the north of the base boundary has shown no CVOC exceedences of water quality standards. Soil gas sampling results indicate elevated CVOC concentrations in soil gas in the northwestern portion of the landfill and off-site at the northwestern boundary of the landfill. Soil sampling within the boundaries of the landfill, but outside of the trenches show no contamination. The waste trenches were not sampled due to safety concerns.

TCE and PCE contamination likely results from chlorinated solvents disposed as waste within the trenches. The DCE compounds and vinyl chloride are probably degradation products (daughter products) of TCE and/or PCE. Evaluation of soil gas sampling results indicates that trenches in the northwestern portion of the landfill are the predominant discharge area for contaminants into the shallow groundwater. These trenches are the most likely source area for CVOC contamination observed in surface water and shallow groundwater in the coulee to the west and north of the landfill. It is unknown if other trenches within the landfill have potential to act as sources for shallow groundwater contamination.

Baseline Risk Assessment Summary: Malmstrom completed a baseline risk assessment, considering both human health and ecological risks, for LF-19. Conclusions of the risk assessment indicated risks posed to human health and ecological receptors were within acceptable levels.

Scope of Corrective Action
Malmstrom is required, under the conditions of its hazardous waste permit, to institute corrective measures for all releases of hazardous waste or constituents from solid waste management units at the facility. In addition, corrective action must be implemented for contamination found outside the facility boundary. Malmstrom must also comply with Montana's water quality laws, which require that state waters meet water quality standards as published in Circular WQB-7.

Shallow groundwater and ephemeral surface water within and adjacent to LF-19 contain concentrations of hazardous constituents (CVOCs) which exceed Circular WQB-7 water quality standards. Results of the remedial investigations indicate these hazardous constituents have migrated off-site into shallow groundwater and ephemeral surface water in the coulee.

The relevant cleanup standards for LF-19 are the numeric water quality criteria as published in Circular WQB-7. Corrective action objectives for LF-19 are to minimize risk to human and ecological receptors by reducing CVOC concentrations below the cleanup standards through source control and/or reduction, containment of the contaminants, and/or treatment of contaminated media. In addition, long-term site management and maintenance requirements should be minimized to efficiently control costs and level of effort.

Summary of Alternatives
Malmstrom conducted a Corrective Measures Study (CMS) to analyze remedial technologies that would meet the corrective measures objectives and cleanup standards. Remedial technologies and process options were initially evaluated through a screening process based on technical effectiveness, implementability, and cost. Based on the screening of technologies and process options, four remedial alternatives were developed for shallow groundwater at LF-19.

Alternative 1: No Action
The No Action alternative provides a baseline from which to analyze other alternatives. It does not include any active remediation or monitoring.

Alternative 2: Institutional Controls (ICs)
Under this alternative, institutional controls would be implemented to prevent use of, or exposure to, contaminated shallow groundwater both on and off the LF-19 site. Environmental institutional controls are legal or administrative restrictions used to prevent and/or limit potential exposure to contaminants in impacted areas. Legal and/or administrative controls and physical restrictions would be applied to the LF-19 site to control or prevent present and future on-base and off-base use and access to contaminated shallow groundwater.

For on-base controls, Malmstrom's General Plan consolidates plans and programs related to management and development of Air Force lands, facilities, and resources. The General Plan is used to guide future growth and development of on-base activities. Updates to the General Plan would be made to incorporate institutional controls to prohibit current and future use of ground and surface water, and to restrict land use of LF-19.

Off-base institutional controls would include easements and administrative agreements with adjacent landowners. Malmstrom currently has a perpetual easement for off-base properties within 1,000 feet of the base boundary that precludes human habitation and building for human occupancy.

Alternative 3: Monitored Natural Attenuation (MNA) with ICs

Under this alternative, routine groundwater monitoring would be conducted to evaluate progress towards meeting cleanup goals through natural attenuation processes. Institutional controls would also be implemented to prevent use of, or exposure to, contaminated shallow groundwater both on and off-site.

Natural attenuation is the reduction in mass or concentration of a chemical compound in soil or groundwater over time or distance from the source due to naturally occurring physical, chemical or biological processes. Monitored natural attenuation (MNA) refers to the use of natural attenuation processes within the context of a carefully controlled and monitored site cleanup approach. To measure whether natural attenuation of compounds is occurring, a monitoring program must be designed to 1) demonstrate natural attenuation is occurring according to expectations; 2) detect changes in environmental and contaminant conditions; and 3) verify the contaminant plume is not expanding.

Reductive dechlorination is a natural attenuation process by which anaerobic microbes systematically reduce CVOCs to benign end products such as ethane and ethene. Malmstrom would monitor the existing groundwater monitoring system in areas where CVOC concentrations are above Circular WQB-7 standards. In addition, up to six additional monitoring wells would be installed and included in the monitoring program. Groundwater samples would be collected and analyzed for CVOCs and geochemical parameters associated with natural attenuation. The data would be evaluated to ensure natural attenuation of the contaminants is occurring. MNA would end when concentrations of contaminants meet cleanup standards and remediation objectives.

Alternative 4: Enhanced Reductive Dechlorination (ERD) with MNA and ICs

Under this alternative, naturally occurring reductive dechlorination of CVOCs in shallow groundwater would be stimulated through the injection of substrates designed to further promote degradation. MNA and ICs would also be used in tandem with ERD.

Subsurface treatment barriers such as ERD form a zone where contaminants migrating in groundwater are intercepted and degraded or transformed into harmless end products. ERD involves addition of compounds to the subsurface which enhance the naturally-occurring reductive dechlorination of CVOCs. The ERD biological barrier would be installed along the northwestern edge of LF-19, perpendicular to the contaminant groundwater plume.

To form the barrier, an organic substrate would be added to the subsurface through soil borings or a shallow trench. The installation of the treatment barrier at the leading edge of the contaminant plume is designed to stop continued migration of CVOCs dissolved in the groundwater and to enhance degradation of the contaminants.

Malmstrom would install new monitoring wells within and downgradient of the contaminant plume to verify reduction of CVOCs in groundwater and monitor whether further substrate injections are necessary

Alternative 5 – Proposed Remedy: Source Control, ERD, MNA, and ICs
Malmstrom evaluated each alternative and recommended Alternative 4 as having the highest potential to meet the cleanup standards and corrective action objectives. MDEQ reviewed the results of the CMS and agreed in general with Malmstrom's evaluation and recommendation. However, MDEQ believes the recommended alternative does not adequately address source control within the waste trenches. Therefore, MDEQ is proposing to include further on-site investigation of the waste trenches to determine the most appropriate method for source control of hazardous constituents that are migrating or may migrate from the trenches to ground and surface water.

MDEQ is proposing a shallow groundwater remedy that will include a subsurface treatment barrier, monitored natural attenuation, and institutional controls, as outlined in Alternative 4. In addition, further investigation of the waste trenches is proposed with the intention of developing an on-site source control technology.

The focus of further investigation of the waste trenches would be to determine whether specific sources can be located and provide information necessary to select, design, and build a source control system. Investigation would include drilling potential source areas within the trenches to characterize groundwater and permeability of the waste to both air and water. Potential source control remedies could include limited waste excavation and disposal or treatment, passive venting, or in-situ treatment technologies such as air sparging, soil vapor extraction, or treatment barrier systems such as ERD.

Evaluation of the Proposed Remedy and Alternatives
The alternatives were evaluated using specific criteria. The criteria are discussed below. Table 1 shows the results of the alternative evaluations.

Protection of human health and the environment: The selected remedial alternative must be protective of human health and the environment. To be protective over both the short and long term, the selected remedy for the site must adequately and reliably manage exposure risk of contaminants to both human and ecological receptors.

Attainment of media cleanup standards: The selected remedial alternative must attain cleanup standards set by state and federal regulations. Surface and groundwater must meet Montana water quality standards as set forth in Circular WQB-7. MDEQ expects groundwater to be returned to maximum beneficial use within a timeframe that is reasonable; therefore, timeframes for attaining water quality standards must be evaluated as part of this criterion.

Source Control: The selected remedial alternative must control sources of releases to reduce or eliminate, to the extent practicable, further releases of hazardous waste and hazardous constituents that might pose threats to human health and the environment. In addition, source

control is necessary to reduce or eliminate the potential for migration of hazardous waste or hazardous constituents to surface and/or groundwater in concentrations above state water quality standards.

Compliance with applicable waste management standards: The selected remedial alternative must meet all applicable regulatory standards for management of any waste generated during implementation of the remedy.

Other Factors: Five other factors were also used to assess remedial alternatives.

- The long-term reliability and effectiveness of the remedial alternative, including performance over time;
- Anticipated performance of the alternative to permanently and significantly reduce toxicity, mobility, or volume of waste and/or hazardous constituents;
- Short-term effectiveness of the remedial alternative and whether the alternative poses risk to nearby populations or workers during implementation of the remedy. Possible factors include fire, explosion, and exposure to hazardous substances;
- Ease or difficulty in implementing the remedial alternative (implementability); and
- Cost, including capitol, annual operation and maintenance, and periodic review costs.

Evaluation Summary
Alternatives 1 and 2 would not comply with Montana's hazardous waste laws and regulations which require corrective action for off-site contamination, or with Montana's water quality regulations, which require that surface and groundwater meet water quality standards under Circular WQB-7.

Alternatives 3, 4, and 5 would meet regulatory requirements for off-site corrective action and progress towards attainment of water quality standards. The primary differences between the alternatives are timeframes for attaining cleanup standards; reduction in toxicity, mobility, and volume of contaminants; and source control. Alternatives 4 and 5 have greater potential to attain cleanup standards and corrective action goals than Alternative 3.

Alternative 4 contains an element of source control by enhancing natural attenuation immediately downgradient (and off-site) of suspected sources within waste trenches on-site. However, it may be impossible to control releases and ensure the long-term effectiveness of remediating shallow groundwater without significant on-site source control. The enhanced reductive dechlorination system should be effective in remediating contamination found off-base in the drainage downgradient of the landfill. However, the time required to operate the enhanced reductive dechlorination system is indeterminate and dependent upon the nature and extent of the source(s) within the LF-19 landfill. With no effective source control within the source area, the dechlorination treatment system may have to be operated indefinitely.

Alternative 5 (proposed remedy) includes provisions for additional investigations, focused on providing information necessary to identify potential source control remedies. Such on-site source control, in conjunction with ERD and MNA, would decrease the amount of time necessary to remediate contamination in the shallow groundwater. Higher costs and safety concerns with drilling into the waste trenches are two disadvantages to Alternative 5. Safety concerns can be mitigated through proper safety precautions. Higher initial costs of Alternative 5 would be off-set by a shorter timeframe in attaining cleanup standards. Based on these factors, MDEQ is proposing Alternative 5 as the remedial alternative for LF-19.

Public Participation

The public comment period allows interested citizens, members of the regulated community, and other governmental agencies, an opportunity to comment on the proposed remedy for contaminated groundwater at the LF-19 landfill. The public is given forty-five (45) days to review and comment on the proposed remedy before MDEQ takes any final action.

Comments and Comment Period

The comment period for the proposed remedy selection and permit modification will begin on March 1, 2006 and end on April 14, 2006. Written comments may be submitted to MDEQ within the 45-day comment period. Comments should include all reasonably available references, factual grounds for comments, and supporting material. As set forth in 40 CFR 124.5(c)(2), only the changes proposed in the permit modification (selection of a remedy for the LF-19 landfill) are open for public comment.

Public Hearing

A public hearing will be held if MDEQ determines, based upon requests, there is a significant degree of public interest in the proposed remedy selection. Written requests for a public hearing may be sent to Rebecca Holmes at the address listed below.

Location of the Statement of Basis and Environmental Assessment

The Statement of Basis and an Environmental Assessment are available for review on MDEQ's website (http://www.deq.mt.gov/pubcom.asp). The documents are also available for review at the following locations:

Location Information	Review Hours
Great Falls Public Library 301 Second Avenue, North Great Falls, MT (406)453-0349	Monday through Wednesday 10:00 am – 6:00 pm Thursday 10:00 am – 8:00 pm Friday – Saturday 10:00 am – 6:00 pm Sunday 1:00 pm – 5:00 pm

Montana Department of Environmental Quality Permitting and Compliance Division Waste and Underground Tank Management Bureau Metcalf Building 1520 E. 6th Ave. Helena, Montana (406) 444-5300	Monday through Friday 8:00 am -5:00 pm

Written Comments
Please submit written comments to:

Rebecca Holmes
MDEQ, Permitting and Compliance Division
Waste and Underground Tank Management Bureau
P.O. Box 200901
Helena, MT 59620-0901
(406) 444-2876

Procedures for Reaching a Final Decision on Remedy Selection
MDEQ will prepare a Response to Comments after reviewing all comments. The Response to Comments will: 1) explain any changes to the proposed remedy and permit modification; and 2) describe and respond to all significant comments.

MDEQ will then make a final decision on modifying the Malmstrom hazardous waste permit (MTHWP-01-01) to incorporate the remedy for LF-19. When MDEQ makes a final permit decision, notice will be given to MAFB and each person who submitted written comments or requested a notice of the final decision. The final permit decision shall become effective thirty (30) days after the service of notice of the decision, unless a later date is specified or a public hearing is requested under 40 CFR 124.11. If no comments are received requesting a change in the proposed remedy selection, the final permit modification to include the selected remedy shall become effective immediately upon issuance.

For More Information
If you need further information, please contact Rebecca Holmes at the address and phone number listed above.

Dated February 24, 2006

TABLE 1 – SUMMARY OF REMEDIAL ALTERNATIVE EVALUATION

Remedial Alternative	Protection of Health and the Environment	Attain media cleanup standards	Control source areas	Comply with waste management standards	Long-term effectiveness and permanence	Reduction in Toxicity, Mobility or Volume (TMV)	Short-term effectiveness	Implementability	Cost
Alternative 1: No Action	**Satisfies Criteria** Risk assessment concluded risk of exposure to receptors at an acceptable level.	**Does Not Satisfy Criteria** No action taken to satisfy media cleanup standards	**Does Not Satisfy Criteria** No action taken to control source areas	**Satisfies Criteria** No managed waste produced	**Does Not Satisfy Criteria** No action to reduce contamination on or off-site	**Does Not Satisfy Criteria** Does not reduce TMV.	**Satisfies Criteria** No short-term impacts to community, workers, or environment	**Satisfies Criteria** No impediments to implementation	$0
Alternative 2: Institutional Controls (ICs)	**Satisfies Criteria** Risk assessment concluded risk of exposure to receptors at an acceptable level	**Does Not Satisfy Criteria** No action taken to satisfy media cleanup standards	**Does Not Satisfy Criteria** No action taken to control source areas	**Satisfies Criteria** No managed waste produced	**Does Not Satisfy Criteria** No action to reduce contamination on or off-site	**Does Not Satisfy Criteria** Does not reduce TMV.	**Satisfies Criteria** No short-term impacts to community, workers, or environment	**Satisfies Criteria Over Time** No impediments to implementation for on-base areas, but additional administrative issues may need to be addressed for off-base areas (landowner agreements, easements, etc.)	$0
Alternative 3: Monitored Natural Attenuation (MNA) with ICs	**Satisfies Criteria** Risk assessment concluded risk of exposure to receptors at an acceptable level	**Satisfies Criteria** Media cleanup standards are likely to be attained over a long period of time if site conditions remain unchanged	**Does Not Satisfy Criteria** No direct action taken to control source areas. Contaminants within source areas may naturally degrade over a long period of time.	**Satisfies Criteria** Minimal managed waste may be produced during installation of monitoring wells. Wastes would be properly managed through work plans.	**Satisfies Criteria Over Time** High potential for contaminates to degrade within groundwater plume. Degradation of contaminants will take longer than Alternative 4.	**Satisfies Criteria** TMV is reduced over a long period of time.	**Satisfies Criteria** No short-term impacts to community, workers, or environment	**Satisfies Criteria Over Time** No impediments to implementation for on-base areas, but additional administrative issues may need to be addressed for off-base areas (landowner agreements, easements, etc.)	$309,000
Alternative 4: Enhanced Reductive Dechlorination (ERD) with MNA and ICs	**Satisfies Criteria** Risk assessment concluded risk of exposure to receptors at an acceptable level	**Satisfies Criteria** Alternative will likely optimize conditions which will accelerate contaminant degradation in impacted groundwater	**Satisfies Criteria Over Time** No direct action taken to control source areas. Contaminants within source areas may naturally degrade over a long period of time.	**Satisfies Criteria** Managed waste may be produced during installation of treatment barrier and monitoring wells. Wastes would be properly managed through work plans.	**Satisfies Criteria** High potential for contaminants to degrade within groundwater plume. The treatment barrier will accelerate degradation.	**Satisfies Criteria** TMV is reduced over a shorter period of time in areas where treatment barriers are in place.	**Satisfies Criteria** No short-term impacts to community, workers, or environment	**Satisfies Criteria Over Time** No impediments to implementation for on-base areas, but additional administrative issues may need to be addressed for off-base areas (landowner agreements, easements, etc.)	$570,000
Alternative 5: Enhanced Reductive Dechlorination (ERD) with MNA, ICs, and on-site source control**	**Satisfies Criteria** Risk assessment concluded risk of exposure to receptors at an acceptable level	**Satisfies Criteria** Alternative will likely optimize environmental conditions to accelerate contaminant degradation in impacted groundwater, both on and off-site	**Satisfies Criteria** Direct action to control source control. Additional investigation needed to determine best technology for on-site source control system.	**Satisfies Criteria** Managed waste may be produced during installation of treatment barrier, and monitoring wells. Managed waste may be produced during investigation and installation of on-site source control. Wastes would be properly managed through work plans.	**Satisfies Criteria** High potential for contaminants to degrade within groundwater plume. The treatment barrier and on-site source control systems will accelerate degradation both on and off-site.	**Satisfies Criteria** TMV is reduced over a shorter period of time in areas where treatment barriers and on-site source control systems are in place.	**Satisfies Criteria** Some short-term safety impacts to workers may occur during drilling of waste trenches and installation of source control system. However, this impact would be mitigated through proper safety precautions.	**Satisfies Criteria Over Time** No impediments to implementation for on-base areas, but additional administrative issues may need to be addressed for off-base areas (landowner agreements, easements, etc.). Additional field studies will be necessary to further characterize waste trenches, and perform air modeling and monitoring.	$704,747**

**** Cost for installation of passive venting was used to estimate total cost of remedial alternative.**