Hazardous Waste Permit HW-021

Minot AFB
Hazardous Waste Permit
Permit Number HW-021

Permittee: Department of Defense
Minot Air Force Base
EPA ID No. ND4571924758

Pursuant to Chapter 23.1-04 (Hazardous Waste Management Act) of North Dakota Century Code (NDCC) and Article 33.1-24 (Hazardous Waste Management Rules) of the North Dakota Administrative Code (NDAC), a permit is hereby issued by the North Dakota Department of Environmental Quality to the Department of Defense (hereafter called the Permittee), Minot Air Force Base (MAFB) (hereafter referred to as the Facility), Site ID No. ND4571924758, to implement Corrective Action at the Minot Air Force Base, Ward County, ND.

The Permittee must comply with all the terms and conditions of this permit. This permit consists of the conditions contained in Modules I through II (including those referenced in the permit application), attachments and applicable rules contained in Article 33.1-24 NDAC. This permit is based on the premise that the information submitted in the revised permit application dated August 6, 2018, and decision document dated March 21, 2022, is accurate and that the hazardous waste management units on the facility have been constructed and will be operated as specified in the application, as part of the permit. Any inaccuracies or misrepresentations found in the application may be grounds for the termination or modification of this permit in accordance with Sections 33.1-24-06-12 and 33.1-24-06-13 NDAC. The Permittee must inform the North Dakota Department of Environmental Quality of any deviations from, or changes in, the application which would affect the Permittee’s ability to comply with the applicable rules or permit conditions.

This permit is effective as of ______________ 2022 and shall remain in effect until ______________ 2024, unless revoked and reissued in accordance with section 33.1-24-06-12 NDAC or terminated in accordance with Section 33.1-24-06-13 NDAC.

Signature __________________________________________ Date ______________

Charles R. Hyatt, Director
Division of Waste Management
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Module I Standard Conditions

Effect of Permit

The Permittee is allowed to implement corrective action activities in accordance with conditions of this permit. Compliance with this permit constitutes compliance, for purposes of enforcement, with Chapter 23.1-04 of the North Dakota Century Code (NDCC) and Article 33.1-24 of the North Dakota Administrative Code (NDAC) except for those requirements not included in the permit which become effective by statute or which are promulgated.

Issuance of this permit does not convey property rights of any sort or any exclusive privilege, nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of state or local law or regulations.

Compliance with the terms of this permit (NDAC 33.1-24-06-10) does not constitute a defense to any order issued or any action brought under NDCC 23.1-04, NDAC 33.1-24, Sections 3008(a), 3007, 3013, 3004(v), 3008(c) or Section 7003 of Resource Conservation and Recovery Act (RCRA), Sections 104, 106(a), 106(e), or 107 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq., commonly known as CERCLA), or any other law providing for protection of public health or the environment.

I.A. Permit Actions

I.A.1. Permit Modification, Revocation, Re-issuance and Termination

This permit may be modified, revoked and reissued, or terminated for cause as specified in Sections 33.1-24-06-12 through 33.1-24-06-14 NDAC. The filing of a request for a permit modification, revocation and re-issuance, or termination, or the notification of planned changes or anticipated noncompliance on the part of the Permittee does not stay the applicability or enforceability of any permit condition.

I.A.2. Permit Renewal

This permit may be renewed as specified in subsection 2 of Section 33.1-24- 06-04 NDAC and Permit Module I.D.2. Review of any application for a permit renewal shall consider improvements in the state of control and measurement technology, as well as changes in applicable regulations.
I.B.  **Severability**

The provisions of this permit are severable, as specified in Section 33.1-24-07-12 NDAC, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

I.C.  **Duties and Requirements**

I.C.1.  **Duty to Comply**

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the NDCC and is grounds for enforcement action, for permit termination, revocation and re-issuance or modification, or for denial of a permit renewal application. However, the Permittee need not comply with the conditions of this permit to the extent and for the duration such noncompliance is authorized in an emergency permit (NDAC 33.1-24-06-04(1)).

I.C.2.  **Duty to Reapply**

If the Permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the Permittee shall submit a complete application for a new permit at least one hundred eighty (180) days before this permit expires (NDAC 33.1-24-06-04(2)).

I.C.3.  **Need to Halt or Reduce Activity**

It shall not be a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit (NDAC 33.1-24-06-04(3)).

I.C.4.  **Duty to Mitigate**

In the event of noncompliance with this permit, the Permittee shall take all reasonable steps to minimize releases to the environment and shall carry out such measures as are reasonable to prevent any adverse impacts on human health or the environment (NDAC 33.1-24-06-04(4)).

I.C.5.  **Proper Operation and Maintenance**

The Permittee shall at all times properly operate and maintain all facilities, systems and related appurtenances which are installed or used by the Permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance include effective performance, adequate funding, adequate operator
staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit (NDAC 33.1-24-06-04(5)).

I.C.6. Duty to Provide Information

The Permittee shall furnish to the Department, within a reasonable time, any relevant information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The Permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit (NDAC 33.1-24-06-04(8)).

I.C.7. Inspection and Entry

The Permittee shall allow the Department, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

I.C.7.a. Enter at reasonable times upon the Permittee's premises where a regulated activity is located or conducted or where records must be kept under the conditions of this permit;

I.C.7.b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

I.C.7.c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices or operations regulated or required under this permit; and

I.C.7.d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized, any substances or parameters at any location (NDAC 33.1-24-06-04(9)).

I.C.8. Monitoring and Records

I.C.8.a. Samples and measurements taken for the purposes of monitoring must be representative of the monitoring activity.

I.C.8.b. The Permittee shall retain, at the facility, records of all monitoring information including all calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, copies of all reports and records required by this permit, the certification required by subdivision i of subsection 2 of Section 33.1-24-05-40 NDAC, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report, certification or application. This
period may be extended by the request of the Department at any time and is automatically extended during the course of any unresolved enforcement action regarding this facility (NDAC 33.1-24-06-04(10)).

I.C.8.c. Records of monitoring information must include:

1. The date, exact place, and time of sampling or measurements;
2. The individuals who performed the sampling or measurements;
3. The dates analyses were performed;
4. The individuals who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

I.C.9. Signatory Requirement

All applications, reports or information submitted to the Department must be signed and certified, as required by Section 33.1-24-06-03 NDAC (NDAC 33.1-24-06-04(11)).

I.C.10. Reporting Requirements

I.C.10.a. Planned Changes

The Permittee shall give notice to the Department, as soon as possible, of any planned physical alterations or additions to the permitted facility (NDAC 33.1-24-06-04(12)(a)).

I.C.10.b. Anticipated Noncompliance

The Permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements (NDAC 33.1-24-06.04(12)(b)).

I.C.11. Transfers

This permit may be transferred to a new owner or operator only if it is modified or revoked and reissued pursuant to subsection 2 of Section 33-24-06-11 NDAC or subdivision b of subsection 2 of Section 33.1-24-06-12 NDAC. Before transferring ownership or operation of the facility during its operating life, the Permittee shall notify the new owner or operator, in writing, of the requirements of Chapters 33.1-24-05 and 33.1-24-06 NDAC and this permit.
I.C.12. Twenty-four Hour Reporting

I.C.12.a. The Permittee shall report to the Department any noncompliance with this permit which may endanger health or the environment.

I.C.12.b. Any information shall be reported orally within twenty-four hours from the time the Permittee becomes aware of the circumstances. The following shall be included as information which must be reported orally:

I.C.12.b.1.a. Information concerning the release of any hazardous waste that may cause an endangerment to public drinking water supplies; and

I.C.12.b.2. Any information of a release or discharge of hazardous waste, or of a fire or explosion from the hazardous waste management units, which could threaten the environment or human health outside the facility. The description of the occurrence and its cause must include:

I.C.12.b.2.a. Name, address, and telephone number of the owner or operator;
I.C.12.b.2.b. Name, address, and telephone number of the facility;
I.C.12.b.2.c. Date, time, and type of incident;
I.C.12.b.2.d. Name and quantity of materials involved;
I.C.12.b.2.e. The extent of injuries, if any;
I.C.12.b.2.f. An assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable; and
I.C.12.b.2.g. Estimated quantity and disposition of recovered material that resulted from the incident.

I.C.12.c. A written submission must also be provided within five (5) days of the time the Permittee becomes aware of the circumstances. The written submission must contain a description of the noncompliance and its cause; the period(s) of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue, and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

I.C.12.d. The Department may waive the five-day written notice requirement in favor of a written report within fifteen (15) days (NDAC 33.1-24-06-04(12)(f)).
I.C.13. **Other Noncompliance**

The Permittee shall report all other instances of noncompliance not otherwise required to be reported above, at the time written reports, as required by this permit, are submitted. The reports shall contain the information listed in Permit Module I.D.12. as appropriate (NDAC 33.1-24-06-04(12)(g)).

I.C.14. **Other Information**

Where the Permittee becomes aware that the Permittee failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, the Permittee shall promptly submit such facts or information (NDAC 33.1-24-06-04(12)(k)).

I.D. **Definitions**

For purpose of this permit, terms used herein shall have the same meaning as those in Chapter 23.1-04 NDCC, Chapters 33.1-24-01, -02, -05, and -06 NDAC unless this permit specifically provides otherwise. Where terms are not defined in the regulation, the permit or EPA guidelines or publications, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term. "Department" means the North Dakota Department of Environmental Quality or authorized representative.

I.E. **Reports, Notifications and Submissions to The Department**

All reports, notifications or other submissions which are required by this permit to be sent or given to the Department should be sent by certified mail or given to:

Derek Kannenberg, Manager  
Hazardous Waste Program  
North Dakota Division of Waste Management 918 East Divide Avenue, 3rd Floor  
Bismarck, ND 58501-1947

I.F. **Documents to be Maintained at the Facility**

The Permittee shall maintain at the facility, until closure of the regulated waste management units is completed and certified by an independent, registered professional engineer, the following documents and all amendments, revisions and modifications to these documents:

I.F.1. A waste analysis plan as required by subsection 2 of Section 33.1-24-05-04 NDAC and this permit.

I.F.2. A closure plan as required by subsection 1 of Section 33.1-24-05-61 NDAC and this permit.
I.F.3. An operating record as required by subsection 1 of Section 33.1-24-05-40 NDAC and this permit.

I.F.4. A copy of the latest revision of the amended Part B application for this facility and most current permit with attachments.

I.F.5. All other documents required by this permit.
Module II Corrective Action

II.A. Applicability

The conditions of this Module apply to:

II.A.1. The SWMUs and AOC identified in Appendix A of Attachment A.

II.A.2. Any additional SWMU or AOC discovered during the course of groundwater monitoring, field investigations, environmental audits or other means.

II.B. Definitions

II.B.1. "Areas of Concern" (AOC), for purposes of this permit, includes any area at a facility having a probable release of a hazardous waste or hazardous constituent which may or may not be from a SWMU and is determined by the Department to pose a current or potential threat to human health or the environment. AOC identified in Appendix A of Attachment A and any additional AOC identified in the future shall receive the same level of investigation and remediation as that of a SWMU.

II.B.2. "Corrective Action Management Unit (CAMU)" means an area within a facility as designated by the Department for the purpose of implementing corrective action requirements of this permit. A CAMU shall be used only for the management of remediation wastes pursuant to implementing such corrective action requirements at the facility.

II.B.3. "Corrective Measures" (CM), for purposes of this permit, includes all corrective actions necessary to protect human health and the environment for all releases of hazardous waste or hazardous constituents from any SWMU or AOC at the facility, regardless of the time at which waste was placed in the unit, as required under Section 33.1-24-05-58 NDAC. CM may address releases to air, soils, surface water or ground water.

II.B.4. A "hazardous constituent" means any constituent identified in Appendix V of Chapter 33.1-24-02 NDAC or any constituent identified in Appendix XII of Chapter 33.1-24-05 NDAC.

II.B.5. "Land disposal," for purposes of this permit and Chapter 33.1-24-05 NDAC, means placement in or on the land and includes, but is not limited to, placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, underground mine or cave or concrete vault or bunker intended for disposal purposes.

II.B.6. A "release," for the purposes of this permit, has the same definition as “disposal” found in subsection 33.1-24-01-04(26) NDAC and further includes any escaping
or leaching into the environment of any solid or hazardous waste or hazardous constituents.

II.B.7. "Remediation waste" means all solid and hazardous wastes, and all media (including ground water, surface water, soils and sediments) and debris, which contain listed hazardous wastes or hazardous constituents or which themselves exhibit a hazardous waste characteristic, that are managed for the purpose of implementing corrective action requirements. For a given facility, remediation wastes may originate only from within the facility boundary but may include waste managed in implementing corrective action beyond the facility boundary.

II.B.8. A "Solid Waste Management Unit" (SWMU) means any discernible unit which has been used for the treatment, storage or disposal of solid wastes at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. SWMUs include RCRA-regulated hazardous waste management units. Such units include any area at a facility in which solid wastes have been routinely or systematically released.

II.B.9. A "unit" for the purposes of this permit, includes, but is not limited to, any landfill, surface impoundment, waste pile, land treatment unit, incinerator, injection well, tank, container storage area, septic tank, drain field, waste water treatment unit, elementary neutralization unit, transfer station or recycling unit.

II.C. Notification and Assessment Requirements for Newly Identified SWMUs and AOC

The Permittee shall notify the Department, in writing, within fifteen (15) calendar days of discovery, of any additional SWMU or AOC as discovered under Permit Module II.A.2. The notification shall include, at a minimum, the location of the SWMU or AOC and all available information pertaining to the nature of the release (e.g., media affected, hazardous constituents released, magnitude of release, etc.).

II.C.1. The Permittee shall prepare and submit to the Department, within one hundred eighty (180) calendar days of notification, a written assessment of each SWMU or AOC identified under Permit Module II.C. At a minimum, this assessment shall include the following information:

II.C.1.a. Location of unit(s) on a topographic map of appropriate scale size as required under subdivision q of subsection 2 of Section 33.1-24-06-17 NDAC.

II.C.1.b. Designation of type and function of unit(s).

II.C.1.c. A planar map of each SWMU or AOC which shows the approximate length and width dimensions of the unit and two geologic cross-sections through each SWMU/AOC which show the vertical and lateral extent of contamination and/or
thickness of the waste deposit, soils description, and the approximate location of the potentiometric surface and/or water table.

II.C.1.d. Dates that the unit(s) was operated.

II.C.1.e. Specification of all wastes that have been managed at/in the unit(s) of the extent available. Include any available data on hazardous constituents in the wastes.

II.C.1.f. All available information pertaining to any release of hazardous waste or hazardous constituents from such unit(s) (to include ground water data, soil analysis, air, and/or surface water data).

II.C.2. Based on the results of the assessment, the Department shall determine the need for further investigations of the units addressed in the assessment. If the Department determines that such investigations are needed, the Permittee shall be required to prepare a plan for such investigations as outlined in Permit Module II.E.1.a.

II.C.3. If the Department determines that further investigation of the SWMU or AOC is required, the permit will be modified in accordance with Section 33-24-06-12 NDAC.

II.D. Notification Requirements for Newly Discovered Releases at Previously Identified SWMUs and AOC

The Permittee shall notify the Department, in writing, of any newly discovered release(s) of hazardous waste or hazardous constituents discovered during the course of ground water monitoring, field investigations, environmental audits or other means within fifteen (15) calendar days of discovery. Such newly discovered releases may be from a SWMU or AOC identified in Permit Module II.A.2. for which further investigation under Permit Module II.C.2 was not required. The notification shall include pertinent information regarding the release, including the location and extent of the release, the volume of material released, the type of hazardous waste and/or constituents released, the time and duration of the release, activities performed to contain and control the release, and the volume of the release recovered. In addition, an assessment of the actual and potential impacts of the releases on human health and the environment should also be provided.

II.D.1. If the Department determines that further investigation of the SWMU or AOC is needed, the Permittee shall be required to prepare a plan for such investigations as outlined in Permit Module II.E.1.a.
II.E. RCRA Facility Investigation (RFI)

II.E.1. RFI Workplan(s)

II.E.1.a. The Permittee shall prepare and submit to the Department, within one hundred twenty (120) calendar days of notification, a RFI workplan for those units identified under Permit Module II.C.2. or Permit Module II.D.1. This RFI workplan(s) shall be developed to meet the requirements of Permit Module II.E.1.b.

II.E.1.b. The RFI workplan(s) shall meet the requirements of Appendix B of Attachment A at a minimum. The workplan(s) shall include schedules of implementation and completion of specific actions necessary to determine the nature and extent of releases and the potential pathways of contaminant releases to the air, land, surface water, and ground water. The Permittee must provide sufficient justification and/or documentation to exclude particular media or pathways associated with a unit (ground water, surface water, soil, subsurface gas or air). Such deletions of a unit, medium or pathway from the RFI is subject to the approval of the Department. The Permittee shall provide sufficient written justification for any omissions or deviations from the requirements of Appendix B of Attachment A. Such omissions or deviations are subject to approval by the Department. In addition, the scope of the RFI workplan(s) shall include all investigations necessary to ensure compliance with Section 33-24-05-58 NDAC.

II.E.1.c. The RFI workplan(s) must be approved by the Department, in writing, prior to implementation. The letter approving the RFI workplan(s) shall specify the start date of the RFI workplan schedule. If the Department disapproves the RFI workplan(s), the Department shall either: (1) notify the Permittee, in writing, of the RFI workplan's deficiencies and specify a due date for submission of a revised RFI workplan or (2) revise the RFI workplan and notify the Permittee of the revisions and the start date of the schedule within the approved RFI workplan.

II.E.2. RFI Implementation

II.E.2.a. The Permittee shall implement the RFI(s) in accordance with the approved RFI workplan(s). The Permittee shall notify the Department no less than seven (7) calendar days prior to any sampling activity.

II.E.3. RFI Reports

II.E.3.a. The Permittee shall provide the Department with RFI progress reports every ninety (90) calendar days beginning thirty (30) calendar days from the start date specified in the RFI workplan approval letter. The progress reports shall contain the following information at a minimum:

II.E.3.a.1. A description of the portion of the RFI completed;
II.E.3.a.2. Summaries of findings;

II.E.3.a.3. Summaries of all deviations from the approved RFI workplan during the reporting period;

II.E.3.a.4. Summaries of all problems or potential problems encountered during the reporting period;

II.E.3.a.5. Projected work for the next reporting period; and

II.E.3.a.6. Changes in personnel during the reporting period.

II.E.3.b. The Permittee shall prepare and submit to the Department draft and final RFI report(s) for the investigations conducted pursuant to the workplan(s) submitted under Permit Module II.E.1. The draft RFI report(s) shall be submitted to the Department for review in accordance with the schedule in the approved RFI workplan(s). The final RFI report(s) shall be submitted within sixty (60) calendar days of receipt of the Department's comments on the draft RFI report. The RFI report(s) shall include all analyses and summary of all required investigations of SWMUs and AOC and their results. The summary shall describe the type and extent of contamination at the facility, including sources and migration pathways, and a description of actual or potential receptors. The report(s) shall also describe the extent of contamination (qualitative and quantitative) in relation to background levels indicative of the area. The objective of this task shall be to ensure that the data generated during the investigation are sufficient in quality (e.g., quality assurance procedures have been followed) and quantity to describe the nature and extent of contamination, potential threat to human health and/or the environment, and to support a Corrective Measures Study (CMS), if necessary.

II.E.3.c. The Department shall review the final RFI report(s). The Department shall notify the Permittee of the need for further investigative action and/or the need for a CMS to meet the requirements of Permit Module II.G. and Section 33.1-24-05-58 NDAC. The Department shall also notify the Permittee if no further action is required.

II.F. Interim Measures (IM)

II.F.1. IM Workplan

II.F.1.a. Upon notification by the Department, the Permittee shall prepare and submit an IM workplan for any SWMU or AOC which poses a current or potential threat to human health or the environment. The IM workplan shall be submitted within sixty (60) calendar days of such notification and shall include the elements listed in Permit Module II.F.1.b. Such IM may be conducted concurrently with investigations required under the terms of this permit.
II.F.1.b. The IM workplan shall ensure that the IM are designed to mitigate any current or potential threat(s) to human health or the environment and is consistent with and integrated into any long-term solution at the facility. The IM workplan shall include the IM objectives, procedures for implementation (including any designs, plans, or specifications), and schedules for implementation.

II.F.1.c. The IM workplan must be approved, in writing, by the Department prior to implementation. The written approval shall specify the starting date of the IM workplan schedule. If the Department disapproves the IM workplan, the Department shall either: (1) notify the Permittee, in writing, of the IM workplan's deficiencies and specify a due date for submission of a revised IM workplan or (2) revise the IM workplan and notify the Permittee of the revisions and the start date of the schedule within the approved IM workplan.

II.F.2. IM Implementation

II.F.2.a. The Permittee shall implement the IM in accordance with the approved IM workplan.

II.F.2.b. The Permittee shall provide seven (7) calendar days notice to the Department of any planned changes, deletions or additions to the IM workplan.

II.F.2.c. Final approval of corrective action required under Section 33.1-24-05-58 NDAC which is achieved through interim measures shall be in accordance with Section 33.1-24-06-12 NDAC and Permit Module II.H. as a permit modification.

II.F.3. IM Reports

II.F.3.a. If the scheduled completion time of IM is greater than three (3) months, the Permittee shall provide the Department with progress reports every ninety (90) days beginning thirty (30) calendar days from the starting date specified in the IM workplan approval letter. The progress reports shall contain the following information at a minimum:

II.F.3.a.1. A description of the portion of the IM completed;

II.F.3.a.2. Summaries of all deviations from the IM workplan during the reporting period;

II.F.3.a.3. Summaries of all problems or potential problems encountered during the reporting period;

II.F.3.a.4. Projected work for the next reporting period; and

II.F.3.a.5. Copies of laboratory/monitoring data generated during the reporting period.
II.F.3.b. The Permittee shall prepare and submit to the Department, within sixty (60) calendar days of completion of IM conducted under Permit Module II.F., an IM report. The IM report shall contain the following information at a minimum:

II.F.3.b.1. A description of IM implemented;

II.F.3.b.2. Summaries of results;

II.F.3.b.3. Summaries of all problems encountered;

II.F.3.b.4. Summaries of accomplishments and/or effectiveness of IM; and

II.F.3.b.5. Copies of all relevant laboratory/monitoring data, etc., in accordance with Permit Module I.D.8.

II.G. Corrective Measure Study (CMS)

II.G.1. CMS Plan

II.G.1.a. The Permittee shall prepare and submit a CMS plan for those units requiring a CMS within ninety (90) calendar days following receipt of written notification of: (1) approval by the Department of the RFI report and (2) a requirement by the Department to perform a CMS. This CMS plan shall be developed to meet the requirements of Permit Module II.G.1.b.

II.G.1.b. The CMS plan shall include schedules of implementation and completion of specific actions necessary to complete a CMS that will meet the requirements of Appendix C of Attachment A. The Permittee shall provide sufficient written justification for any omissions or deviations from the minimum requirements of Appendix C of Attachment A. Such omissions or deviations are subject to the approval of the Department. The scope of the CMS plan shall include all investigations necessary to ensure compliance with NDCC 23.1-04-05. or Section 33.1-24-05-58 and subdivision b of subsection 1 of Section 33.1-24-06-05 NDAC.

The Permittee shall implement corrective actions beyond the facility boundary, where necessary, to protect human health and the environment unless the Permittee demonstrates, to the satisfaction of the Department, that despite the Permittee’s best efforts, the Permittee was unable to obtain the necessary permission to undertake such actions. The Permittee is not relieved of all responsibility to clean up a release that has migrated beyond the facility boundary where off-site access is denied. On-site measures to address such releases will be determined on a case-by-case basis.

II.G.1.c. The Department shall either approve or disapprove, in writing, the CMS plan. If the Department disapproves the CMS plan, the Department shall either: (1) notify the Permittee, in writing, of the CMS plan’s deficiencies and specify a due date
for submittal of a revised CMS plan or (2) revise the CMS plan and notify the Permittee of the revisions. This modified CMS plan becomes the approved CMS plan.

II.G.1.d. The Permittee shall implement the CMS according to the schedules specified in the CMS plan. Pursuant to Permit Module II.G.1.b., the CMS shall be conducted in accordance with the approved CMS plan.

II.G.2. CMS Report

II.G.2.a. The Permittee shall provide the Department with progress reports every ninety (90) days beginning thirty (30) calendar days from the starting date specified in the CMS plan. The progress reports shall, at a minimum, contain the information specified in Task IV.A. of Appendix C of Attachment A.

II.G.2.b. The Permittee shall prepare and submit to the Department a draft and final CMS report for the study conducted pursuant to the approved CMS plan. The draft CMS report shall be submitted to the Department in accordance with the schedule specified in the CMS plan. The final CMS report shall be submitted to the Department within sixty (60) calendar days of receipt of the Department's comments on the draft CMS report. The CMS final report shall summarize any bench-scale or pilot tests conducted, include an evaluation of each remedial alternative, and present all information gathered under the approved CMS plan. The CMS final report must contain adequate information to support the Department's decisions on the recommended remedy, described under Permit Module II.H.

II.G.2.c. If the Department determines that the CMS final report does not fully satisfy the information requirements specified under Permit Module II.G.2.b., the Department may disapprove the CMS final report. If the Department disapproves the CMS final report, the Department shall notify the Permittee, in writing, of any deficiencies and specify a due date for submittal of a revised CMS final report. The Department shall also notify the Permittee if no further action is required.

II.G.2.d. As specified under Permit Module II.G.2.b. (based on preliminary results and the CMS final report) the Department may require the Permittee to evaluate additional remedies or particular elements of one or more proposed remedies.

II.H. Remedy Approval and Permit Modification

II.H.1. A remedy or remedies shall be selected by the Department from the remedial alternatives evaluated in the CMS. The remedy or remedies shall be based, at a minimum, on protection of human health and the environment, existing law and regulations, and guidance.

II.H.2. Pursuant to Section 33.1-24-06-12 NDAC, a permit modification shall be initiated by the Department after selection of a remedy under Permit Module II.H.1.
II.I. **Approved Remedies for Specific SWMUs and AOC**

As required in Module II.H., the Department has selected remedies for SMWUs and AOC requiring corrective measures to be implemented. These selected remedies are found in Appendix F of Attachment A.

II.J. **Corrective Measure Implementation (CMI)**

II.J.1. **CMI Plan**

II.J.1.a. The Permittee shall prepare and submit a CMI plan for the selected corrective measure(s) within ninety (90) calendar days of receipt of the Department's approval of the CMS. The CMI plan shall be developed to meet the requirements of Permit Module II.J.1.b.

II.J.1.b. The CMI plan shall include information to document the overall management strategy for performing the design, construction, operation, maintenance and monitoring of corrective measure(s). The CMI plan shall be developed to meet the requirements of Appendix D of Attachment A unless written justification for any omissions or deviations are provided by the Permittee. Such omissions or deviations are subject to the approval of the Department.

II.J.1.c. The Department shall either approve or disapprove, in writing, the CMI plan. If the Department disapproves the CMI, the Department shall either: (1) notify the Permittee, in writing, of the CMI plan's deficiencies and specify a due date for submittal of a revised CMI plan or (2) revise the CMI plan and notify the Permittee of the revisions. This modified CMI plan becomes the approved CMI plan.

II.J.1.d. The Permittee shall implement the CM according to the schedules specified in the CMI plan. Pursuant to Permit Module II.J.1.b., the CMI shall be conducted in accordance with the approved CMI plan.

II.J.1.e. The Permittee may be required to conduct additional ground water monitoring to evaluate the effectiveness of the selected corrective measures.

II.J.2. **CMI Report**

II.J.2.a. The Permittee shall provide the Department with progress reports every ninety (90) days beginning thirty (30) calendar days from the starting date specified in the CMI plan. The progress reports shall, at a minimum, contain the information specified in Task II.A. of Appendix D of Attachment A.

II.J.2.b. The Permittee shall prepare and submit to the Department a draft and final report at the completion of the construction of the project(s). The final CMI report shall be submitted to the Department within sixty (60) calendar days of receipt of the Department's comments on the draft CMI report. The CMI final report shall
document that the project is consistent with the design specifications and that the corrective measure(s) is/are performing adequately.

II.J.2.c. If the Department determines that the CMI final report does not fully satisfy the information requirements specified under Permit Module II.J.2.b., the Department may disapprove the CMI final report and the Department shall notify the Permittee, in writing, of any deficiencies and specify a due date for submittal of a revised CMI final report.

II.K. Modification of the Corrective Action Compliance Schedule

II.K.1. If at any time the Department determines that modification of the Compliance Schedule (Appendix E of Attachment A) is necessary, the Department may initiate a modification to this schedule.

II.K.2. Modifications that are initiated or finalized by the Department shall be carried out according to the procedures in Sections 33.1-24-06-12 or 33.1-24-06-14 NDAC.

II.K.3. Modifications to the Compliance Schedule do not constitute a re-issuance of the permit.

II.L. Imminent Hazards

II.L.1. The Permittee shall report to the Department any imminent or existing hazard to public health or the environment from any release of hazardous waste or hazardous constituents. Such information shall be reported orally within 24 hours from such time the Permittee becomes aware of the circumstances, as specified under Permit Module I.D.12.

II.L.2. A written report shall also be provided to the Department within fifteen (15) calendar days of the time the Permittee becomes aware of the circumstances. The written report shall contain information specified under Permit Module I.D.12.c.

II.M. Plan and Report Requirements

II.M.1. All plans and schedules shall be subject to approval by the Department prior to implementation. The Permittee shall revise all submittals and schedules as specified by the Department. Upon approval the Permittee shall implement all plans and schedules as written.

II.M.2. The results of all plans and reports shall be submitted in accordance with the approved schedule. Extensions of the due date for submittals may be granted by the Department based on the Permittee's demonstration that sufficient justification for the extension exists.
II.M.3. If the Permittee at any time determines that the written assessment required under Permit Module II.C. or RFI workplan(s) required under Permit Module II.E. no longer satisfies the requirement of Section 33.1-24-05-58 NDAC, or this permit, for prior continuing releases of hazardous waste or hazardous constituents from SWMUs or AOC, the Permittee shall submit an amended RFI workplan(s) to the Department within sixty (60) calendar days of such determination.

II.M.4. All final reports shall be signed and certified in accordance with Section 33.1-24-06-03 NDAC.

II.M.5. One copy of all reports and plans shall be submitted by the Permittee to the Department at the following address:

Derek Kannenberg, Manager
Hazardous Waste Program
North Dakota Division of Waste Management
918 East Divide Avenue, 3rd Floor
Bismarck, ND 58501-1947
Attachment A

Corrective Action
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Appendix A

Scope of Work for a RCRA Facility Investigation (RFI)

Purpose

The purpose of this RCRA Facility Investigation (RFI) is to determine the nature and extent of releases of hazardous waste or constituents from regulated units, solid waste management units, and other source areas at the facility and to gather all necessary data to support the CMS. The Permittee shall furnish all personnel, materials, and services necessary for, or incidental to, performing the RCRA remedial investigation at this facility.

Scope

The RFI consists of seven tasks:

Task I: Description of Current Conditions
   A. Facility Background
   B. Nature and Extent of Contamination
   C. Implementation of Interim Measures

Task II: Pre-Investigation Evaluation of Corrective Measure Technologies

Task III: RFI Workplan Requirements
   A. Project Management Plan
   B. Data Collection Quality Assurance Plan
   C. Data Management Plan
   D. Health and Safety Plan
   E. Community Relations Plan

Task IV: Facility Investigation
   A. Environmental Setting
   B. Source Characterization
   C. Contamination Characterization
   D. Potential Receptor Identification
   E. Risk Assessment

Task V: Investigation Analysis
   A. Protection Standards

Task VI: Laboratory and Bench-Scale Studies
Task VII: Reports

A. Progress
B. Draft and Final

Task I: Description of Current Conditions

The Permittee shall submit for Department approval a report providing the background information pertinent to the facility, contamination and IM as set forth below. The data gathered during any previous investigations or inspections and other relevant data shall be included.

A Facility Background

The Permittee's report shall summarize the regional location, pertinent boundary features, general facility physiography, hydrogeology, and historical use of the facility for the treatment, storage or disposal of solid and hazardous waste. The Permittee's report shall include:

1. Map(s) depicting the following:
   a. General geographic location;
   b. Property lines, with the owners of all adjacent property clearly indicated;
   c. Topography and surface drainage (with a contour interval of two (2) feet and a scale of 1 inch = 100 feet) depicting all waterways, wetlands, floodplains, water features, drainage patterns, and surface water containment areas;
   d. All tanks, buildings, utilities, paved areas, easements, rights-of-way, and other features;
   e. All solid or hazardous waste treatment, storage or disposal areas active after November 19, 1980;
   f. All known past solid or hazardous waste treatment, storage or disposal areas regardless of whether they were active on November 19, 1980;
   g. All known past and present product and waste aboveground and underground tanks or piping directly related to SWMUs and AOC;
   h. Surrounding land uses (residential, commercial, agricultural, recreational); and
   i. The location of all production and ground water monitoring wells. These wells shall be clearly labeled and ground and top of casing
elevations and construction details included (these elevations and details may be included as an attachment).

All maps shall be consistent with the requirements set forth in Section 33.1-24-06-17 NDAC and be of sufficient detail and accuracy to locate and report all current and future work performed at the site.

2. A history and description of facility ownership and operation, solid and hazardous waste generation, treatment, storage and disposal activities at the facility;

3. Dates or periods of past product and waste spills, identification of the materials spilled, the amount spilled, the location where spilled, and a description of the response actions conducted (local, state, or federal response units or private parties), including any inspection reports or technical reports generated as a result of the response;

4. A summary of past permits requested and/or received, any enforcement actions and their subsequent responses, and a list of documents and studies prepared for the facility; and

5. A summary of all past and present product containers and tanks, including type of product, use, capacity of containers and tanks, and amounts present at facility.

B Nature and Extent of Contamination

1. The Permittee shall prepare and submit for Department approval a report describing the existing information on the nature and extent of contamination.

The report shall summarize all possible source areas of contamination. This, at a minimum, should include all regulated units, SWMUs, spill areas, and other suspected source areas of contamination. For each area, the Permittee shall identify the following:

a. Location of unit/area (which shall be depicted on a facility map);

b. Quantities of solid and hazardous wastes;

c. Hazardous waste or constituents, to the extent known; and

d. Identification of areas where additional information is necessary.
2. The Permittee shall prepare an assessment and description of the existing degree and extent of contamination. This should include:
   a. Available monitoring data and qualitative information on locations and levels of contamination at the facility;
   b. All potential migration pathways including information on geology, pedology, hydrogeology, physiography, hydrology, water quality, meteorology, and air quality; and
   c. The potential impact(s) on human health and the environment, including demography, ground water and surface water use, flora, fauna, and land use.

B Implementation of Interim Measures

The Permittee's report shall document IM which were or are being undertaken at the facility. This shall include:

1. Objectives of the IM: how the measure is mitigating a potential threat to human health and the environment and/or is consistent with and integrated into any long-term solution at the facility;
2. Design, construction, operation, and maintenance requirements;
3. Schedules for design, construction and monitoring; and
4. Schedule for progress reports.

Task II: Pre-Investigation Evaluation of Corrective Measure (CM) Technologies

Prior to starting the facility investigation, the Permittee shall submit to the Department a report that identifies the potential CM technologies that may be used on-site or off-site for the containment, treatment, remediation, and/or disposal of contamination. This report shall also identify any field data that needs to be collected in the facility investigation to facilitate the evaluation and selection of the final CM(s) (e.g., compatibility of waste and construction materials, information to evaluate effectiveness, treatability of wastes, etc.).

Task III: RFI Workplan Requirements

The Permittee shall prepare a RFI workplan. This RFI workplan shall include the development of several plans which shall be prepared concurrently. During the RFI, it may be necessary to
revise the RFI workplan to increase or decrease the detail of information collected to accommodate the facility specific situation. The RFI workplan includes the following:

A  **Project Management Plan**

The Permittee shall prepare a project management plan which will include a discussion of the technical approach, schedules, budget, and personnel. The project management plan will also include a description of qualifications of personnel performing or directing the RFI, including contractor personnel. This plan shall also document the overall management approach to the RFI.

B  **Data Collection Quality Assurance Plan**

The Permittee shall prepare a plan to document all monitoring procedures: sampling, field measurements and sample analysis performed during the investigation to characterize the environmental setting, source, and contamination, so as to ensure that all information, data, and resulting decisions are technically sound, statistically valid, and properly documented.

1. **Data Collection Strategy**

   The strategy section of the Data Collection Quality Assurance Plan shall include, but not be limited to, the following:

   a. Description of the intended uses for the data and the necessary level of precision and accuracy for these intended uses;

   b. Description of methods and procedures to be used to assess the precision, accuracy, and completeness of the measurement data;

   c. Description of the rationale used to assure that the data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition or an environmental condition. Examples of factors which shall be considered and discussed include:

      i. Environmental conditions at the time of sampling;

      ii. Number of sampling points;

      iii. Representativeness of selected media; and

      iv. Representativeness of selected analytical parameters.
d. Description of the measures to be taken to assure that the following data sets can be compared to each other:

i. RFI data generated by the Permittee over some time period;

ii. RFI data generated by an outside laboratory or consultant versus data generated by the Permittee;

iii. Data generated by separate consultants or laboratories; and

iv. Data generated by an outside consultant or laboratory over some time period.

e. Details relating to the schedule and information to be provided in quality assurance reports. The reports should include but not be limited to:

i. Periodic assessment of measurement data accuracy, precision, and completeness;

ii. Results of performance audits;

iii. Results of system audits;

iv. Significant quality assurance problems and recommended solutions; and

v. Resolutions of previously stated problems.

2. Sampling

The sampling section of the Data Collection Quality Assurance Plan shall discuss:

a. Selecting appropriate sampling location, depths, etc.;

b. Providing a statistically sufficient number of sampling sites;

c. Measuring all necessary ancillary data;

d. Determining conditions under which sampling should be conducted;

e. Determining which media are to be sampled (e.g., ground water, air, soil, sediment, etc.);
f. Determining which parameters are to be measured and where;

g. Selecting the frequency of sampling and length of sampling period;

h. Selecting the types of sample (e.g., composites vs. grabs) and number of samples to be collected;

i. Measures to be taken to prevent contamination of the sampling equipment and cross contamination between sampling points;

j. Documenting field sampling operations and procedures, including:

i. Documentation of procedures for preparation of reagents or supplies which become an integral part of the sample (e.g., filters and absorbing reagents);

ii. Procedures and forms for recording the exact location and specific considerations associated with sample acquisition;

iii. Documentation of specific sample preservation method;

iv. Calibration of field devices;

v. Collection of replicate samples;

vi. Submission of field-biased blanks, where appropriate;

vii. Potential interferences present at the facility;

viii. Construction materials and techniques associated with monitoring wells and piezometers;

ix. Field equipment listing and sample containers;

x. Sampling order; and

xi. Decontamination procedures.

k. Selecting appropriate sample containers;

l. Sample preservation; and
m. Chain-of-custody, including:
   i. Standardized field tracking reporting forms to establish sample custody in the field prior to and during shipment; and
   ii. Pre-prepared sample labels containing all information necessary for effective sample tracking.

3. Field Measurements

The field measurements section of the Data Collection Quality Assurance Plan shall discuss:

a. Selecting appropriate field measurement locations, depths, etc.;

b. Providing a statistically sufficient number of field measurements;

c. Measuring all necessary ancillary data;

d. Determining conditions under which field measurement should be conducted;

e. Determining which media are to be addressed by appropriate field measurements (e.g., ground water, air, soil, sediment, etc.);

f. Determining which parameters are to be measured and where;

g. Selecting the frequency of field measurement and length of field measurement period; and

h. Documenting field measurement operations and procedures, including:

i. Procedures and forms for recording raw data and the exact location, time, and facility-specific considerations associated with the data acquisition;

   i. Calibration of field devices;

   ii. Collection of replicate measurements;

   iii. Submission of field-biased blanks, where appropriate;

   iv. Potential interferences present at the facility;
v. Construction materials and techniques associated with monitoring wells and piezometers used to collect field data;

vi. Field equipment listing;

vii. Order in which field measurements were made; and

viii. Decontamination procedures.

2. Sample Analysis

The sample analysis section of the Data Collection Quality Assurance Plan shall specify the following:

a. Chain-of-custody procedures, including:

   i. Identification of a responsible party to act as sample custodian at the laboratory facility authorized to sign for incoming field samples, obtain documents of shipment, and verify the data entered onto the sample custody records;

   ii. Provision for a laboratory sample custody log consisting of serially numbered standard lab-tracking report sheets; and

   iii. Specification of laboratory sample custody procedures for sample handling, storage, and disbursement for analysis.

b. Sample storage procedures and storage times;

c. Sample preparation methods;

d. Analytical procedures, including:

   iv. Scope and application of the procedure;

   v. Sample matrix;

   vi. Potential interferences;

   vii. Precision and accuracy of the methodology; and

   viii. Instrumentation detection limits.
e. Calibration procedures and frequency;

f. Data reduction, validation, and reporting;

g. Internal quality control checks, laboratory performance, and systems audits and frequency, including:

  i. Method blank(s);

  ii. Laboratory control sample(s);

  iii. Calibration check sample(s);

  iv. Replicate sample(s);

  v. Matrix-spiked sample(s);

  vi. "Blind" quality control sample(s);

  vii. Control charts;

  viii. Surrogate samples;

  ix. Zero and span gases; and

  x. Reagent quality control checks.

h. Preventive maintenance procedures and schedules;

i. Corrective action (for laboratory problems); and

j. Turnaround time.

C Data Management Plan

The Permittee shall develop and initiate a data management plan to document and track investigation data and results. This plan shall identify and set up data documentation materials and procedures, project file requirements, and project-related progress reporting procedures and documents. The plan shall also provide the format to be used to present the raw data and conclusions of the investigation.

1. Data Record
The data record shall include the following:

a. Unique sample or field measurement code;
b. Sampling or field measurement location and sample or measurement type;
c. Sampling or field measurement raw data;
d. Laboratory analysis ID number;
e. Property or component measured; and
f. Result of analysis (e.g., concentration).

2. Tabular Displays

The following data shall be presented in tabular displays:

a. Unsorted (raw) data;
b. Results for each medium or for each constituent monitored;
c. Data reduction for statistical analysis;
d. Sorting of data by potential stratification factors (e.g., location, soil layer, topography); and
e. Summary data.

3. Graphical Displays

The following data shall be presented in graphical formats (e.g., bar graphs, line graphs, area or plan maps, isopleth plots, cross-sectional plots or transects, three-dimensional graphs, etc.):

a. Display sampling location and sampling grid;
b. Indicate boundaries of sampling area and areas where more data are required;
c. Displays levels of contamination at each sampling location;
d. Display geographical extent of contamination;
e. Display contamination levels, averages, and maxima;

f. Illustrate changes in concentration in relation to distance from the source, time, depth or other parameters; and

g. Indicate features affecting intra-media transport and show potential receptors.

D Health and Safety Plan

The Permittee shall prepare a facility health and safety plan.

4. Major elements of the health and safety plan shall include:

   a. Facility description including availability of resources such as roads, water supply, electricity, and telephone service;

   b. Describe the known hazards and evaluate the risks associated with the incident and with each activity conducted;

   c. List key personnel and alternates responsible for site safety, responses operations, and for protection of public health;

   d. Delineate work area;

   e. Describe levels of protection to be worn by personnel in work area;

   f. Establish procedures to control site access;

   g. Describe decontamination procedures for personnel and equipment;

   h. Establish site emergency procedures;

   i. Address emergency medical care for injuries and toxicological problems;

   j. Describe requirements for an environmental surveillance program;

   k. Specify any routine and special training required for responders; and
l. Establish procedures for protecting workers from weather-related problems.

5. The facility health and safety plan shall be consistent with:

a. NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);
b. EPA Order 1440.1 - Respiratory Protection;
c. EPA Order 1440.3 - Health and Safety Requirements for Employees Engaged in Field Activities;
d. Facility contingency plan;
e. EPA Standard Operating Safety Guide (1984);
f. OSHA regulations, particularly in 29 CFR 1910 and 1926;
g. State and local regulations; and
h. Other EPA guidance as provided.

E Community Relations Plan

The Permittee shall prepare a plan for the dissemination of information to the public regarding investigation activities and results.

Task IV: Facility Investigation

The Permittee shall conduct those investigations necessary to characterize the facility (environmental setting); define the source (source characterization); define the degree and extent of contamination (contamination characterization); identify actual or potential receptors and determine the impact(s) of contamination on human health and/or ecological receptors (risk assessment). For reporting of the ecological assessment, refer to "The Risk Assessment Volume II Manual" [EPA/540/1-89/002 AND 001, March 1989].

The investigations should result in data of adequate technical quality to support the development and evaluation of the CM alternative or alternatives during the CMS.

The investigation activities shall follow the plans set forth in Task III of Appendix B. All sampling and analyses shall be conducted in accordance with the Data Collection Quality
Assurance Plan. All sampling locations shall be documented in a log and identified on a detailed site map.

A  Environmental Setting

The Permittee shall collect information to supplement and verify existing information on the environmental setting at the facility. The Permittee shall characterize the following:

1. Hydrogeology

The Permittee shall conduct a program to evaluate hydrogeologic conditions at the facility. This program shall provide the following information:

a. A description of the regional and facility-specific geologic and hydrogeologic characteristics affecting ground water flow beneath the facility, including:

i. Regional and facility-specific stratigraphy: description of strata including strike and dip, identification of stratigraphic contacts;

ii. Structural geology: description of local and regional structural features (e.g., folding, faulting, tilting, jointing, etc);

iii. Depositional history;

iv. Identification and characterization of areas and amounts of recharge and discharge;

v. Regional and facility-specific ground water flow patterns; and

vi. Characterize seasonal and temporal variations in the ground water flow regime.

b. An analysis of any topographic features that might influence the ground water flow system. (Note: Stereographic analysis of aerial photographs may aid in this analysis).

c. Based on field data, test, and cores, a representative and accurate classification and description of the hydrogeologic units which may be part of the migration pathways at the facility (i.e., the aquifers and any intervening saturated and unsaturated units), including:

i. Hydraulic conductivity and porosity (total and effective);

ii. Lithology, grain size, sorting, degree of cementation;
iii. An interpretation of hydraulic interconnections between saturated zones;

iv. The attenuation capacity and mechanisms of the natural earth materials (e.g., ion exchange capacity, organic carbon content, mineral content, etc.); and

v. Recording the depth to the immiscible layer(s) and the thickness of the immiscible layer(s) when immiscible contaminants are present, either floating on or at the bottom of the water column.

d. Based on field studies and cores, structural geology and hydrogeologic cross-sections showing the extent (depth, thickness, lateral extent) of hydrogeologic units which may be part of the migration pathways identifying:

i. Sand and gravel deposits in unconsolidated deposits;

ii. Zones of fracturing or channeling in consolidated or unconsolidated deposits;

iii. Zones of higher permeability or low permeability that might direct and restrict the flow of contaminants;

iv. The uppermost aquifer: geologic formation, group of formations or part of a formation capable of yielding a significant amount of ground water to wells or springs; and

v. Water-bearing zones above the first confining layer that may serve as a pathway for contaminant migration including perched zones of saturation.

e. Based on data obtained from ground water monitoring wells and piezometers installed upgradient and downgradient of the potential contaminant source, a representative description of water level or fluid pressure monitoring including:

i. Water-level contour and/or potentiometric maps;

ii. Hydrologic cross-sections showing vertical gradients;

iii. The flow system, including the vertical and horizontal components of flow; and

iv. Any temporal changes in hydraulic gradients, for example, due to tidal or seasonal influences.
A description of manmade influences that may affect the hydrogeology of the site, identifying:

i. Active and inactive local water supply and production wells with an approximate schedule of pumping; and

ii. Manmade hydraulic structures (pipelines, french drains, ditches, unlined ponds, septic tanks, North Dakota Pollutant Discharge Elimination System outfalls, retention areas, etc.).

2. Soils

The Permittee shall conduct a program to characterize the soil and rock units above the water table in the vicinity of the contaminant release(s). Such characterization shall include, but not be limited to, the following information:

a. Surface soil distribution;
b. Hydraulic conductivity (saturated and unsaturated);
c. Relative permeability;
d. Porosity;
e. Soil sorptive capacity;
f. Cation Exchange Capacity (CEC);
g. Soil organic content;
h. Effect of stratification on unsaturated flow;
i. Infiltration;
j. Storage capacity;
k. Vertical flow rate; and
l. Depth of water table.

3. Surface Water and Sediment

The Permittee shall conduct a program to characterize the surface water bodies in the vicinity of the facility. Such characterization shall include, but not be limited to, the following activities and information:
a. Description of the temporal and permanent surface water bodies including:

i. For impoundments: location, elevation, surface area, depth, volume, freeboard, and purpose of impoundment;

ii. For rivers, streams, ditches, drains, swamps and channels: location, elevation, flow, velocity, depth, width, seasonal fluctuations, and flooding tendencies (i.e., 100-year event); and

iii. Drainage patterns.

b. Description of the chemistry of the natural surface water and sediments. This includes determining the pH, total dissolved solids, total suspended solids, biological oxygen demand, alkalinity, conductivity, dissolved oxygen profiles, nutrients (NH$_3$, NO$_3$-/NO$_2$ -, PO$_4$ $^3-$), chemical oxygen demand, total organic carbon, specific contaminant concentrations, etc.

c. Description of sediment characteristics including:

i. Deposition area;

ii. Thickness profile; and

iii. Physical and chemical parameters (e.g., grain size, density, organic carbon content, ion exchange capacity, pH, etc.).

4. Air

The Permittee shall provide information characterizing the climate in the vicinity of the facility. Such information shall include, but not be limited to:

a. A description of the following parameters:

i. Annual and monthly rainfall averages;

ii. Monthly temperature averages and extremes;

iii. Wind speed and direction;

iv. Relative humidity/dew point;

v. Atmospheric pressure;

vi. Evaporation data;

vii. Development of inversions; and
viii. Climate extremes that have been known to occur in the vicinity of the facility, including frequency of occurrence.

b. A description of topographic and manmade features which affect air flow and emission patterns, including:

i. Ridges, hills or mountain areas;

ii. Canyons or valleys;

iii. Surface water bodies (e.g., rivers, lakes, bays, etc.);

iv. Wind breaks and forests; and


B Source Characterization

The Permittee shall collect analytic data to completely characterize the wastes and the areas where wastes have been placed, collected or removed including type, quantity, physical form, disposition (containment or nature of deposits), and facility characteristics affecting release (e.g., facility security, and engineered barriers). This shall include quantification of the following specific characteristics at each source area:

1. Unit/Disposal Area characteristics:

   a. Location of unit/disposal area;

   b. Type of unit/disposal area;

   c. Design features;

   d. Operating practices (past and present);

   e. Period of operation;

   f. Age of unit/disposal area;

   g. General physical conditions;

   h. Method used to close the unit/disposal area; and

   i. Determine if there is potential for continuing release by any closed unit/area.

2. Waste Characteristics:
a. Type of waste:
   i. Hazardous classification (e.g., flammable, reactive, corrosive, oxidizing or reducing agent);
   ii. Quantity; and
   iii. Chemical composition.

b. Physical and chemical characteristics:
   i. Physical form (solid, liquid, gas);
   ii. Physical description (e.g., powder, oily sludge);
   iii. General chemical class (e.g., acid, base, solvent);
   iv. Density and molecular weight;
   v. Viscosity;
   vi. Cohesiveness of the waste;
   vii. Solubility in water;
   viii. Flash point; and
   ix. Boiling point.

c. Migration and dispersal characteristics of the waste:
   i. Sorption;
   ii. Biodegradability, bioconcentration, biotransformation;
   iii. Photodegradation rates;
   iv. Hydrolysis rates; and
   v. Chemical transformations.

The Permittee shall document the procedures used in making the above determinations.

C Contamination Characterization

The Permittee shall collect analytical data on ground water, soils, surface water, sediment, and subsurface gas contamination in the vicinity of the facility. This data shall
be sufficient to define the extent, origin, direction, and rate of movement of contaminant plumes. Data shall include time and location of sampling, media sampled, concentrations found, conditions during sampling, and the identity of the individuals performing the sampling and analysis. The Permittee shall address the following types of contamination at the facility:

1. Ground Water Contamination

   The Permittee shall conduct a ground water investigation to characterize any plumes of contamination at the facility. This investigation shall, at a minimum, provide the following information:

   a. A description of the horizontal and vertical extent of any immiscible or dissolved plume(s) originating from the facility;

   b. Available monitoring data and qualitative information on locations and levels of contamination at the facility;

   c. The horizontal and vertical direction of contamination movement;

   d. The velocity of contaminant movement;

   e. The horizontal and vertical concentration profiles of Appendix XII of Chapter 33.1-24-05 NDAC constituents in the plume(s);

   f. An evaluation of factors influencing the plume movement;

   g. An extrapolation of future contaminant movement;

   h. All potential migration pathways including information on geology, pedology, hydrogeology, physiography, hydrology, and water quality;

   i. Completely characterize the contaminants; and

   j. Determine if contaminants are the same in all areas of facility. If not, delineate the areas that contain different types of contaminants.

   The Permittee shall document the procedures used in making the above determinations (e.g., well design, well construction, geophysics, modeling, etc.).

2. Soil Contamination
The Permittee shall conduct an investigation to characterize the contamination of the soil and rock units above the water table in the vicinity of the contaminant release. The investigation shall include the following information:

a. A description of the vertical and horizontal extent of contamination.

b. A description of contaminant and soil chemical properties within the contaminant source area and plume. This includes contaminant solubility, speciation, adsorption, leachability, exchange capacity, biodegradability, hydrolysis, photolysis, oxidation, and other factors that might affect contaminant migration and transformation.

c. Specific contaminant concentration.

d. The velocity and direction of contaminant movement.

e. The extrapolation of future contaminant movement.

The Permittee shall document the procedures used in making the above determinations.

3. Surface Water and Sediment Contamination

The Permittee shall conduct a surface water investigation to characterize contamination in surface water bodies resulting from contaminant releases at the facility.

The investigation shall include, but not be limited to, the following information:

a. A description of the horizontal and vertical extent of any immiscible or dissolved plume(s) originating from the facility and the extent of contamination in underlying sediments;

b. The horizontal and vertical direction of contaminant movement;

c. The contaminant velocity;

d. An evaluation of the physical, biological, and chemical factors influencing contaminant movement;

e. An extrapolation of future contaminant movement; and

f. A description of the chemistry of the contaminated surface waters and sediments. This includes determining the pH, total dissolved solids, specific contaminant concentration, etc.;
The Permittee shall document the procedures used in making the above determinations.

4. Air Contamination

The Permittee shall conduct an investigation to characterize the particulate and gaseous contaminants released into the atmosphere. This investigation shall provide the following information:

a. A description of the horizontal and vertical direction and velocity of contaminant movement;

b. The rate and amount of the release; and

c. The chemical and physical composition of the contaminant(s) released, including horizontal and vertical concentration profiles. The Permittee shall document the procedures used in making the above determinations.

5. Subsurface Gas Contamination

The Permittee shall conduct an investigation to characterize subsurface gases emitted from buried hazardous waste and hazardous constituents in the ground water. This investigation shall include the following information:

[NOTE: If this is not applicable to the buried wastes on-site, document the procedures used in making this determination.]

a. A description of the horizontal and vertical extent of subsurface gases mitigation;

b. The chemical composition of the gases being emitted;

c. The rate, amount, and density of the gases being emitted; and

d. Horizontal and vertical concentration profiles of the subsurface gases emitted.

The Permittee shall document the procedures used in making the above determinations.

D Potential Receptor Identification

The Permittee shall collect data describing the human populations and environmental systems that are susceptible to contaminant exposure from the facility. Chemical analysis of biological samples may be needed. Data on observable effects in ecosystems may also be obtained. The following characteristics shall be identified:
1. Local uses and possible future uses of ground water:
   a. Type of use (e.g., drinking water source: municipal or residential, agricultural, domestic/non-potable, and industrial); and
   b. Location of ground water users, including wells and discharge areas.

2. Local uses and possible future uses of surface waters draining the facility:
   a. Domestic and municipal (e.g., potable and lawn/gardening watering);
   b. Recreational (e.g., swimming, fishing);
   c. Agricultural;
   d. Industrial; and
   e. Environmental (e.g., fish and wildlife propagation).

3. Human use of or access to the facility and adjacent lands, including, but not limited to:
   a. Recreation;
   b. Hunting;
   c. Residential;
   d. Commercial;
   e. Zoning;
   f. Relationship between population locations and prevailing wind direction; and
   g. The potential impact(s) on human health including demography, ground water and surface water use, and land use.

4. A description of the biota on/in surface water bodies on, adjacent to, or affected by the facility.

5. A description of the ecology overlying and adjacent to the facility.

6. A demographic profile of the people who use or have access to the facility and adjacent land, including, but not limited to: age, sex, and sensitive subgroups.
7. A description of any endangered or threatened species near the facility.

E Risk Assessment

The baseline risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases (under the assumption of no action). The baseline risk assessment contributes to the site characterization and subsequent development, evaluation, and selection of appropriate response alternatives. There are four steps in the risk assessment process.

1. Determine contaminants of concern: Data collection and evaluation involve the gathering and analyzing of site data relevant to the human health evaluation and identifying the substances present at the site that are the focus of the risk assessment process.

2. Exposure assessment: Using the procedure outlined in Section D for determining potential receptors, estimate the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed. In the exposure assessment, reasonable maximum estimates of exposure are developed for both current and future land-use assumptions.

3. Toxicity assessment: This component of the risk assessment considers the types of adverse health effects associated with chemical exposures and the relationship between the magnitude of exposure and adverse effects.

4. Risk Characterization: This summarizes and combines outputs of the exposure and toxicity and assessments to characterize baseline risk, both in quantitative expressions and qualitative statements.

Task V: Investigation Analysis

The Permittee shall prepare an analysis and summary of all facility investigations and their results. The objective of this task shall be to ensure that the investigation data are sufficient in quality (e.g., quality assurance procedures have been followed) and quantity to describe the nature and extent of contamination, potential threat to human health and/or the environment, and to support the CMS.

A Protection Standards

1. Ground Water Protection Standards

For the facility, the Permittee shall provide information to support the Department's selection/development of Ground Water Protection Standards for all of the Appendix XII of Chapter 33.1-24-05 NDAC constituents found in the ground water during the Facility Investigation (TASK IV of Appendix B).

a. The Ground Water Protection Standards shall consist of:
i. For any constituents listed in Table 1 of Section 33.1-24-05-51 NDAC, the respective value (MCL) given in that table the background level of the constituent is below those given in Table 1; or

ii. The background level of that constituent in the ground water; or

iii. A Department-approved Alternate Concentration Limit (ACL).

b. Information to support the Department's subsequent selection of ACLs shall be developed by the Permittee in accordance with U.S. EPA guidance. For any proposed ACLs, the Permittee shall include a justification based upon the criteria set forth in Section 33.1-24-05-51(2) NDAC.

2. Other Relevant Protection Standards

The Permittee shall identify all relevant and applicable standards for the protection of human health and the environment (e.g., federally-approved state water quality standards, etc.).

**Task VI: Laboratory and Bench-Scale Studies**

The Permittee shall conduct laboratory and/or bench-scale studies to determine the applicability of a corrective measure technology or technologies to facility conditions. The Permittee shall analyze the technologies, based on literature review, vendor contracts, and past experience to determine the testing requirements.

The Permittee shall develop a testing plan identifying the type(s) and goal(s) of the study(ies), the level of effort needed, and the procedures to be used for data management and interpretation.

Upon completion of the testing, the Permittee shall evaluate the testing results to assess the technology or technologies with respect to the site-specific questions identified in the test plan.

The Permittee shall prepare a report summarizing the testing program and its results, both positive and negative.

[NOTE: Submit any future and/or previous laboratory and bench-scale studies using the above criteria.]
Task VII: Reports

A  Progress

The Permittee shall provide the Department with RFI progress reports every ninety (90) calendar days beginning sixty (60) calendar days from the start date specified in the RFI workplan approval letter. The progress reports shall contain the following information at a minimum:

1. A description of the portion of the RFI completed;
2. Summaries of findings;
3. Summaries of all deviations from the approved RFI workplan during the reporting period;
4. Summaries of all problems or potential problems encountered during the reporting period;
5. Projected work for the next reporting period;
6. Changes in personnel during the reporting period.

B  Draft and Final

The Permittee shall prepare and submit to the Department draft and final RFI report(s) for the investigations conducted, pursuant to the workplan(s) submitted under Permit Module II.E.1. The draft RFI report(s) shall be submitted to the Department for review in accordance with the schedule in the approved RFI workplan(s). The final RFI report(s) shall be submitted within sixty (60) calendar days of receipt of the Department’s comments on the draft RFI report. The RFI report(s) shall include all analyses and summary of all required investigations of SWMUs and AOC and their results. The summary shall describe the type and extent of contamination at the facility, including sources and migration pathways, and a description of actual or potential receptors. The report(s) shall also describe the extent of contamination (qualitative and quantitative) in relation to background levels indicative of the area. The objective of this task shall be to ensure that the data generated during the investigation are sufficient in quality (e.g., quality assurance procedures have been followed) and quantity to describe the nature and extent of contamination, potential threat to human health and/or the environment, and to support a CMS, if necessary.
Appendix B

Scope of Work for a Corrective Measure Study

Purpose

The purpose of this Corrective Measure Study (CMS) is to develop and evaluate the corrective action alternative or alternatives and to recommend the corrective measure or measures to be taken at the facility. The Permittee will furnish the personnel, materials, and services necessary to prepare the CMS, except as otherwise specified.

Scope

The CMS consists of four tasks:

Task I: Identification and Development of the Corrective Measure Alternative or Alternatives

A. Description of Current Situation
B. Establishment of Corrective Action Objectives
C. Screening of Corrective Measures Technologies
D. Identification of the Corrective Measure Alternative or Alternatives

Task II: Evaluation of the Corrective Measure Alternative or Alternatives

A. Technical/Environmental/Human Health/Institutional
B. Cost Estimate

Task III: Justification and Recommendation of the Corrective Measure or Measures

A. Technical
B. Environmental
C. Human Health

Task IV: Reports

A. Progress
B. Draft
C. Final
Task I: Identification and Development of the Corrective Action Alternative or Alternatives

Based on the results of the RFI and consideration of the identified preliminary corrective measure technologies (Task III of Appendix B), the Permittee shall identify, screen and develop the alternative or alternatives for removal, containment, treatment and/or other remediation of the contamination based on the objectives established for the corrective action.

A Description of Current Situation

The Permittee shall submit an update to the information describing the current situation at the facility and the known nature and extent of the contamination as documented by the RFI report. The Permittee shall provide an update to information presented in Task I of Appendix B of the RFI to the Department regarding previous response activities and any interim measures which have or are being implemented at the facility. The Permittee shall also make a facility-specific statement of the purpose for the response, based on the results of the RFI. The statement of purpose should identify the actual or potential exposure pathways that should be addressed by corrective measures.

B Establishment of Corrective Action Objectives

The Permittee, in conjunction with the Department, shall establish site-specific objectives for the corrective action. These objectives shall be based on public health, environmental and ecological criteria, information gathered during the RFI, EPA guidance, and the requirements of any applicable federal and state statutes. At a minimum, all corrective actions concerning ground water releases must be consistent with, and as stringent as, those required under Section 33-04-05-57 NDAC.

C Screening of Corrective Measure Technologies

The Permittee shall review the results of the RFI and reassess the technologies specified in Task II of Appendix B and to identify additional technologies which are applicable at the facility. The Permittee shall screen the preliminary corrective measure technologies identified in Task II of Appendix B of the RFI and any supplemental technologies to eliminate those that may prove infeasible to implement, that rely on technologies unlikely to perform satisfactorily or reliably or that do not achieve the corrective measure objective within a reasonable time period. This screening process focuses on eliminating those technologies which have severe limitations for a given set of waste and site-specific conditions. The screening step may also eliminate technologies based on inherent technology limitations. Site, waste, and technology characteristics which are used to screen inapplicable technologies are described in more detail below:
1. Site Characteristics

Site data should be reviewed to identify conditions that may limit or promote the use of certain technologies. Technologies whose use is clearly precluded by site characteristics should be eliminated from further consideration;

2. Waste Characteristics

Identification of waste characteristics that limit the effectiveness or feasibility of technologies is an important part of the screening process. Technologies clearly limited by these waste characteristics should be eliminated from consideration. Waste characteristics particularly affect the feasibility of in-situ methods, direct treatment methods, and land disposal (on/off-site); and

3. Technology Limitations

During the screening process the level of technology development performance record and inherent construction, operation, and maintenance problems should be identified for each technology considered. Technologies that are unreliable, perform poorly, or are not fully demonstrated may be eliminated in the screening process. For example, certain treatment methods have been developed to a point where they can be implemented in the field without extensive technology transfer or development.

B Identification of the Corrective Measure Alternative or Alternatives

The Permittee shall develop the corrective measure alternative or alternatives based on the corrective action objectives and analysis of preliminary corrective measure technologies, as presented in Task II of Appendix B of the RFI and as supplemented following the preparation of the RFI report. The Permittee shall rely on engineering practice to determine which of the previously identified technologies appear most suitable for the site. Technologies can be combined to form the overall corrective action alternative or alternatives. The alternative or alternatives developed should represent a workable number of option(s) that each appear to adequately address all site problems and corrective action objectives. Each alternative may consist of an individual technology or a combination of technologies. The Permittee shall document the reasons for excluding technologies, identified in Task II of Appendix B, as supplemented in the development of the alternative or alternatives.

Task II: Evaluation of the Corrective Measure Alternative or Alternatives

The Permittee shall describe each corrective measure alternative that passes through the initial screening in Task I of Appendix C and evaluate each corrective measure alternative and its component. The evaluation shall be based on technical, environmental, human health,
and institutional concerns. The Permittee shall also develop cost estimates of each corrective
measure.

A  Technical/Environmental/Human Health/Institutional

The Permittee shall provide a description of each corrective measure alternative which
includes, but is not limited to, the following: preliminary process flow sheets, preliminary
sizing and type of construction for buildings and structures, and rough quantities of
utilities required. The Permittee shall evaluate each alternative in the four following
areas:

1.  Technical

The Permittee shall evaluate each corrective measure alternative based on
performance, reliability, implementability, and safety.

a.  The Permittee shall evaluate performance based on the effectiveness and
useful life of the corrective measure:

i.  Effectiveness shall be evaluated in terms of the ability to
perform intended functions, such as containment, diversion,
removal, destruction or treatment. The effectiveness of each
corrective measure shall be determined either through design
specifications or by performance evaluation. Any specific waste
or site characteristics which could potentially impede effective-
ness shall be considered. The evaluation should also consider
the effectiveness of combinations of technologies; and

ii.  Useful life is defined as the length of time the level of
effectiveness can be maintained. Most corrective measure
technologies, with the exception of destruction, deteriorate
with time. Often, deterioration can be slowed through proper
system operation and maintenance, but the technology
eventually may require replacement. Each corrective
measure shall be evaluated in terms of the projected service
lives of its component technologies. Resource availability in
the future life of the technology, as well as appropriateness
of the technologies, must be considered in estimating the
useful life of the project.

b.  The Permittee shall provide information on the reliability of each
corrective measure including their operation and maintenance
requirements and their demonstrated reliability:
i. Operation and maintenance requirements include the frequency and complexity of necessary operation and maintenance. Technologies requiring frequent or complex operation and maintenance activities should be regarded as less reliable than technologies requiring little or straightforward operation and maintenance. The availability of labor and materials to meet these requirements shall also be considered; and

ii. Demonstrated and expected reliability is a way of measuring the risk and effect of failure. The Permittee should evaluate whether the technologies have been used effectively under analogous conditions; whether the combination of technologies have been used together effectively; whether failure of any one technology has an immediate impact on receptors, and whether the corrective measure has the flexibility to deal with uncontrollable changes at the site.

c. The Permittee shall describe the implementability of each corrective measure including the relative ease of installation (constructability) and the time required to achieve a given level of response:

i. Constructability is determined by conditions both internal and external to the facility conditions and include such items as location of underground utilities, depth to water table, heterogeneity of subsurface materials, and location of the facility (i.e., remote location vs. a congested urban area). The Permittee shall evaluate what measures can be taken to facilitate construction under these conditions. External factors which affect implementation include the need for special permits or agreements, equipment availability, and the location of suitable off-site treatment or disposal facilities; and

ii. Time has two components that shall be addressed: the time it takes to implement a corrective measure and the time it takes to actually see beneficial results. Beneficial results are defined as the reduction of contaminants to some acceptable, pre-established level.

d. The Permittee shall evaluate each corrective measure alternative with regard to safety. This evaluation shall include threats to the safety of nearby communities and environments as well as those to workers during implementation. Factors to consider are fire, explosion, and exposure to hazardous substances.
2. Environment

The Permittee shall perform an environmental assessment for each alternative. The environmental assessment shall focus on the facility conditions and pathways of contamination actually addressed by each alternative. The environmental assessment for each alternative will include, at a minimum, an evaluation of the short- and long-term beneficial and adverse effects of the response alternative, any adverse effects on environmentally sensitive areas, and an analysis of measures to mitigate adverse effects.

3. Human Health

The Permittee shall assess each alternative in terms of the extent of which it mitigates short- and long-term potential exposure to any residual contamination and protects human health both during and after implementation of the corrective measure. The assessment will describe the levels of characterizations of contaminants on-site, potential exposure routes, and potentially affected population. Each alternative will be evaluated to determine the level of exposure to contaminants and the reduction over time. For management of mitigation measures, the relative reduction of impact will be determined by comparing residual levels of each alternative with existing criteria, standards or guidelines acceptable to the Department.

4. Institutional.

The Permittee shall assess relevant institutional needs for each alternative. Specifically, the effects of federal, state and local environmental and public health standards, regulations, guidance, advisories, ordinances, or community relations on the design, operation, and timing of each alternative.

B Cost Estimate

The Permittee shall develop an estimate of the cost of each corrective measure alternative (and for each phase or segment of the alternative). The cost estimate shall include both capital and operation and maintenance costs.

1. Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs.

   a. Direct capital costs include:

      i. Construction costs: costs of materials, labor (including fringe benefits and worker's compensation), and equipment required to install the corrective measure;
ii. Equipment costs: costs of treatment, containment disposal and/or service equipment necessary to implement the action; these materials remain until the corrective action is complete;

iii. Land and site-development costs: expenses associated with purchase of land and development of existing property; and

iv. Buildings and services costs: costs of process and non-process buildings, utility connections, purchased services, and disposal costs.

b. Indirect capital costs include:

i. Engineering expenses: costs of administration, design, construction supervision, drafting, and testing of corrective measure alternatives;

ii. Legal fees and license or permit costs: administrative and technical costs necessary to obtain licenses and permits for installation and operation;

iii. Startup and shakedown costs: costs incurred during corrective measure startup; and

iv. Contingency allowances: funds to cover costs resulting from unforeseen circumstances, such as adverse weather conditions, strikes, and inadequate facility characterization.

2. Operation and maintenance costs are post-construction costs necessary to ensure continued effectiveness of a corrective measure. The Permittee shall consider the following operation and maintenance cost components:

a. Operating labor costs: wages, salaries, training, overhead, and fringe benefits associated with the labor needed for post-construction operations;

b. Maintenance materials and labor costs: costs for labor, parts, and other resources required for routine maintenance of facilities and equipment;

c. Auxiliary materials and energy: costs of such items as chemicals and electricity for operations, water and sewer service, and fuel;

d. Purchased services: sampling costs, laboratory fees, and professional fees for which the need can be predicted;

e. Disposal and treatment costs: costs of transporting, treating, and disposing of waste materials such as residues, recovered product,
sludges from tanks the recovered product may produce, etc., generated during operations;

f. Administrative costs: costs associated with administration of corrective measure operations and maintenance not included under other categories;

g. Insurance, taxes, and licensing costs: costs of such items as liability and sudden accidental insurance, real estate taxes on purchased land or rights-of-way, licensing fees for certain technologies, and permit renewal and reporting costs;

h. Maintenance reserve and contingency funds: annual payments into escrow funds to cover: (1) costs of anticipated replacement or rebuilding of equipment and (2) any large, unanticipated operation and maintenance costs; and

i. Other costs. Items that do not fit any of the above categories.

Task III: Justification and Recommendation of the Corrective Measure(s)

The Permittee shall justify and recommend a corrective measure alternative using technical, human health, and environmental criteria. This recommendation shall include summary tables which allow the alternative or alternatives to be understood easily. Tradeoffs among health risks, environmental effects, and other pertinent factors shall be highlighted. The Department will select the corrective measure alternative or alternatives to be implemented based on the results of Tasks II and III of Appendix C. At a minimum, the following criteria will be used to justify the final corrective measure or measures.

A Technical

1. Performance: Corrective measure or measures which are most effective at performing their intended functions and maintaining the performance over extended periods of time will be given preference;

2. Reliability: Corrective measure or measures which do not require frequent or complex operation and maintenance activities and that have proven effective under waste and facility conditions similar to those anticipated will be given preference;

3. Implementability: Corrective measure or measures which can be constructed and operating to reduce levels of contamination to attain or exceed applicable standards in the shortest period of time will be preferred; and

4. Safety: Corrective measure or measure which poses the least threat to the safety of nearby residents and environments, as well as workers during implementation, will be preferred.
Human Health

The corrective measure or measures must comply with existing U.S. EPA/Department criteria, standards or guidelines for the protection of human health. Corrective measures which provide the minimum level of exposure to contaminants and the maximum reduction in exposure with time are preferred.

Environmental

The corrective measure or measures posing the least adverse impact (or greatest improvement) over the shortest period of time on the environment will be favored.

Task IV: Reports

The Permittee shall prepare a CMS report representing the results of Task I through Task III of Appendix C and recommending a corrective measure alternative. Two copies of the preliminary report shall be provided by the Permittee.

A Progress

The Permittee shall, at a minimum, provide the Department with signed progress reports every ninety (90) calendar days containing:

1. A description and estimate of the percentage of the CMS completed;
2. Summaries of all findings;
3. Summaries of all changes made in the CMS during the reporting period;
4. Summaries of all contacts with representatives of the local community, public interest groups or state government during the reporting period;
5. Summaries of all problems or potential problems encountered during the reporting period;
6. Actions being taken to rectify problems;
7. Changes in personnel during reporting period;
8. Projected work for the next reporting period.

B Draft

The Report shall, at a minimum, include:

1. A description of the facility;
2. The corrective measure or measures:
   a. Description of the corrective measure or measures and rationale for selection;
   b. Performance expectations;
   c. Preliminary design criteria and rationale;
   d. General operation and maintenance requirements; and
   e. Long-term monitoring requirements.

3. A summary of the RFI and impact on the selected corrective measure or measures;
   a. Field studies (ground water, surface water, soil, air); and
   b. Laboratory studies (bench-scale, pick-scale).

4. Design and implementation precautions;
   a. Special technical problems;
   b. Additional engineering data required;
   c. Permits and regulatory requirements;
   d. Access, easements, right-of-way;
   e. Health and safety requirements; and
   f. Community relations activities.

5. Cost estimates and schedules;
   a. Capital cost estimate;
   b. Operation and maintenance cost estimate; and
   c. Project schedule (design, construction, operation). One copy of the draft shall be provided by the Permittee to the Department.
6. **Final**

The Permittee shall finalize the CMS report, incorporating comments received from the Department on the draft CMS report.
Appendix C

Scope of Work for the Corrective Measure Implementation

Purpose

The purpose of this Corrective Measure Implementation (CMI) program is to design, construct, operate, maintain, and monitor the performance of the corrective measure or measures selected to protect human health and the environment. The Permittee will furnish all personnel, materials, and services necessary for the implementation of the corrective measure or measures.

Scope

The Corrective Measure Implementation program consists of four tasks:

Task I: Corrective Measure Implementation Program Plan

A. Program Management Plan

Task II: Corrective Measure Design

A. Design Plans and Specifications
B. Operation and Maintenance Plan
C. Cost Estimate
D. Project Schedule
E. Construction Quality Assurance Objectives
F. Design Phases

Task III: Corrective Measure Construction

A. Responsibility and Authority
B. Construction Quality Assurance Personnel Qualifications
C. Inspection Activities
D. Sampling Requirements
E. Documentation

Task IV: Reports

A. Progress
B. Draft
C. Final
Task I: Corrective Measure Implementation Program Plan

The Permittee shall prepare a CMI program plan. This program will include the development and implementation of several plans, which require concurrent preparation. It may be necessary to revise plans as the work is performed to focus efforts on a particular problem. The program plan includes the following:

A Program Management Plan

The Permittee shall prepare a program management plan which will document the overall management strategy for performing the design, construction, operation, maintenance, and monitoring of corrective measure(s). The plan shall document the responsibility and authority of all organizations and key personnel involved with the implementation. The program management plan will also include a description of qualifications of key personnel directing the CMI program, including contractor personnel.

Task II: Corrective Measure Design

The Permittee shall prepare final construction plans and specifications to implement the corrective measure(s) at the facility as defined in the CMS.

A Design Plans and Specifications

The Permittee shall develop clear and comprehensive design plans and specifications which include, but are not limited to, the following:

1. Discussion of the design strategy and the design basis, including:
   a. Compliance with all applicable or relevant environmental and public health standards; and
   b. Minimization of environmental and public impacts.

2. Discussion of the technical factors of importance, including:
   a. Use of currently accepted environmental control measures and technology;
   b. Methods used to determine location of proposed corrective measure(s);
   c. The constructability of the design; and
   d. Use of currently acceptable construction practices and techniques.

3. Description of assumptions made and detailed justification of these assumptions;
4. Discussion of the possible sources of error and references to possible operation and maintenance problems;

5. Detailed drawings of the proposed design, including:
   a. Qualitative flow sheets; and
   b. Quantitative flow sheets.

6. Tables listing equipment and specifications;

7. Tables listing monitoring wells used during corrective measure(s);

8. Tables giving material and energy balances;

9. Appendices including:
   a. Sample calculations (one example presented and explained clearly for significant or unique design calculations);
   b. Derivation of equations essential to understanding the report; and
   c. Results of laboratory or field tests.

B Operation and Maintenance Plan

The Permittee shall prepare an operation and maintenance plan to cover both implementation and long-term maintenance of the corrective measure. The plan shall be composed of the following elements:

1. Description of normal operation and maintenance (O&M);
   a. Description of tasks for operation;
   b. Description of tasks for maintenance;
   c. Description of prescribed treatment or operation conditions; and
   d. Schedule showing frequency of each O&M task.

2. Description of potential operating problems;
   a. Description and analysis of potential operation problems;
   b. Sources of information regarding problems; and
   c. Common and/or anticipated remedies.
3. Description of routine monitoring and laboratory testing;
   a. Description of monitoring tasks;
   b. Description of required laboratory tests and their interpretation;
   c. Required QA/QC; and
   d. Schedule of monitoring frequency and date, if appropriate, when monitoring may cease.

4. Description of alternate O&M;
   a. Should systems fail, alternate procedures to prevent undue hazard; and
   b. Analysis of vulnerability and additional resource requirements should a failure occur.

5. Safety plan;
   a. Description of precautions, of necessary equipment, etc., for site personnel; and
   b. Safety tasks required in event of system's failure.

6. Description of equipment; and
   a. Equipment identification;
   b. Installation of monitoring components using RCRA Ground Water Technical Enforcement Guidance Document;
   c. Maintenance schedule of site equipment; and
   d. Replacement schedule for equipment and installed components.

7. Records and reporting mechanisms required.
   a. Daily operating logs;
   b. Laboratory records;
   c. Records for operating costs;
   d. Mechanism for reporting emergencies;
   e. Personnel and maintenance records; and
f. Monthly/annual reports to the Department.

B Cost Estimate

The Permittee shall develop cost estimates. The cost estimate developed in the CMS shall be refined to reflect the more detailed/accurate design plans and specifications being developed. The cost estimate shall include both capital and operation and maintenance costs.

C Project Schedule

The Permittee shall develop a project schedule for construction and implementation of the corrective measure or measures which identifies timing for initiation and completion of all critical path tasks. Permittee shall specifically identify dates for completion of the project and major interim milestones.

D Construction Quality Assurance Objectives

The Permittee shall identify and document the objectives and framework for the development of a construction quality assurance program including, but not limited to, the following: responsibility and authority, personnel qualifications, inspection activities, sampling requirements, and documentation.

E Design Phase

The design of the corrective measure(s) should include the phases outlined below:

1. Preliminary design.
   
The Permittee shall submit the preliminary design when the design effort reflects a level such that the technical requirements of the project have been addressed and outlined. The submittal will be reviewed to determine if the final design will provide an operable and useable corrective measure. Supporting data and documentation shall be provided with the design documents defining functional aspects of the program.

2. Correlating plans and specifications.
   
   General correlation between drawings and technical specifications is a basic requirement of any set of working construction plans and specifications. Before submitting the project specifications, the Permittee shall:

   a. Coordinate and cross-check the specifications and drawings; and

   b. Complete the proofing of the edited specifications and required cross-checking of all drawings and specifications.
2. Equipment startup and operator training.

The Permittee shall prepare, and include in the technical specifications governing treatment systems, contractor requirements for providing appropriate service visits by experienced personnel to supervise the installation, adjustment, startup and operation of the treatment systems, and training covering appropriate operational procedures once the startup has been successfully accomplished.

3. Final design.

The Permittee shall execute the required revisions and submit the final documents 100 percent complete with reproducible drawings and specifications.

The final design submittal consists of the final design plans and specifications (100 percent complete), the Permittee's final construction cost estimate, the final operation and maintenance plan, final quality assurance plan, and final project schedule. The quality of the design documents should be such that the Permittee would be able to include them in a bid package and invite contractors to submit bids for the construction project.

**Task III: Corrective Measure Construction**

Following Department approval of the final design, the Permittee shall develop and implement a Construction Quality Assurance (CQA) program to ensure, with a reasonable degree of certainty, that a completed corrective measure(s) meets or exceeds all design criteria, plans, and specifications. The CQA plan is a facility-specific document which must be submitted to the Department for approval prior to the start of construction. At a minimum, the CQA plan should include the elements which are summarized below. Upon Department approval of the CQA plan, the Permittee shall construct and implement the corrective measures in accordance with the approved design, schedule, and the CQA plan. The Permittee shall also implement the elements of the approved operation and maintenance plan.

A **Responsibility and Approval**

The responsibility and authority of all organizations (i.e., technical consultants, construction firms, etc.) and key personnel involved in the construction of the corrective measure shall be described fully in the CQA plan. The Permittee must identify a CQA officer and the necessary supporting inspection staff.

B **Construction Quality Assurance Personnel Qualifications**

The qualifications of the CQA officer and supporting inspection personnel shall be presented in the CQA plan to demonstrate that they possess the training and experience necessary to fulfill their identified responsibilities.
The observations and tests that will be used to monitor the construction and/or installation of the components of the corrective measure(s) shall be summarized in the CQA plan. The plan shall include the scope and frequency of each type of inspection. Inspections shall verify compliance with all environmental requirements and include, but not be limited to, air quality and emissions monitoring records, waste disposal records (e.g., RCRA transportation manifests), etc. The inspection should also ensure compliance with all health and safety procedures. In addition to oversight inspections, the Permittee shall conduct the following activities:

1. **Preconstruction inspection and meeting.**

   The Permittee shall conduct a preconstruction inspection and meeting to:
   a. Review methods for documenting and reporting inspection data
   b. Review methods for distributing and storing documents and reports;
   c. Review work area security and safety protocol;
   d. Discuss any appropriate modifications of the construction quality assurance plan to ensure that site-specific considerations are addressed; and
   e. Conduct a site walk-around to verify that the design criteria, plans, and specifications are understood and to review material and equipment storage locations.

   The preconstruction inspection and meeting shall be documented by a designated person and minutes should be transmitted to all parties.

2. **Pre-final inspection.**

   Upon preliminary project completion, the Permittee shall notify the Department for the purposes of conducting a pre-final inspection. The pre-final inspection will consist of a walk-through inspection of the entire project site. The inspection is to determine whether the project is complete and consistent with the contract documents and the Department-approved corrective measure. Any outstanding construction items discovered during the inspection will be identified and noted. Additionally, treatment equipment will be operationally tested by the Permittee. The Permittee will certify that the equipment has performed to meet the purpose and intent of the specifications. Retesting will be completed where deficiencies are revealed. The pre-final inspection report should outline the outstanding construction items, actions required to resolve items, completion date for these items, and date for final inspection.
3. Final inspection.

Upon completion of any outstanding construction items, the Permittee shall notify the Department for the purposes of conducting a final inspection. The final inspection will consist of a walk-through inspection of the project site. The pre-final inspection report will be used as a checklist with the final inspection focusing on the outstanding construction items identified in the pre-final inspection. Confirmation shall be made that outstanding items have been resolved.

B Sampling Requirements

The sampling activities, sample size, sample locations, frequency of testing, acceptance and rejection criteria, and plans for correcting problems as addressed in the project specifications should be presented in the CQA plan.

C Documentation

Reporting requirements for CQA activities shall be described in detail in the CQA plan. This should include such items as daily summary reports, inspection data sheets, problem identification and corrective measures reports, design acceptance reports, and final documentation. Provisions for the final storage of all records also should be presented in the CQA plan.

Task IV: Reports

The Permittee shall prepare plans, specifications, and reports as set forth in Task I through Task IV of Appendix D to document the design, construction, operation, maintenance, and monitoring of the corrective measure. The documentation shall include, but not be limited to, the following:

A Progress

The Permittee shall, at a minimum, provide the Department with signed progress reports every ninety (90) days beginning thirty (30) days after the start of the design and construction phases and frequency to-be-determined progress reports for operation and maintenance activities containing:

1. A description and estimate of the percentage of the CMI completed;
2. Summaries of all findings;
3. Summaries of all changes made in the CMI during the reporting period;
4. Summaries of all contacts with representatives of the local community, public interest groups or state government during the reporting period;
5. Summaries of all problems or potential problems encountered during the reporting period;

6. Actions being taken to rectify problems;

7. Changes in personnel during the reporting period;

8. Projected work for the next reporting period; and

B Draft

1. The Permittee shall submit a draft CMI program plan.

2. The Permittee shall submit draft construction plans and specifications, design reports, cost estimates, schedules, operation and maintenance plans, and study reports.

3. The Permittee shall submit a draft CQA program plan and documentation.

4. At the "completion" of the construction of the project, the Permittee shall submit a CMI report to the Department. The report shall document that the project is consistent with the design specifications and that the corrective measure is performing adequately. The report shall include, but not be limited to, the following elements:

a. Synopsis of the corrective measure and certification of the design and construction;

b. Explanation of any modifications to the plans and why these were necessary for the project;

c. Listing of the criteria, established before the corrective measure was initiated, for judging the functioning of the corrective measure and also explaining any modification to these criteria;

d. Results of facility monitoring, indicating that the corrective measure will meet or exceed the performance criteria; and

e. Explanation of the operation and maintenance (including monitoring) to be undertaken at the facility.

This report should include all of the daily inspection summary reports, inspection summary reports, inspection data sheets, problem identification and corrective measure reports, block evaluation reports, photographic reporting data sheets, design engineers' acceptance reports, deviations from design and material specifications (with justifying documentation), and as-built drawings.
C Final

The Permittee shall finalize the CMI program plan, construction plans and specifications, design reports, cost estimates, project schedule, operation and maintenance plan, study reports, CQA program plan/documentation, and the CMI report incorporating comments received on draft submissions.
## Appendix D

### Corrective Action Compliance Schedule

<table>
<thead>
<tr>
<th>Activity and Permit Conditions</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Notification of newly identified SWMU and AOC - Permit Module II.C.</td>
<td>Within 15 days of discovery.</td>
</tr>
<tr>
<td>2. Submittal of SWMU/AOC assessment report - Permit Module II.C.1.</td>
<td>Within 180 days of notification.</td>
</tr>
<tr>
<td>3. Notification of newly discovered releases at previously identified SWMUs and AOC - Permit Module II.D.</td>
<td>Within 15 days of discovery.</td>
</tr>
<tr>
<td>4. Submittal of RFI Workplan(s) for SWMUs and AOC - Permit Modules II.C.2, II.D.1. and II.E.1.a.</td>
<td>Within 120 days after receipt of notification by the NDDEQ* which SWMU and AOC require an RFI.</td>
</tr>
<tr>
<td>5. Submittal of RFI progress reports - Permit Module II.E.3.a.</td>
<td>Every 90 days, beginning 30 days from the starting date specified by the NDDEQ.</td>
</tr>
<tr>
<td>6. Submittal of draft RFI report - Permit Module II.E.3.b.</td>
<td>In accordance with the approved RFI Workplan.</td>
</tr>
<tr>
<td>7. Submittal of final RFI report – Permit Module II.E.3.b.</td>
<td>Within 60 days after receipt of NDDEQ comments on the draft RFI report.</td>
</tr>
<tr>
<td>8. Submittal of Interim Measures Workplan - Permit Module II.F.1.a.</td>
<td>Within 60 days of notification by the NDDEQ.</td>
</tr>
<tr>
<td>9. Submittal of Interim Measures Progress reports - Permit Module II.F.3.a.</td>
<td>Every 30 days, if time to complete Interim Measures exceeds 3 months.</td>
</tr>
<tr>
<td>10. Submittal of Interim Measures report - Permit Module II.F.3.b.</td>
<td>Within 60 days of completion of Interim Measures.</td>
</tr>
<tr>
<td>11. Submittal of CMS plan - Permit Module II.G.1.a.</td>
<td>Within 90 days of notification by the NDDEQ that a CMS is needed.</td>
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<tr>
<td>12. Submittal of CMS Progress Reports - Permit Module II.G.2.a.</td>
<td>Every 90 days, beginning 30 days after the start of CMS implementation.</td>
</tr>
<tr>
<td>13. Submittal of draft CMS report - Permit Module II.G.2.b.</td>
<td>In accordance with the CMS plan.</td>
</tr>
<tr>
<td>Activity and Permit Conditions</td>
<td>Due Date</td>
</tr>
<tr>
<td>-------------------------------</td>
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</tr>
<tr>
<td>14. Submittal of final CMS report - Permit Module II.G.2.b.</td>
<td>Within 60 days after receipt of NDDEQ comments on draft CMS report.</td>
</tr>
<tr>
<td>15. Submittal of CMI plan - Permit Module II.J.1.a</td>
<td>Within 90 days after receipt of NDDEQ approval of the CMS report.</td>
</tr>
<tr>
<td>16. Submittal of CMI Progress Reports - Permit Module II.J.2.a.</td>
<td>Every 90 days, 30 days after the start of CMI implementation.</td>
</tr>
<tr>
<td>17. Submittal of draft CMI report - Permit Module II.J.2.b.</td>
<td>At the completion of the construction of the project(s).</td>
</tr>
<tr>
<td>18. Submittal of final CMI report - Permit Module II.J.2.b.</td>
<td>Within 60 days of receipt of NDDEQ comments on draft CMI report.</td>
</tr>
<tr>
<td>19. Imminent Hazard report - Permit Module II.L.1. and II.L.2.</td>
<td>Oral notification within 24 hours; written notification within 15 days.</td>
</tr>
</tbody>
</table>

*NDDEQ: North Dakota Department of Environmental Quality*
Appendix E

Solid Waste Management Units and Areas of Concern
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<table>
<thead>
<tr>
<th>SWMU Designation</th>
<th>Description</th>
<th>ERP Number</th>
<th>Status</th>
<th>Regulatory Documentation</th>
</tr>
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<tr>
<td>1a</td>
<td>EOD Area – OB/OD</td>
<td>OT-03</td>
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<td>Regulatory Documentation</td>
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<td>• Tank removed 4 June 1992</td>
<td>7 May 1999</td>
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Contamination remains in place

No further action planned until impeding structures removed
<table>
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<tr>
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<th>ERP Number</th>
<th>Status</th>
<th>Regulatory Documentation</th>
</tr>
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</table>
| 4ee              | UST for Used Oil Bldg No. 585; Tank No. 2166-1 | —          | • Closed  
| 4ff              | UST for Used Oil Bldg No. 585; Tank No. 2166-2 | —          | • Closed  
| 4gg              | UST for Used Oil Bldg No. 585; Tank No. 2166 | TU500      | • Closed with Land Use Controls  
• Tank removed 2 October 1996  
• Impeding structures, asphalt, and valve pits demolished/removed in 2013  
• Minor DRO contamination remains | NDDH Decision Document 17 March 2008 |
| 4hh              | UST for Used Oil Bldg No. 585; Tank No. 2104 | TU500      | • Closed with Land Use Controls  
• Tank removed 2 October 1996  
• Impeding structures, asphalt, and valve pits demolished/removed in 2013  
• Minor DRO contamination remains | NDDH Decision Document 17 March 2008 |
| 4ii              | UST for Used Oil Bldg No. 585; Tank No. 2105 | TU500      | • Closed with Land Use Controls  
• Tank removed 2 October 1996  
• Impeding structures, asphalt, and valve pits demolished/removed in 2013  
• Minor DRO contamination remains | NDDH Decision Document 17 March 2008 |
<table>
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<th>SWMU Designation</th>
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<td>Drummed Hazardous Waste Accumulation/Collection Point; Bldg No. 748</td>
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<td>NDDH letter 13 April 2000 approved RFI recommendation of no further action</td>
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<td>Contamination under foundation remains in place</td>
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<td>7b</td>
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<td>Contamination under foundation and utilities remains in place</td>
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<td>7c</td>
<td>Oil/Water Separator Bldg 521; OWS No. —</td>
<td>—</td>
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<td></td>
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<td>OWS removed 10 June 1996</td>
<td></td>
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<td>7d</td>
<td>Part of Oil/Water Separator Bldg 758; OWS No. —</td>
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<td>OWS removed 20 May 1997</td>
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<td>Oil/Water Separator Bldg 765, OWS No. —</td>
<td>OW526</td>
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| 7g               | Oil/Water Separator Bldg 837, OWS No. 2162 | —          | • Closed with Land Use Controls  
• OWS removed 9 Dec 1998  
• Very minor contamination remains under hangar foundation | NDDH Decision Document 10 May 1999 |
| 7h               | Oil/Water Separator Bldgs 836 and 837, OWS No.2184 | OW836      | • Closed with Land Use Controls  
• OWS removed 9 Dec 1998  
• Slight amount of contamination remains | NDDH Decision Document 10 May 1999 |
| 7i               | Oil/Water Separator Bldgs 862 and 863, OWS No. 2214 | —          | • Closed with Land Use Controls  
• OWS removed 28 July 1999  
• Contamination remains in place | NDDH Decision Document 10 May 1999 |
| 7j               | Oil/Water Separator Bldgs 867 and 868; OWS No. — | OW531      | • Closed with Land Use Controls  
• OWS abandoned in place 1991  
• Contamination remains in place | NDDH Decision Document 10 May 1999 |
| 7k               | Oil/Water Separator Bldg 869; OWS No. —; Tank No. 2206 | —          | • Closed with Land Use Controls  
• OWS is out of service  
• Contamination remains in place | NDDH Decision Document 10 May 1999 |
| 7l               | Oil/Water Separator Bldg 870; OWS No. — | —          | • Closed  
• OWS removed 1 Nov 1995 | NDDH Decision Document 10 May 1999 |
| 7m               | Oil/Water Separator Bldg 970; OWS No. — | —          | • Closed with Land Use Controls  
• OWS removed 22 March 1999  
• Contamination remains in place | NDDH Decision Document 10 May 1999 |
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| 7n               | Oil/Water Separator Bldg 1135; OWS No. — | —          | • Closed  
• OWS removed 13 May 1997 | NDDH Decision Document 10 May 1999 |
| 7o               | Oil/Water Separator Bldg 1144; OWS No. — | —          | • Closed  
• OWS removed 19 May 1997 | NDDH Decision Document 10 May 1999 |
| 7p               | Oil/Water Separator Bldg 2035; OWS No. — | —          | • Closed  
• OWS removed 27 May 1992 | NDDH Decision Document 10 May 1999 |
| 7q               | Oil/Water Separator Bldg 2038; OWS No. —; Tank No. 2213 | OW545      | • OWS removed 5 Dec 1998  
• Previously closed; but other site contamination subsequently discovered  
• Air Force planning second RI/FS | NDDH Decision Document 10 May 1999  
Addendum April 2018 |
| 7r               | Oil/Water Separator Bldg 2196; OWS No. — | —          | • Closed  
• OWS used as holding chamber | NDDH Decision Document 10 May 1999 |
| 7s               | Oil/Water Separator Bldg 2221; OWS No. —; Tank No. 2143 | —          | • Closed  
• OWS removed 12 May 1992  
• Included in SWMU 2 | NDDH Decision Document 10 May 1999 |
| 7t               | Oil Interceptor Bldg No. 418 | SS-09      | • Closed  
• Included under SWMU 3 long term monitoring  
• Contamination now below regulatory and risk-based levels | NDDH Decision Document 10 May 1999 |
<table>
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<tr>
<th>SWMU Designation</th>
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<td>Oil Interceptor Bldg No. 995</td>
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<td>Closed—No further action Oil-interceptor removed Contamination remains in place under building</td>
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<td>7aa</td>
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<td>NDDH Decision Document 10 May 1999</td>
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<td>8</td>
<td>Former Sanitary Landfill Area</td>
<td>LF-02</td>
<td>• Long Term Monitoring</td>
<td>NDDH Decision Document</td>
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<td></td>
<td></td>
<td></td>
<td>• Monitored Natural Attenuation</td>
<td>11 May 1995 Approves Long Term Monitoring</td>
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<td></td>
<td></td>
<td></td>
<td>• Biennial sampling</td>
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<td>• Perpetuity site</td>
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## Areas of Concern

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<tr>
<td>A</td>
<td>Transient Parking Apron</td>
<td>AOC A</td>
<td>Closed—No further action required</td>
<td>NDDH Letter 13 April 2000</td>
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<tr>
<td>B</td>
<td>Mass Parking Apron/Former Pumphouse Buildings 1072, 1074, and 1076</td>
<td>TU502</td>
<td>Formerly closed with internal controls and no further action required until parking apron is removed or soil is excavated  Mass Parking Apron repair project including concrete removal initiated April 2017</td>
<td>NDDH Decision Document 21 December 2007</td>
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<tr>
<td></td>
<td></td>
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<td>Contamination remains in place</td>
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</table>
**Acronyms**

AOC – Area of Concern
CMI – Corrective Measure Implementation
EOD – Explosive Ordnance Disposal
ERP – Environmental Restoration Program (formerly IRP – Installation Restoration Program)
IC – Institutional Control
LTM – Long Term Monitoring
LUC – Land Use Control
MNA – Monitored Natural Attenuation
NDDH – North Dakota Department of Health*
NFA – No Further Action
OB/OD – Open Burn/Open Detonation
POL – Petroleum, Oil, Lubricants
RFI – Remedial Field Investigation
SWMU – Solid Waste Management Unit

*As of April 2019, the North Dakota Department of Environmental Quality (NDDEQ)*
Appendix F
Approved Remedies for Specific SWMUs & AOC
Closure Documentation

SWMU 1a & 1b

EOD OB/OD & Past Burial Sites

ERP Site OT-03
MEMORANDUM FOR North Dakota Department of Health
Division of Waste Management
Environmental Health Section
Attn: Neil M. Knatterud, Director
1200 Missouri Avenue
P.O. Box 5520
Bismarck ND 58506-5520

FROM: 5 CES/CEV
320 Peacekeeper Place
Minot AFB ND 58705-5006

SUBJECT: Closure of Solid Waste Management Units (SWMU) 1a and 1b, Minot
AFB's Hazardous Waste Permit #HW-021

1. Reference your letter dated 18 March 1998, subject as shown above.

2. Minot AFB has completed all activities associated with closure of the Explosive
Ordnance Disposal Area (SWMUs 1a and 1b).

3. Attached are the requested certification of clearance by Air Force Explosive Ordnance
Disposal (EOD) personnel and certification of closure.

4. Since Minot AFB does not intend to continue permitting activity for a new explosive
ordnance disposal area, we hereby withdraw our miscellaneous unit treatment permit
application.

5. Questions concerning this matter should be directed to Mr. Mark Welch at
(701) 723-4824.

KEVIN P. NELSON, GM-14, P.E.
Deputy Base Civil Engineer

Global Power for America
Decision Document

SWMU 2

Fire Protection Training Area

ERP Site FT-01
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1.0 Site and Location
   1.1 Minot Air Force Base, North Dakota
   1.2 SWMU 2, ERP Site FT-01

2.0 Statement of Basis
   2.1 The decision described herein concerning the remedial alternative (RA) at the Fire Protection Training Area (FPTA) is based on an evaluation of the results received from the investigations performed under the US Air Force Installation Restoration Program (IRP). Documented studies include Phase I Records Search performed by Reynolds, Smith and Hill (December 1984); the Phase II, Stage I Site Investigation performed by Fred C. Hart Associates, Inc. (October 1988), Stage II, Remedial Investigation/Feasibility Study performed by EA Engineering, Science, and Technology, Inc. (July 1991), and the Pre-Design Investigation Report performed by the US Army Corps of Engineers, Omaha District (March 1995).

3.0 Description of the Selected Remedy
   3.1 Contaminated soil is to be excavated from the site, stockpiled, transported, and treated on a newly constructed land treatment unit. Land treatment includes amending the soil to optimum conditions for biological degradation of contaminants. Steps will be taken by the contractor to regulate soil pH, nitrogen, phosphorus, and oxygen levels. Due to the limited area available adjacent to the site, the soil will be land treated in seven batches and placed in 12" lifts on the land treatment unit. Stormwater dewatering is expected, both for the excavated areas until they can be backfilled and from the land treatment unit itself. Infiltration of water is expected in the excavation due to the elevation of the perched water table, which is highly variable across the site and with seasonal and yearly considerations. Contaminated water encountered will be run through the oil/water separator at Building 970 and discharged to the sanitary sewer. Land treatment is the preferred remedial alternative for this site.

4.0 Declaration of Consistency with CERLCA and NCP
   4.1 This document presents the selected remedy for this site, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of the 1986 National Contingency Plan (NCP), and the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. It has been determined that land treatment is the most effective way of remediating the site.

5.0 Site Identification
   5.1 Minot AFB (MAFB) is located approximately 12 miles north of Minot, North Dakota, in Ward County, as shown in Figure 1-1. Prior to 1955, the property comprising MAFB was farmland. The government purchased the land in 1955, and construction began approximately two years later. The main base area encompasses approximately 4,636 acres. The land use adjacent to the base is predominately agricultural.
5.2 The FPTA is located in the west central portion of MAFB property, north of the base runway. The FPTA served as a contaminated fuels and lubricant disposal point for many years. The burn pit was equipped with a drain line which allowed liquids poured into the pit to enter into a nearby drainage ditch through an oil/water separator. Fuels entering the ditch soaked into the ditch bottom or were transported off site by rainwater runoff. Oil lagoons used as contaminated fuel and lubricant disposal points were located near the burn pit. The lagoons were used for oil disposal from early 1960 to 1972, when the 5,000-gallon underground storage tank was installed to store the used oil. Approximately 2,000 gallons of JP-4 fuel was burned each month in training operations. The FPTA was originally closed the summer of 1990. A project, “Restore Fire Protection Training Area,” was opened for bids in 1991. The contractor removed and disposed of a 6,000 gallon draft (water) underground storage tank (UST), a 5,000 gallon used oil UST, an oil/water separator, underground piping, the aircraft mock-up, a smoke training building and related items. The contractor also excavated and landfarmed on site approximately 2,600 yd$^3$ of contaminated soil from the oil/water separator excavation and the UST excavation. The contractor completed this work in 1992. This soil is currently serving as a cap over the FPTA.

5.3 A site investigation was completed in December 1992 at the FPTA; three additional monitoring wells were installed during this investigation. Please reference Figure 1-2a for the location of newly installed wells designated as FW-6, FW-7 and FW-8.

5.4 The US Army Corps of Engineers, Omaha District, was given authority to begin design on project QJVF957004, Remedial Design/Remedial Action of FPTA, in 1994.

5.5 US Army Corps of Engineers, Omaha District, completed a site investigation of the FPTA in December 1994 and submitted a Draft Pre-Design Investigation Report in March 1995.

5.6 US Army Corps of Engineers completed the design on a project to close the FPTA in May 1995.

6.0 Physiography

6.1 MAFB is located within the Central Recharge Area, a 1,333 square mile, nearly flat expanse of glacial ground moraine. The Central Recharge Area is mantled by several hundred feet of glacial drift. The ground surface slopes gently toward the northeast and contains thousands of small, poorly draining prairie potholes (Pettyjohn and Hutchinson 1971).

6.2 Imported vegetation and pavements have displaced the natural land surface and most native plant species on Minot AFB. Nonnative species such as barnyard grass, downy brome, green foxtail, and crested wheatgrass occur throughout the base. Spruce, green ash, Russian olive, and juniper trees have been planted to provide landscaping and windbreaks.

7.0 Climate

7.1 The region has a subhumid to semiarid climate typical of the Northern Great Plains. Winters tend to be dry and very cold. Short, heavy summer thunderstorms and long droughts are common.

7.2 The Rocky Mountains to the far west effectively limit the modifying influences of maritime air masses from the Pacific Ocean. Northwesterly winds prevail throughout the year. Winds have an annual average velocity of slightly more than 10 miles per hour (mph), although on occasion, winds sustain a velocity in excess of 75 mph. Average annual precipitation is about 17.2 inches, with large variations in precipitation from year to year. During 1993, a wet year,
8.66 inches of rainfall was recorded during the month of July, with the annual total approximately 23 inches.

7.3 The average January temperature is 7°F, but winter readings have been recorded -40°F. The mean July temperature is 70°F, but occasionally temperature exceed 100°F. The average annual temperature for a 54-year recording period in the Minot area is 40°F.

8.0 Adjacent Land Uses

8.1 MAFB is located in the Northern Great Plains native grassland (e.g. Blue grama and western wheat grass). Most of the area surrounding the base has been converted to agriculture (EA Engineering 1990).

9.0 Surrounding Population

9.1 MAFB is located approximately 50 miles south of Canada, in the north-central portion of North Dakota. Daytime base population is approximately 11,500, including dependents, military, and civilian personnel. About 8,500 people are permanent base residents, including approximately 4,900 dependents. MAFB has 2,459 housing units in a residential area supported by three schools and one day-care center.

10.0 General Hydrology

10.1 MAFB is located within the Souris River drainage system. The base is approximately 13 miles upstream from this major river. MAFB is located within the Egg Creek drainage basin, which is an intermittent tributary basin of the Souris River. Egg Creek drains eastward about 30 miles to North Lake, which in turn drains north to the Souris River via Cut Bank Creek. Because Egg Creek is an intermittent Class III Stream, North Dakota’s least stringent surfacewater-quality standards apply (EA Engineering 1990). No area of MAFB is located in a designated floodplain, although ponding does occur in natural potholes on the base.

10.2 Regional surface drainage is controlled by the Souris River, which originates in Saskatchewan, Canada. The Souris River enters North Dakota flowing generally southeast. About 30 miles southeast of MAFB, it loops northeast, then north where it reenters Canada through Manitoba, eventually discharging into Hudson Bay. Flow is regulated by a U.S./Canada joint commission. Area runoff is sparse. The Souris River has one perennial tributary in North Dakota, the Des Lacs River (State of North Dakota 1984).

10.3 The Souris River is a Class IA stream. Its waters are suitable for domestic supply after conventional treatment and softening. The Des Lacs River is a Class II stream. Its waters are suitable for domestic supply after advanced treatment.

10.4 Deposits of outwash sands and gravels form very productive aquifers along the major river valleys (Winter et al. 1984) such as the Minot and Sundre buried channel aquifers occurring near the town of Minot. Typical aquifer thickness is less than 100 feet.

10.5 Several sedimentary bedrock aquifers, such as the Fort Union and Fox Hills-Hell Creek aquifers of Tertiary age, underlie the Minot area below the glacial deposits at depths usually greater than 200 feet. These aquifers are relatively productive, but their poor water quality limits their use to livestock watering and domestic consumption only in areas where no other source is available (Winter et al. 1984).

11.0 Geology
11.1 MAFB is situated upon a laterally, and vertically extensive ground moraine plain. The ground moraine is a glacial sediment composed almost entirely of till. The till is characterized as an unstratified deposit of sediment with a particle size ranging from clay to boulders. However, clay and silt size particles account for the largest percentage of the sediment volume sample. The completed boring program confirmed that this till extends to a depth of at least 100 feet beneath MAFB. Deeper borings completed in the vicinity of MAFB indicate the till extends to depths ranging from 140 to 180 feet. Below that depth, the Paleozoic bedrock surface is encountered. Quaternary glacial sediments rest unconformably upon an irregular Paleozoic bedrock surface.

11.2 The only type of deposit other than till present within the glacial sediments is a minor occurrence of glacial sand and gravel. A review of available literature and the completed borings indicate that these sand and gravel deposits are discontinuous, lenticular, and contain a variety of sediment types. These sand and gravel deposits account for less than 5% of the total volume of the first 100 feet of glacial sediments. Generally, the sand and gravel deposits are scattered throughout the till.

11.3 The ground moraine plain beneath MAFB is part of what is referred to in the literature as the Central Recharge Area. The term recharge refers to the process in which water, emanating from precipitation, enters water-bearing units.

11.4 The results of geotechnical sampling completed during investigations at MAFB indicated the permeability of the glacial till to be approximately in the range of $10^{-6}$ to $10^{-8}$ cm/sec, which, in relative terms, is very low. This range is commensurate with the permeability values of glacial till reported in the literature. By use of this information and other information obtained during other on base investigations, it was determined that the rate of movement of water downward through this glacial till is in the range of a few centimeters to a few feet per year.

12.0 Public Community and Regulatory Agencies

12.1 An Administrative Record (AR) is the legal record of the physical situation at an installation by which response actions are reviewed and defended. An AR must be established at each installation which has conducted or is conducting IRP activities and must be available to the public at or near the installation. This record is maintained at the following location and is updated as needed by the base Remedial Project Manager.

5 CES/CEV
320 Peacekeeper Place
Minot AFB, ND 58705-5006

12.2 An Information Repository (IR) is a project file on IRP activities at AF installations. The repository is to be established for all remedial action sites and for all sites where removal actions last longer than 120 days. It is located either on or off base at a place convenient to the community and contains site information, investigatory reports, information about the sources and nature of the contaminants, and a schedule for cleanup operations. The IR is intended to address community relations requirements and is a source of reading material for the public. This is maintained at the following location and is updated as needed by the base Remedial Project Manager.

Minot State University Library
500 University West
Minot, ND 58703
13.1 A Technical Review Committee (TRC) was established at Minot AFB Apr 92 to review and comment on Department of Defense actions and proposed actions with respect to releases or threatened releases of hazardous substances into the environment at MAFB. The TRC was also established to ensure open communication and exchange of ideas with the general public about the MAFB IRP and CERCLA (1980), SARA (1986), and RCRA (1976).

13.2 The primary purpose and function of the TRC was informational, specifically to foster community and interagency awareness and understanding of MAFB IRP remedial actions related to the releases or threatened releases of hazardous substances at MAFB.

13.3 The TRC was replaced by the Restoration Advisory Board (RAB) in 1994, MAFB first meeting was held 8 Feb 95 with quarterly meetings thereafter. The RAB is an advisory body designed to act as a focal point for the exchange of information between MAFB and the local community regarding restoration activities.

14.0 ALTERNATIVE 1 – NO ACTION

14.1 No-action Alternative is included as a baseline against which all remedial action alternatives are compared. The No-action Alternative does not include provisions for long-term monitoring or institutional site controls.

14.2 Overall Protection of Human Health and the Environment. This alternative provides poor overall protection of human health and the environment because the contaminant levels are not reduced. No provision is made for monitoring to evaluate changes in conditions.

14.3 Long Term Effectiveness and Permanence. The No-action Alternative does not provide long term effectiveness and permanence. The groundwater remains as defined in the remedial investigations.

14.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. The No-action Alternative does not reduce the toxicity, mobility, or volume of groundwater contaminants in the site plume.

14.5 Short-term Effectiveness. There are no short-term effects to consider for this alternative since no remedial actions are taken.

14.6 Implementability. This alternative can be easily implemented.

15.0 ALTERNATIVE 2 – LIMITED ACTION

15.1 Actions potentially applicable to the limited action response include long-term monitoring, institutional controls, and natural attenuation with monitoring.

15.2 Long-term monitoring includes collecting and analyzing groundwater samples to track contaminant distribution and concentration. Considering the potential for groundwater flow in multiple directions, a perimeter of monitoring wells would be established using existing well locations, augmented by additional wells. Considering the relatively impermeable soils and low potential risk, sampling and laboratory analysis of this alternative could maybe be conducted annually for volatile organic compounds and total petroleum hydrocarbons.

15.3 With this alternative, the USAF would maintain long-term ownership of the site and take responsibility for restricting access to the site and the contaminated soil and groundwater.
If Minot AFB were closed, future restrictions could include deed disclosures, groundwater use planning, and continued monitoring.

15.4 **Overall Protection of Human Health and the Environment.** The Limited-action Alternative provides protection of human health and the environment given that risk is associated with the future use of the site and groundwater. Provisions are made for monitoring of contaminant distribution and concentrations to evaluate changes in site conditions. If contaminants migrate before natural attenuation occurs, a warning or mitigation plan can be implemented.

15.5 **Long Term Effectiveness and Permanence.** Based on risk assessment, the Limited-action Alternative provides long-term effectiveness and permanence. Although groundwater contamination remains as defined in the remedial investigation, this alternative prevents the future use of groundwater for potable purposes.

15.6 **Reduction of Toxicity, Mobility, or Volume Through Treatment.** The Limited-action Alternative provides for the reduction of toxicity by natural attenuation, but does not reduce mobility or volume of soil and groundwater contaminants in the site plume.

15.7 **Short-term Effectiveness.** There are no short-term effects to consider for this alternative since contaminants are not contained and concentrations are not reduced.

15.8 **Implementability.** This alternative can be easily implemented.

16.0 **ALTERNATIVE 3 – EX-SITU AIR STRIPPING; UV/H₂O, GAC (VAPOR)**

16.1 **Overall Protection of Human Health and the Environment.** This Remedial Alternative provides protection of human health and the environment through recovery of contaminated groundwater and subsequent destruction of the contaminants. This alternative provides a short-term and long-term solution to contaminant mitigation by removing these constituents from groundwater. In addition, minimal residuals requiring disposal are generated by this alternative.

16.2 **Long Term Effectiveness and Permanence.** With this alternative contaminated groundwater is extracted from the aquifer for aboveground treatment. Extraction is accomplished using an array of extraction wells. It should be noted that silty and clayey soils with low hydraulic conductivity may significantly inhibit yields to wells, and therefore limit the effectiveness of this alternative. The use of ultra-violet (UV) radiation/oxidation to treat the recovered groundwater is a permanent solution to the existing problem. Implementation of this alternative would provide long-term remediation of the groundwater by destroying contaminants of concern. The reliability of this alternative has been demonstrated, but the technology does not have a long history of successful implementation.

16.3 **Reduction of Toxicity, Mobility, or Volume Through Treatment.** Groundwater recovery and subsequent treatment via UV radiation/oxidation would permanently and significantly reduce the toxicity of contaminated groundwater. Based on application at similar sites, this technology is capable of destroying 99 percent of volatile organic compounds in treated effluent (EPA 1991).

16.4 **Short-term Effectiveness.** Implementation of this alternative involves installation and development of groundwater extraction wells, installation of a piping network to transport the recovered groundwater to the treatment system, and installation of a UV radiation/oxidation system. The installation of extraction wells would be completed using conventional techniques. No adverse impact to the community, workers, or the environment would result during the site preparation (e.g., grading of area) or installation of the treatment system.
Engineering controls, such as dust suppression, would be employed to mitigate off-site migration of dust, if necessary. The time required for treatment using this alternative will be driven by the time required to recover the contaminated groundwater.

16.5 **Implementability.** The technologies that constitute this alternative employ conventional and commercially available materials and equipment. The technologies have been demonstrated successfully, but have not been have a long history of application at sites with similar conditions. At this time, operations and maintenance for the groundwater recovery and treatment system are expected to include periodic monitoring of the effluent water stream, equipment maintenance (e.g., chemical feed systems, UV light replacement, and the scrubber carbon replacement), replacement of chemicals (e.g., hydrogen peroxide, pH adjustment chemicals), and stack testing.

16.6 The use of extraction wells and treatment of recovered groundwater via UV radiation/oxidation provides flexibility in expanding the system to include additional remedial actions (e.g., incorporation of additional extraction wells). These units are significantly dependent on UV radiation to promote contaminant reduction and, therefore, proper sizing is critical to successful implementation.

16.7 The commercial availability of services is limited to Ultrox International and, therefore, competitive bidding for this system will not be possible. Similar systems exist, such as the UV light ozone generators and hydrogen peroxide treatment system. These units are commercially available and delays in procurement are not anticipated.

17.0 ALTERNATIVE 4 – IN SITU BIOREMEDICATION

17.1 Bioremediation techniques are destruction techniques directed towards stimulating the microorganisms to grow and use the contaminants as a food and energy source by creating a favorable environment for microorganisms. Generally, this means providing some combinations of oxygen, nutrients, moisture, and controlling the temperature and pH. The In Situ Bioremediation of soil typically involves the percolation or injection of groundwater or uncontaminated water mixed with nutrients and saturated with dissolved oxygen.

17.2 The main advantage of the In Situ process is that is allows soils to be treated without being excavated and transported, resulting in less disturbance of the site. Also, both contaminated groundwater and soil can be treated simultaneously. Remediation times are often years, depending mainly on the degradation rates of contaminants, site characteristics, and climate.

17.3 **Overall Protection of Human Health and the Environment.** Bioremediation is capable of transforming contaminants into nonhazardous substances. Bioremediation operates at low air flow rates that provide only the amount of oxygen necessary for biodegradation while minimizing volatilization and release of contaminants into the atmosphere. There are also no contaminated effluents to complete exposure pathways and create additional environmental damage.

17.4 **Long Term Effectiveness and Permanence.** Bioremediation is capable of transforming contaminants into nonhazardous substances, therefore, making it very permanent.

17.5 **Reduction of Toxicity, Mobility, or Volume Through Treatment.** In Situ Bioremediation reduces the toxicity, mobility, and volume of contaminants by transforming them into nonhazardous substances. Bioremediation is also able to biodegrade the nonvolatile organics that other vapor extraction technologies utilizing volatilization cannot address.
Bioremediation also minimizes the risks of volatilization of contaminants into the atmosphere.

17.6 **Short-term Effectiveness.** In Situ Bioremediation is not a short term remediation technique.

17.7 **Implementability.** Very fine grained soils, such as silt or clay, are impermeable, making it difficult to transport nutrients into the matrix. For effective bioremediation, the permeability limit is generally considered to be a hydraulic conductivity of $10^{-4}$ cm/sec. Therefore, bioremediation did not appear to be a viable option.

18.0 **ALTERNATIVE 4 – LAND TREATMENT**

18.1 Land treatment is a full-scale bioremediation technology in which contaminated soils or sludges are applied to a specifically prepared surface and periodically turned over or tilled into the soil to aerate waste. Soil conditions are often controlled to optimize the rate of contaminant degradation. Conditions normally controlled include: moisture content, oxygen level (by mixing the soil by tilling), nutrients (primarily oxygen and phosphorous), pH, and soil bulking (by adding soil amendments).

18.2 **Overall Protection of Human Health and the Environment.** Land treatment of the soil will not create any long-term adverse health effects; however, it will create temporary exposure pathways (i.e. dermal, inhalation and ingestion) during the remediation process. Therefore, workers on site during remedial procedures would be required to don the appropriate personal protective equipment and comply with a site safety and health plan.

18.3 **Long Term Effectiveness and Permanence.** Land treatment of contaminated soils is effective and permanent for remediating contaminated soils, because the contamination will remain on site while being remediated.

18.4 **Reduction of Toxicity, Mobility, or Volume Through Treatment.** Land treatment of the contaminated soils reduces toxicity, mobility, and volume of contaminated soil at the site.

18.5 **Short-term Effectiveness.** Land treatment of the contaminated soil would be the most effective short-term remediation method.

18.6 **Implementability.** Based on the soil types, the contaminant characteristics, the remoteness of the site, relatively low cost, no long-term management of the site besides long-term monitoring of the monitoring wells, and ease of implementation, land treatment is considered to be the most effective method of remediation.

19.0 **CONSISTENCY WITH ENVIRONMENTAL LAWS**

19.1 This section discusses compliance of each of the five remediation alternatives with applicable and relevant and appropriate regulations (ARARs). Applicable requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. Relevant and appropriate requirements address problems or situations sufficiently similar to those encountered at the site and that their use is well suited to the environmental and technical factors at a particular site.

19.2 **No Action.** A no-action alternative does not serve to remediate a known contaminated site and does not comply with ARARs. This alternative is therefore, not acceptable.
19.3 **Limited-action.** There are not location-specific ARARs applicable under the Limited-action Alternative. With action-specific ARARs, the Limited-action Alternative would meet ARARs for construction and abandonment of groundwater monitoring wells. The chemical-specific North Dakota and federal ARARs for the contaminants of concern in drinking water could maybe not be achieved by natural attenuation. However, groundwater is not used and would be considered nonpotable.

19.4 **Ex-Situ Air Stripping.** Compliance with chemical-specific ARARs would be achieved using UV/chemical oxidation. Each of the contaminants of concern present in the groundwater could more than likely be treated to achieve North Dakota and/or federal cleanup standards.

19.5 **In Situ Bioremediation.** Bioremediation would have to comply with the regulations in the Clean Air Act (40 CFR Part 50) and Article 33-15 of the North Dakota Administrative Code (NDAC).

19.6 **Land Treatment.** Land treatment may require the control of fugitive dust and emissions, as outlined in the Clean Air Act (40 CFR Part 50) and in the NDAC.

20.0 **SCREENING OF ALTERNATIVES.** Screening of the list of alternatives discussed is based on site soil conditions, contaminant concentration and characteristics, feasibility of given technologies, and overall exposure and risk to human health and the environment at the FPTA.

20.1 **No Action.** This alternative is generally applicable to those sites where contaminant levels are very low or where exposure pathways are controlled or limited. A no-action decision is unacceptable because the site’s soil and groundwater are contaminated with petroleum products.

20.2 **Limited-action.** Groundwater monitoring would determine if migration off-site could be a problem, and if it was, preventative action could be implemented. This alternative provides for the reduction of toxicity by natural attenuation, but does not reduce mobility or volume of groundwater contaminants in the plume.

20.3 **Bioremediation/Air Stripping.** Soil permeability can be a major controlling factor with a number of remedial alternatives. In particular, bioremediation and air stripping are dependent on movement of water and soil vapor through the soil matrix. Typically, glacial till soils have relatively low permeabilities; soils at the FPTA have permeabilities in the range of $10^{-6}$ to $10^{-8}$ cm/sec. Therefore, these alternatives would not be technically applicable to the site based on permeability requirements alone.

20.3.1 Depth to groundwater and the ability to develop a reverse gradient of contaminant plume dispersion are important to in-situ bioremediation or ex-situ air stripping. Control of dispersion of contamination within the saturation zone and on the water table, in the case of liquid-phase contamination, is practical only where drawdown wells can pump enough volume to control groundwater movement. The groundwater affected by operation at the FPTA is perched water within the glacial till and shallow pumping wells could not be developed. Pumping the deeper bedrock aquifers in the area, though potentially recharged through the glacial till, would not result in removal of contaminants in the soils or shallow aquifer without extensive pumping and recharge over a very long period of time. Based on these hydrological conditions, these options appear to be inapplicable at the FPTA.

20.4 **Land Treatment.** The land treatment alternative has been chosen because it should be considerably cheaper than bioremediation or air stripping, we are confident it will work, and then contaminant concentrations should be reduced to acceptable levels. The operation
and maintenance period should also be significantly shorter than with the other alternatives discussed, excluding the No-action Alternative.

21.0 COORDINATION WITH REGULATORY AGENCIES

21.1 Reports published in connection with this investigation were completed and submitted to lead agencies for review and comments. Agencies include the EPA Region VIII, Denver, Colorado; and the North Dakota Department of Health (NDDH), the lead regulatory agency.

22.0 CONCLUSION

22.1 The alternative described will provide overall protection to human health and the environment by preventing exposure to the contaminants by remediating the contaminants through a land treatment process. This alternative will reduce the toxicity, mobility, and volume of the contaminants by removing them. This will provide a long-term solution to the problem and be relatively easy to implement at a reasonable cost. The NDDH and the community are likely to accept this alternative based on the facts described in this decision document.
Decision Document

SWMU 3

POL Area

ERP Site SS-09
0.0 Site and Location

0.1 Minot Air Force Base, North Dakota

0.2 SWMU 3, ERP Site SS-09

1.0 Statement of Basis

1.1 This Decision Document has been prepared according to the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (U.S. Environmental Protection Agency 1988), and according to format and content requirements of Handbook to Support the Installation Restoration Program (IRP) Statement of Work, (U.S. Air Force 1993). Previous reports published in connection with this investigation were completed and submitted to agencies for review and comments. Agencies included the EPA Region VIII, Denver, Colorado; and the North Dakota Department of Health (NDDH), the lead regulatory agency. Reports include the Geoprobe Survey Informal Technical Information Report (ITIR), Sampling and Analysis Plan, and the Work Plan (U.S. Air Force 1993a, b, c). Final investigative conclusions and recommendations were presented in the Remedial Investigation/Feasibility Study (RI/FS) Final Technical Report (U.S. Air Force 1994b). This Decision Document summarizes final analytical test results and interpretations used to develop and appropriate remedial action plan for contamination at the POL Storage Area (SS-09).

2.0 Remedy Selection

2.1 Considering the risk assessment findings and cost estimates for remedial action alternatives, the “Limited Action” general response is appropriate for the POL Storage Area.

2.2 The Limited Action response will include biennial groundwater sampling and laboratory analysis for benzene, toluene, ethylbenzene, and xylenes (BTEX), as well as diesel range organics (DRO) to monitor the effectiveness of natural attenuation.

3.0 Declaration of Consistency with CERLCA and NCP

3.1 This document presents the selected remedy for these sites developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, National Contingency Plan (NCP), and the Resource Conservation and Recovery Act (RCRA) of 1976, as amended.

4.0 Site Identification

4.1 Minot AFB (MAFB) is located approximately 12 miles north of Minot, North Dakota, in Ward County, as shown in Figure 1-1. Prior to 1955, the property comprising MAFB was farmland. The government purchased the land in 1955, and construction began approximately two years later. The main base area encompasses approximately 4,636 acres. The land use adjacent to the base is predominantly agricultural.
MINOT AIR FORCE BASE
NORTH DAKOTA

RCRA PERMIT APPLICATION

Site Vicinity Map
Including Minot AFB
North Dakota

Figure 1-1

United States Air Force
Minot AFB
4.2 The POL Storage Area is located in the south-central portion of the base. The facility receives and distributes fuel through a pumping station, a manifolded underground piping and valve system, four aboveground storage tanks (ASTs), and previously, seven underground storage tanks (USTs). Three of these USTs which stored used fuels and oils, have been removed. The site includes a vacant field northeast of the storage area where an estimated 15,000 gallons of jet fuel was spilled on the ground in 1982. A storage tank inventory, including location, current status, size, and contents of all storage tanks, is included in Table 1.

4.3 On April 3, 1982, ten to 20 loaded railcar tankers arrived at the fuel off-loading spur adjacent to the POL storage area. These tankers were filled with JP-4 when temperatures were 45°F. Over the next few days, daytime temperatures increased to 90°F, causing the expanding fuel to overflow onto the tracks. The jet fuel overflowed from the railroad tankers and was at track level (about three inches deep). Because of the fuel’s dangerously low flash point, emergency response crews applied water to lower the temperature. The remaining high level fuel was offloaded from the railcars using pump trucks.

Emergency personnel at the POL storage area calculated that about 15,000 gallons of JP-4 had been lost. Fire crews used water to disperse the fuel. The remaining, unretrievable JP-4 was washed from the tracks into the vacant lot southeast of the central heating plant. The fuel/water mixture was left to evaporate and soak into the ground.

In 1990, excavation workers detected strong hydrocarbon odors during trenching operations along Trainer Trail and immediately informed Environment Engineering. Environment Engineering notified the NDDH, who requested an environmental investigation. The Air Force and subcontractors installed six monitoring wells (OW-1 through OW-6). Monitoring Well OW-1 was reported to have collected free-floating product on the groundwater surface. The Air Force then contracted with Twin City Testing Corporation to investigate the site conditions. Twin City drilled 25 soil borings and installed five additional monitoring wells (MW-1 through MW-5) during 1990 and 1991.

Table 1
Storage Tank Inventory – POL Storage Yard

<table>
<thead>
<tr>
<th>Designation</th>
<th>Location</th>
<th>Status</th>
<th>Size</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST, Steel</td>
<td>Structure 1961</td>
<td>Active</td>
<td>30,000 bbl</td>
<td>JP-8</td>
</tr>
<tr>
<td>AST, Steel</td>
<td>Structure 1964</td>
<td>Active</td>
<td>20,000 bbl</td>
<td>JP-8</td>
</tr>
<tr>
<td>AST, Steel</td>
<td>Structure 1963</td>
<td>Active</td>
<td>5,000 bbl</td>
<td>JP-8</td>
</tr>
<tr>
<td>AST, Steel</td>
<td>Structure 1963</td>
<td>Active</td>
<td>5,000 bbl</td>
<td>JP-8</td>
</tr>
<tr>
<td>AST, Steel</td>
<td>West of Bldg 407</td>
<td>Active</td>
<td>25,000 gal</td>
<td>Deicing Fluid (Ethylene Glycol)</td>
</tr>
<tr>
<td>UST, Steel</td>
<td>East of Bldg 407</td>
<td>Active</td>
<td>50,000 gal</td>
<td>Avgas</td>
</tr>
<tr>
<td>UST, Steel</td>
<td>East of Bldg 407</td>
<td>Active</td>
<td>16,500 gal</td>
<td>Gasoline (until 1993)/Diesel</td>
</tr>
<tr>
<td>UST, Steel</td>
<td>West of Bldg 407</td>
<td>Active</td>
<td>2,000 gal</td>
<td>Waste Tank</td>
</tr>
<tr>
<td>UST, Steel</td>
<td>South of AST 1964</td>
<td>Active</td>
<td>15,000 gal</td>
<td>Diesel</td>
</tr>
<tr>
<td>UST, Steel</td>
<td>South of AST 1964</td>
<td>Active</td>
<td>1,500 gal</td>
<td>Used Oil</td>
</tr>
<tr>
<td>UST, Steel</td>
<td>South of AST 1964</td>
<td>Active</td>
<td>1,500 gal</td>
<td>Used Oil</td>
</tr>
<tr>
<td>UST, Steel</td>
<td>South of AST 1964</td>
<td>Active</td>
<td>8,000 gal</td>
<td>Used Oil</td>
</tr>
</tbody>
</table>

Notes: AST = Aboveground Storage Tank  
UST = Underground Storage Tank  
Bbl = Barrels (42 gallons/barrel)  
Gal = gallon
- All JP-8 tanks contained JP-4 until November/December 1994 - The used oil USTs were removed in the summer of 1991

5.0 Physiography

5.1 MAFB is located within the Central Recharge Area, a 1,333 square mile, nearly flat expanse of glacial ground moraine. The Central Recharge Area is mantled by several hundred feet of glacial drift. The ground surface slopes gently toward the northeast and contains thousands of small, poorly draining prairie potholes (Pettyjohn and Hutchinson 1971).

5.2 Imported vegetation and pavements have displaced the natural land surface and most native plant species on Minot AFB. Nonnative species such as barnyard grass, downy brome, green foxtail, and crested wheatgrass occur throughout the base. Spruce, green ash, Russian olive, and juniper trees have been planted to provide landscaping and windbreaks.

6.0 Adjacent Land Uses

6.1 MAFB is located in the Northern Great Plains native grassland (e.g. Blue grama and western wheat grass). Most of the area surrounding the base has been converted to agriculture (EA Engineering 1990).

7.0 Geology

7.1 MAFB is situated upon a laterally, and vertically extensive ground moraine plain. The ground moraine is a glacial sediment composed almost entirely of till. The till is characterized as an unstratified deposit of sediment with a particle size ranging from clay to boulders. However, clay and silt size particles account for the largest percentage of the sediment volume sample. The completed boring program confirmed that this till extends to a depth of at least 100 feet beneath MAFB. Deeper borings completed in the vicinity of MAFB indicate the till extends to depths ranging from 140 to 180 feet. Below that depth, the Paleozoic bedrock surface is encountered. Quaternary glacial sediments rest unconformably upon an irregular Paleozoic bedrock surface.

7.2 The only type of deposit other than till present within the glacial sediments is a minor occurrence of glacial sand and gravel. A review of available literature and the completed borings indicate that these sand and gravel deposits are discontinuous, lenticular, and contain a variety of sediment types. These sand and gravel deposits account for less than 5% of the total volume of the first 100 feet of glacial sediments. Generally, the sand and gravel deposits are scattered throughout the till.

7.3 The ground moraine plain beneath MAFB is part of what is referred to in the literature as the Central Recharge Area. The term recharge refers to the process in which water, emanating from precipitation, enters water-bearing units.

7.4 The results of geotechnical sampling completed during investigations at MAFB indicated the permeability of the glacial till to be approximately in the range of 10(-6) to 10 (-8) cm/sec, which, in relative terms, is very low. This range is commensurate with the permeability values of glacial till reported in the literature. By use of this information and other information obtained during other on base investigations, it was determined that the rate of movement of water downward through this glacial till is in the range of a few centimeters to a few feet per year.

8.0 Hydrology
8.1 MAFB is located within the Souris River drainage system. The base is many miles upstream from this major river. MAFB is located within the Egg Creek drainage basin, which is an intermittent tributary basin of the Souris River. Egg Creek drains eastward about 30 miles to North Lake, which in turn drains north to the Souris River via Cut Bank Creek. Because Egg Creek is an intermittent Class III Stream, North Dakota’s least stringent surface-water-quality standards apply (EA Engineering 1990). No area of MAFB is located in a designated floodplain, although ponding does occur in natural potholes on the base.

8.2 Regional surface drainage is controlled by the Souris River, which originates in Saskatchewan, Canada. The Souris River enters North Dakota flowing generally southeast. About 30 miles southeast of MAFB, it loops northeast, then north where it reenters Canada through Manitoba, eventually discharging into Hudson Bay. Flow is regulated by a U.S./Canada joint commission. Area runoff is sparse. The Souris River has one perennial tributary in North Dakota, the Des Lacs River (State of North Dakota 1984).

8.3 The Souris River is a Class IA stream. Its waters are suitable for domestic supply after conventional treatment and softening. The Des Lacs River is a Class II stream. Its waters are suitable for domestic supply after advanced treatment.

8.4 Deposits of outwash sands and gravels form very productive aquifers along the major river valleys (Winter et al. 1984) such as the Minot and Sundre buried channel aquifers occurring near the town of Minot. Typical aquifer thickness is less than 100 feet.

8.5 Several sedimentary bedrock aquifers, such as the Fort Union and Fox Hills-Hell Creek aquifers of Tertiary age, underlie the Minot area below the glacial deposits at depths usually greater than 200 feet. These aquifers are relatively productive, but their poor water quality limits their use to livestock watering and domestic consumption only in areas where no other source is available (Winter et al. 1984).

9.0 Surface Hydrology

9.1 Surface water drainage on the MAFB is restricted primarily to drainage ditches, pipes, and lines that drain to two ditches which flow north into Egg Creek. The western primary drainage ditch uses a glacial melt water channel to carry surface water runoff to Egg Creek. Some storm water runoff on the west end of the runway area flows west to a south flowing intermittent stream (Reynolds, 1984).

9.2 There are no perennial streams on MAFB. Surface water on the Base comes from surface runoff. Egg Creek which receives most of the surface drainage from MAFB, is designated as a Class III stream by the North Dakota Department of Health (NDDH). Class III streams are streams where the quality of water is adequate for industrial and agricultural uses such as cooling, washing, irrigation, and stock watering (NDDH, 1989).

10.0 Public Community and Regulatory Agencies

10.1 An Administrative Record (AR) is the legal record of the physical situation at an installation by which response actions are reviewed and defended. An AR must be established at each installation which has conducted or is conducting IRP activities and must be available to the public at or near the installation. This record is maintained at the following location and is updated as needed by the base Remedial Project Manager.

5 CES/CEV
320 Peacekeeper Place
Minot AFB, ND 58705-5006
10.2 An Information Repository (IR) is a project file on IRP activities at AF installations. The repository is to be established for all remedial action sites and for all sites where removal actions last longer than 120 days. It is located either on or off base at a place convenient to the community and contains site information, investigatory reports, information about the sources and nature of the contaminants, and a schedule for cleanup operations. The IR is intended to address community relations requirements and is a source of reading material for the public. This is maintained at the following location and is updated as needed by the base Remedial Project Manager.

Minot State University Library 500
University West
Minot, ND 58703

11.0 Technical Review Committees/Restoration Advisory Boards

11.1 A Technical Review Committee (TRC) was established at Minot AFB Apr 92 to review and comment on Department of Defense actions and proposed actions with respect to releases or threatened releases of hazardous substances into the environment at MAFB. The TRC was also established to ensure open communication and exchange of ideas with the general public about the MAFB IRP and CERCLA (1980), SARA (1986), and RCRA (1976).

11.2 The primary purpose and function of the TRC was informational, specifically to foster community and interagency awareness and understanding of MAFB IRP remedial actions related to the releases or threatened releases of hazardous substances at MAFB.

11.3 The TRC was replaced by the Restoration Advisory Board (RAB) in 1994, MAFB first meeting was held 8 Feb 95. The RAB is an advisory body designed to act as a focal point for the exchange of information between MAFB and the local community regarding restoration activities. RAB meetings are held every 6 months and notice of the meetings are placed in the Minot Daily News.

12.0 Selected Remedy

12.1 One remedy was selected for remediation of the contaminated media at the POL Storage Yard. The remedy of “Limited Action” includes long-term monitoring, institutional controls, and natural attenuation with monitoring.

13.0 Evaluation of Selected Remedy

13.1 An analysis of the remedy was conducted to evaluate the remedy with respect to its relative performance in meeting nine criteria. These evaluation criteria are divided into three categories and have been developed by the EPA to address the technical and policy considerations that have proven important for selecting remedies. The nine criteria are found in (40 CFR 300.430(f)(1)(i)).

13.2 Threshold Criteria
1. Overall protection of human health and the environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARAR) Primary Balancing Criteria
3. Long-Term effectiveness and permanence.
4. Reduction of toxicity, mobility, or volume (TMV)
5. Short term effectiveness
6. Implementability
7. Cost Modifying Criteria
8. State Acceptance
9. Community Acceptance

13.3 Criterion 1: Overall Protection of Human Health and the Environment

a. Protectiveness is the primary requirement that remedial actions must meet under CERCLA. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed through each pathway at the site.

b. The Limited Action remedy provides protection of human health and the environment, given that risk is associated with the future use of the site and groundwater. Provisions are made for monitoring of contaminant distribution and concentrations to evaluate changes in site conditions. If contaminants migrate before natural attenuation occurs, a warning or mitigation plan can be implemented.

13.4 Criterion 2: Compliance with ARAR

a. Compliance with ARAR is one of the statutory requirements of the remedy selection. Applicable requirements are cleanup standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. Relevant and appropriate requirements address problems or situation sufficiently similar to those encountered at the site and thus their use is well suited to the environmental and technical factors at a particular site.

b. There are no location-specific ARARs applicable under the Limited Action remedy. With action-specific ARARs, the Limited Action remedy would meet ARARs for construction and abandonment of groundwater monitoring wells. The chemical-specific North Dakota and federal ARARs for the contaminants of concern in drinking water may be achieved by natural attenuation. However, groundwater would not be used and would be considered non-potable.

13.5 Criterion 3: Long Term Effectiveness and Permanence

a. This criterion reflects CERCLA emphasis on implementing remedies that will ensure protection of human health and the environment in the long term. The assessment of remedies against this criterion evaluates the residual risks at a site after completion of a remedial action.

b. This remedy will achieve long-term effectiveness and permanence. Although groundwater contamination remains as defined in the remedial investigation, this alternative prevents the future use of groundwater for potable purposes until natural attenuation of the contaminants occurs.

13.6 Criterion 4: Reduction of Toxicity, Mobility, and Volume (TMV)

a. This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies a remedy may employ.

b. The Limited Action remedy provides for the reduction of toxicity by natural attenuation, but does not reduce mobility or volume of soil and groundwater contaminants in the site plume.
13.7 Criterion 5: Short Term Effectiveness

a. This criterion addresses short-term impacts of the remedy. The assessment against this criterion examines the effectiveness of remedies in protecting human health and the environment during the construction and implementation of a remedy.

b. There are no short-term effects to consider for this remedy since contaminants are not contained and concentrations are not reduced.

13.8 Criterion 6: Implementability

a. The assessment against this criterion evaluates the technical and administrative feasibility of the remedy and the availability of the goods and services needed to implement them.

b. This remedy is easily implemented.

13.9 Criterion 7: Cost

a. Cost encompasses all engineering, construction, and operation and maintenance costs incurred over the life of the project. The assessment against this criterion is based on the present worth of these costs for each alternative.

b. The capital cost for this alternative has been estimated at $138,205 and was prepared using 1993 dollars. The Operation and Maintenance (O&M) costs are estimated at $71,875 for a one-year period. O&M costs were calculated for a 30-year period using the present worth methods and totaled $1,030,000.

13.10 Criterion 8: State Acceptance

a. This criterion, which is an ongoing concern throughout the corrective action process, reflects the statutory requirement to provide for substantial and meaningful State involvement.

b. North Dakota Department of Health (NDDH) recognizes this remedy as an acceptable form of remedial action.

13.11 Criterion 9: Community Acceptance

a. This criterion reflects the community's apparent preferences or concerns about remedies.

b. The RAB, and IR have been the avenues in which the base has informed the community of IRP and RCRA Corrective Action activities. RAB meetings are held twice each year to update members on corrective action activity. RAB meetings, and the IR have provided an opportunity for public comment/involvement in RCRA and IRP remediation activities. A 30-day notice of a 45-day public comment period regarding the permit to be issued and incorporating this selected remedy will be given.

c. The community members have been favorable toward this remedy.

14.0 CONCLUSION
14.1 The limited action remedy will provide protection of human health and the environment. This remedy includes biennial groundwater sampling, laboratory analysis, and long-term monitoring of the natural attenuation of fuel-related petroleum hydrocarbon contaminants. This groundwater is non-potable and is not used at Minot AFB. The potential migration and natural attenuation of fuel-related contaminants in the groundwater will be monitored. This site is restricted to fuels personnel only, visitors must check in with the “Fuels Control Center” to gain access to the sites.

14.2 This remedy should provide a long-term solution to the problem and was relatively easy to implement at a reasonable cost. The NDDH and the community are likely to accept this alternative based on the facts described in this decision document.
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Addendum I

Decision Document - Remedy Modification

SWMU 3
POL Area, ERP Site SS-09
NDDH Permit HW-021

Introduction

This addendum updates the Decision Document (DD) dated May 20, 1996, for NDDH permit HW-021 at Solid Waste Management Unit (SWMU) #3, Petroleum, Oil, Lubricant (POL) Area, Environmental Restoration Program (ERP) Site SS-09 at Minot Air Force Base (MAFB). It also provides background information and justification for the proposed remedy.

Proposed Remedy Modification

The original permitted remedy for SWMU #3 (POL Area, SS-09) was a Limited Action general response to provide protection of human health and the environment, consisting of biennial groundwater sampling laboratory analysis for benzene, toluene, ethylbenzene, and xylenes (BTEX) and diesel range organics (DRO) to monitor the potential migration and natural attenuation of fuel-related contaminants in groundwater. Further development of technology has produced the means of expediting contaminant degradation, with greater potential toward site closure. Approval for consideration of alternatives to the selected remedy was received after discussion and agreement with the North Dakota Department of Health (NDDH) on 14 May 2013. The reasons for updating the remedy are presented below.

Background

The POL Area is located in the south-central portion of the base. The facility receives and distributes fuels by means of a pumping station, underground piping manifold and valve system, four ASTs, and seven historic USTs. In 1982, several rallicar tankers holding jet fuel waiting off-loading overflowed after unseasonably warm temperatures forced the fuel out of the tankers onto the rail bed. The fuel was dispersed with water to lower the temperature, minimizing the explosive hazard. Approximately 15,000 gallons of fuel mixed with water was washed onto the ground surface in a vacant field northeast of the POL Storage Area.

In 1990, excavation workers detected strong hydrocarbon odors during trenching operations. Between 1993 and 1995, remedial investigations were undertaken at SS009 to characterize the nature and extent of contamination in soil and groundwater. The original Decision Document (NDDH 1996) was signed and long-term monitoring of site groundwater monitoring wells was implemented. The frequency of monitoring has since been reduced to biennial (every two years); the number of monitoring wells to be sampled was also decreased.

The 2012 Long-Term Monitoring report confirmed that natural attenuation processes are slowly removing overall contaminant mass. Benzene was detected in samples from two monitoring wells (MW-5 and POLMWT) above the NDDH action level of 5 micrograms per liter (μg/L). TPH DRO was detected in samples from five monitoring wells (POL2D, POL2E, POLMWT, MW-4 and MW-5) above the NDDH action level of 0.5 milligrams per liter (mg/L).
Proposed Remedy

While the existing remedy did show a reduction in groundwater contaminant concentrations, new technologies have emerged since the original remedy was selected. The proposed remedy has the potential to achieve site closure sooner by accelerating remediation of the groundwater through in-situ aerobic bioremediation (ISAB) technology.

An amendment will be added to the treatment area, designed to assist in the aerobic biodegradation of hydrocarbons. The amendment will be injected into those areas remaining where groundwater exceeds the NDDH action levels for benzene and TPH-DRO.

Justification For Remedy Modification

Approval of the proposed remedy is based upon the following conclusions, derived from the advantages of advanced technology, comparison with the original remedy and in consideration of Department of the Air Force goals.

The Remedial Action Objective (RAO) for SWMU #3 (POL Area) is to remediate groundwater until it meets the NDDH action levels for benzene (5 µg/L) and TPH-DRO (0.5 mg/L). The original remedy (Limited Action including biennial groundwater sampling and laboratory analysis) has been in place since 1996 and has not yet achieved site closure. The proposed remedy (ISAB) is a more aggressive approach and will accelerate biodegradation of hydrocarbons, therefore reaching the RAOs and site closure more quickly than with the original remedy. Once the RAOs are achieved, there will be no further risk of contaminant migration, or risk to human health or the environment.

Once NDDH agree that the RAOs have been achieved, No Further Action (or Site Closure) will be required at SWMU #3 (POL Area).

[Signature]

DOUGLAS W. GILPIN, Lt Col, USAF
Commander, 5th Civil Engineer Squadron

18 Dec 13

Date
Decision Document

SWMU 4a-dd

Basewide Underground Storage Tanks
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DECISION DOCUMENT
SOLID WASTE MANAGEMENT UNITS 4a, 4b, 4d-4u, and 4w -ii
UNDERGROUND STORAGE TANKS

Original May 7, 1999
Updated March 17, 2008 for 4a, 4b, 4p, 4ee, 4ff, 4gg, 4hh, and 4ii

0.0 Site and Location

0.1 Minot Air Force Base, North Dakota

1.0 Statement of Basis

1.1 The decision described herein concerns the selected remedy (SR) at 33 Underground Storage Tanks (UST), identified as Solid Waste Management Units (SWMU) 4a, 4b, 4d-4u, and 4w-ii. These SWMUs are located at various locations throughout the installation. The decision is based on an evaluation of the results received from corrective action performed under the Resource Conservation Recovery Act (RCRA) Compliance Program and the United States Air Force Installation Restoration Program (IRP). Documented studies include the RCRA Facility Assessments of June 1989 and July 1992, Phase I RCRA Facility Investigation 1995, and Corrective Measure Implementation from 1991-1997.

2.0 Remedy Selection

2.1 A remedy was selected depending on the presence of contamination, its concentration, practical ability of remediation and risk posed. The UST were investigated and classified in one of four ways: (1) no contamination present, (2) contamination present but removed where minor amounts of contamination below regulated levels remains, (3) contamination present, site transferred to referenced corresponding SWMU or AOC, (4) contamination remains in place, where contamination is under building foundations and will be removed during building demolition.

2.2 No further action is required at any of these sites at this time. All accessible contamination has been removed.

3.0 Declaration of Consistency with CERLCA and NCP

3.1 This document presents the selected remedy for these sites developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, National Contingency Plan (NCP), and the Resource Conservation and Recovery Act (RCRA) of 1976, as amended.

4.0 Facility

4.1 Minot AFB (MAFB) is located approximately 12 miles north of Minot, North Dakota, in Ward County, as shown in Figure 1-1. Prior to 1955, the property comprising MAFB was farmland. The government purchased the land in 1955, and construction began approximately two years later. The main base area encompasses approximately 4,636 acres. The land use adjacent to the base is predominately agricultural.

4.2 Reference Table 1 for a list of the USTs removed under the RCRA Corrective Action Program and the IRP.
5.0 Physiography

5.1 MAFB is located within the Central Recharge Area, a 1,333 square mile, nearly flat expanse of glacial ground moraine. The Central Recharge Area is mantled by several hundred feet of glacial drift. The ground surface slopes gently toward the northeast and contains thousands of small, poorly draining prairie potholes (Pettyjohn and Hutchinson 1971).

5.2 Imported vegetation and pavements have displaced the natural land surface and most native plant species on Minot AFB. Nonnative species such as barnyard grass, downy brome, green foxtail, and crested wheatgrass occur throughout the base. Spruce, green ash, Russian olive, and juniper trees have been planted to provide landscaping and windbreaks.

6.0 Adjacent Land Uses

6.1 MAFB is located in the Northern Great Plains native grassland (e.g. Blue grama and western wheat grass). Most of the area surrounding the base has been converted to agriculture (EA Engineering 1990).

7.0 Geology

7.1 MAFB is situated upon a laterally, and vertically extensive ground moraine plain. The ground moraine is a glacial sediment composed almost entirely of till. The till is characterized as an unstratified deposit of sediment with a particle size ranging from clay to boulders. However, clay and silt size particles account for the largest percentage of the sediment volume sample. The completed boring program confirmed that this till extends to a depth of at least 100 feet beneath MAFB. Deeper borings completed in the vicinity of MAFB indicate the till extends to depths ranging from 140 to 180 feet. Below that depth, the Paleozoic bedrock surface is encountered. Quaternary glacial sediments rest unconformably upon an irregular Paleozoic bedrock surface.

7.2 The only type of deposit other than till present within the glacial sediments is a minor occurrence of glacial sand and gravel. A review of available literature and the completed borings indicate that these sand and gravel deposits are discontinuous, lenticular, and contain a variety of sediment types. These sand and gravel deposits account for less than 5% of the total volume of the first 100 feet of glacial sediments. Generally, the sand and gravel deposits are scattered throughout the till.

7.3 The ground moraine plain beneath MAFB is part of what is referred to in the literature as the Central Recharge Area. The term recharge refers to the process in which water, emanating from precipitation, enters water-bearing units.

7.4 The results of geotechnical sampling completed during investigations at MAFB indicated the permeability of the glacial till to be approximately in the range of 10(-6) to 10 (-8) cm/sec, which, in relative terms, is very low. This range is commensurate with the permeability values of glacial till reported in the literature. By use of this information and other information obtained during other on base investigations, it was determined that the rate of movement of water downward through this glacial till is in the range of a few centimeters to a few feet per year.

8.0 Hydrology
8.1 MAFB is located within the Souris River drainage system. The base is many miles upstream from this major river. MAFB is located within the Egg Creek drainage basin, which is an intermittent tributary basin of the Souris River. Egg Creek drains eastward about 30 miles to North Lake, which in turn drains north to the Souris River via Bank Creek. Because Egg Creek is an intermittent Class III Stream, North Dakota’s least stringent surface-water-quality standards apply (EA Engineering 1990). No area of MAFB is located in a designated floodplain, although ponding does occur in natural potholes on the base.

8.2 Regional surface drainage is controlled by the Souris River, which originates in Saskatchewan, Canada. The Souris River enters North Dakota flowing generally southeast. About 30 miles southeast of MAFB, it loops northeast, then north where it reenters Canada through Manitoba, eventually discharging into Hudson Bay. Flow is regulated by a U.S./Canada joint commission. Area runoff is sparse. The Souris River has one perennial tributary in North Dakota, the Des Lacs River (State of North Dakota 1984).

8.3 The Souris River is a Class IA stream. Its waters are suitable for domestic supply after conventional treatment and softening. The Des Lacs River is a Class II stream. Its waters are suitable for domestic supply after advanced treatment.

8.4 Deposits of outwash sands and gravels form very productive aquifers along the major river valleys (Winter et al. 1984) such as the Minot and Sundre buried channel aquifers occurring near the town of Minot. Typical aquifer thickness is less than 100 feet.

8.5 Several sedimentary bedrock aquifers, such as the Fort Union and Fox Hills-Hell Creek aquifers of Tertiary age, underlie the Minot area below the glacial deposits at depths usually greater than 200 feet. These aquifers are relatively productive, but their poor water quality limits their use to livestock watering and domestic consumption only in areas where no other source is available (Winter et al. 1984).

9.0 Surface Hydrology

9.1 Surface water drainage on the MAFB is restricted primarily to drainage ditches, pipes, and lines that drain to two ditches which flow north into Egg Creek. The western primary drainage ditch uses a glacial melt water channel to carry surface water runoff to Egg Creek. Some storm water runoff on the west end of the runway area flows west to a south flowing intermittent stream (Reynolds, 1984).

9.2 There are no perennial steams on MAFB. Surface water on the Base comes from surface runoff. Egg Creek which receives most of the surface drainage from MAFB, is designated as a Class III stream by the North Dakota Department of Health (NDDH). Class III streams are streams where the quality of water is adequate for industrial and agricultural uses such as cooling, washing, irrigation, and stock watering (NDDH, 1989).

10.0 Background

10.1 A RCRA Facility Assessment (RFA) was conducted for MAFB by the Environmental Protection Agency (EPA). Versar Inc. conducted a visual site inspection in conjunction with EPA and the NDDH on June 29, 1989. The RFA identified four Solid Waste Management Units (SWMU): the Defense Reutilization and Marketing Office (DRMO), the Explosive Ordnance Disposal Area (EODA), the Firefighting Training Area (FTA), and the Sanitary Landfill Area (SLA).
10.2 Comparison of the MAFB RFA report with those performed at other Air Force Bases indicated that the number and type of SWMU normally associated with an Air Force Base were not identified. Based upon this comparison, the EPA elected to perform a second RFA for MAFB in 1992 to ensure that all SWMU were identified and that the potential for release of hazardous constituents to the environment from these SWMU were evaluated.

10.3 The second RFA was performed by Science Applications International Corporation and A.T. Kearney, Inc., the visual site inspection was performed on July 23 and 24, 1992. Based on the results of this inspection, information acquired during State/Federal file searches, and data from the Part B Permit application, 150 SWMUs and 2 Areas of Concern (AOC) were identified. Of these 150 SWMUs, 63 SWMUs were determined to require further action. The USTs were added to MAFB RCRA Program as SWMUs 4 add. There were 30 USTs included in the 63 SWMUs.

10.4 The 30 USTs were located throughout MAFB, the 28 USTs locations that this decision document deals with are noted in the following figures (4a-ii). The USTs were used as oil storage tanks. Oil was either poured directly into the UST or were installed adjacent to an OWS and the oil was skimmed off the water run through the OWS and collected in the UST.

10.5 The USTs were investigated under the MAFB Phase I RFI conducted in 1995. There were some previous investigations prior to the Phase I RFI, which led to the removal of some of the USTs. These sites were included as SWMUs because of the potential to contaminate soil and/or groundwater.

10.6 During the RFI, borings were advanced, groundwater monitor wells were installed and soil samples were collected for chemical analysis, headspace screening, and lithologic data. Soil and groundwater samples were analyzed for Volatile Organic Compounds, Total Recoverable Petroleum Hydrocarbons (Diesel Range Organics), and total Cadmium, Chromium, and Lead.

10.7 During the Corrective Measure Implementation (CMI), samples were obtained and tested for Total Petroleum Hydrocarbons (TPH), benzene, toluene, ethyl benzene, and xylene (BTEX), chromium and lead. These samples were used to verify the site was clean or dirty after the UST was removed.

10.8 An additional five USTs (4ee ii) were added in March 2008, to document remaining contamination at the AAFES Service Station building.

11.0 Public Community and Regulatory Agencies

11.1 An Administrative Record (AR) is the legal record of the physical situation at an installation by which response actions are reviewed and defended. An AR must be established at each installation which has conducted or is conducting IRP activities and must be available to the public at or near the installation. This record is maintained at the following location and is updated as needed by the base Remedial Project Manager.

5 CES/CEV
320 Peacekeeper Place
Minot AFB, ND 58705-5006
11.2 An Information Repository (IR) is a project file on IRP activities at AF installations. The repository is to be established for all remedial action sites and for all sites where removal actions last longer than 120 days. It is located either on or off base at a place convenient to the community and contains site information, investigatory reports, information about the sources and nature of the contaminants, and a schedule for cleanup operations. The IR is intended to address community relations requirements and is a source of reading material for the public. This is maintained at the following location and is updated as needed by the base Remedial Project Manager.

Minot State University Library 500
University West
Minot, ND 58703

12.0 Technical Review Committees/Restoration Advisory Boards

12.1 A Technical Review Committee (TRC) was established at Minot AFB Apr 92 to review and comment on Department of Defense actions and proposed actions with respect to releases or threatened releases of hazardous substances into the environment at MAFB. The TRC was also established to ensure open communication and exchange of ideas with the general public about the MAFB IRP and CERCLA (1980), SARA (1986), and RCRA (1976).

12.2 The primary purpose and function of the TRC was informational, specifically to foster community and interagency awareness and understanding of MAFB IRP remedial actions related to the releases or threatened releases of hazardous substances at MAFB.

12.3 The TRC was replaced by the Restoration Advisory Board (RAB) in 1994, MAFB first meeting was held 8 Feb 95. The RAB is an advisory body designed to act as a focal point for the exchange of information between MAFB and the local community regarding restoration activities. RAB meetings are held every 6 months and notice of the meetings are placed in the Minot Daily News.

13.0 Selected Remedy

13.1 One remedy was selected for remediation of the contaminated media at the USTs. Contaminated soil was excavated and land treated at a permitted site until a level of 10 parts per million total petroleum hydrocarbons has been reached at which time the soil was considered clean and reusable.

14.0 Evaluation of Selected Remedy

14.1 An analysis of the remedy was conducted to evaluate the remedy with respect to its relative performance in meeting nine criteria. These evaluation criteria are divided into three categories and have been developed by the EPA to address the technical and policy considerations that have proven important for selecting remedies. The nine criteria are found in (40 CFR 300.430(f)(1)(i)).

14.2 Threshold Criteria
1. Overall protection of human health and the environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARAR)
   Primary Balancing Criteria
3. Long-Term effectiveness and permanence.
4. Reduction of toxicity, mobility, or volume (TMV)
5. Short term effectiveness
6. Implementability
7. Cost Modifying Criteria
8. State Acceptance
9. Community Acceptance

14.3 Criterion 1: Overall Protection of Human Health and the Environment
   a. Protectiveness is the primary requirement that remedial actions must meet under CERLCA. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed through each pathway at the site.
   b. Remedy 1- Excavation of the contaminated soil will remove the contamination from the immediate vicinity of the industrial area to an isolated treatment site. Remediation at the land treatment site will immediately begin to reduce and eliminate current risks posed by the contaminated soil and prevents further contamination of ground water. The potential for human exposure to contamination at the UST is eliminated.

14.4 Criterion 2: Compliance with ARAR
   a. Compliance with ARAR is one of the statutory requirements of the remedy selection. Applicable requirements are cleanup standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. Relevant and appropriate requirements address problems or situation sufficiently similar to those encountered at the site and thus their use is well suited to the environmental and technical factors at a particular site. The primary ARAR at the UST include site-specific contaminant levels, Land Treatment of Petroleum Contaminated Soil (Guidelines), Maximum Contaminant Level (MCL), and potentially the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act.
   b. Remedy 1- This remedy seeks a cleanup level of ten parts per million total petroleum hydrocarbons. Other contaminants will be reviewed on a case-by-case basis for determining corrective measures to be implemented. Land treatment according to these guidelines, will reduce the contamination to below MCL. Proper management of the contaminated soil will prevent discharges in violation of the NPDES.

14.5 Criterion 3: Long Term Effectiveness and Permanence
   a. This criterion reflects CERCLA emphasis on implementing remedies that will ensure protection of human health and the environment in the long term. The assessment of remedies against this criterion evaluates the residual risks at a site after completion of a remedial action.
   b. Remedy 1 – This remedy will achieve long-term effectiveness and permanence through remediation of contaminated media to a “clean” condition. Upon completion, the residual risks will be less than industrial screening levels.
14.6 Criterion 4: Reduction of Toxicity, Mobility, and Volume (TMV)

a. This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies a remedy may employ.

b. Remedy 1- Treatment of the contaminants in a permitted land treatment site through the activity of resident microorganisms in the soil has been shown effective in reducing the TMV. Petroleum hydrocarbons serve as food for the microorganisms. An increase in microbiological activity and numbers of organisms confirms the activity taking place. Analysis of contaminant concentrations will be reduced in response to microbe activity.

14.7 Criterion 5: Short Term Effectiveness

a. This criterion addresses short-term impacts of the remedy. The assessment against this criterion examines the effectiveness of remedies in protecting human health and the environment during the construction and implementation of a remedy.

b. Remedy 1- This remedy will create short-term exposure pathways during excavation, sampling events, and land farming activities.

14.8 Criterion 6: Implementability

a. The assessment against this criterion evaluates the technical and administrative feasibility of the remedy and the availability of the goods and services needed to implement them.

b. Remedy-1 This remedy is technically low in goods and services needed for implementation and are readily available. Administrative functions are minimal once a permitted land treatment site is established.

14.9 Criterion 7: Cost

a. Cost encompasses all engineering, construction, and operation and maintenance costs incurred over the life of the project. The assessment against this criterion is based on the present worth of these costs for each alternative.

b. Remedy 1- The cost for this remedy varies according to the amount of soil and the concentration of contamination at each UST location.

14.10 Criterion 8: State Acceptance

a. This criterion, which is an ongoing concern throughout the corrective action process, reflects the statutory requirement to provide for substantial and meaningful State involvement.

b. Remedy 1- North Dakota Department of Health (NDDH) recognizes this remedy as an acceptable form of remedial action.
14.11 Criterion 9: Community Acceptance

a. This criterion reflects the community's apparent preferences or concerns about remedies.

b. The RAB, and IR have been the avenues in which the base has informed the community of IRP and RCRA Corrective Action activities. RAB meetings are held twice each year to update members on corrective action activity. RAB meetings, and the IR have provided an opportunity for public comment/involvement in RCRA and IRP remediation activities. A 30-day notice of a 45-day public comment period regarding the permit to be issued and incorporating this selected remedy will be given.

c. There has been little public interest in this activity based on the questions/comments posed by community members.

d. Remedy 1- The RAB members have been favorable toward this remedy.

15.0 INDIVIDUAL SITE STATUS

15.1 NO CONTAMINATION PRESENT

15.1.1 There are nine sites (4u, 4v, 4w, 4x, 4y, 4z, 4aa, 4bb, and 4cc) where no contamination was encountered. All the USTs were removed from the ground. No further action is required at any of these sites.

15.2 CONTAMINATION PRESENT BUT REMOVED

15.2.1 There are eleven sites (4g, 4h, 4j, 4k, 4l, 4m, 4q, 4r, 4s, 4ee, and 4ff) where contamination was present, however all contamination except very minor amounts was removed when the UST was removed. No further action required at these sites.

15.3 CONTAMINATION PRESENT, SITE TRANSFERRED TO REFERENCED CORRESPONDING SWMU OR AOC

15.3.1 There are four sites (4c, 4i, 4n, and 4o) that fall under this category. Sites are closed, as they are addressed under the corresponding SWMU, SWMU 3.

15.3.2 There are three sites (4a, 4b, and 4p) that fall under this category. These USTs were associated with hydrant pumphouse buildings. Contamination associated with these USTs was not removed when the buildings were demolished because additional contamination was discovered with the September 2007 removal of the associated pumphouses, 16 JP-8 storage USTs, and piping. These sites are closed and will be addressed under the corresponding AOC-B Mass Parking Apron where a RCRA Cleanup Process is programmed for FY09 starting with a preliminary assessment (PA) and site inspection (SI). All contamination present will be removed under this Cleanup Action at AOC-B.

15.4 CONTAMINATION REMAINS IN PLACE
15.4.1 There are eight sites (4d, 4e, 4f, 4t, 4dd, 4gg, 4hh and 4ii) where contamination was present. All accessible contamination was removed when the USTs were removed. Contamination remains at these sites under the foundations of the associated buildings or around utilities where it is technically impractical to remove until the impeding structures are taken out of service, i.e., demolished. No further action recommended at these eight sites until the impeding structures are taken out of service, i.e., demolished.
<table>
<thead>
<tr>
<th>Solid Waste Management Unit (SWMU)</th>
<th>Building Number</th>
<th>Installation Date/Capacity (gallons)/Material</th>
<th>Removal Date</th>
<th>Status</th>
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<tr>
<td>4a</td>
<td>1072</td>
<td>1962/2,000/Steel</td>
<td>29 Sept 1997</td>
<td>CONTAMINATION REMAINS IN PLACE&lt;br&gt;Removed 50 CY soil, placed under AOC</td>
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<td>4b</td>
<td>1074</td>
<td>1962/2,000/Steel</td>
<td>29 Sept 1997</td>
<td>CONTAMINATION REMAINS IN PLACE&lt;br&gt;Removed 50 CY soil, placed under AOC</td>
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<tr>
<td>4c</td>
<td>407</td>
<td>1957/2,000/Steel</td>
<td>7 Aug 1996/Installed New Double UST</td>
<td>CONTAMINATION REMAINS IN PLACE&lt;br&gt;Placed under SWMU 3 (LTM)</td>
</tr>
<tr>
<td>4d 4e</td>
<td>425 585 (2103) 585 (2106)</td>
<td>1958/4,000/Steel 1964/12,000/Steel</td>
<td>5 May 1992</td>
<td>CONTAMINATION REMAINS IN PLACE&lt;br&gt;Removed 10,000 CY soil</td>
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<tr>
<td>4f</td>
<td>718</td>
<td>1979/800/Steel</td>
<td>9 Jun 1995</td>
<td>CONTAMINATION REMAINS IN PLACE&lt;br&gt;Removed 1500 CY soil</td>
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<tr>
<td>4g 4h</td>
<td>585 (2103) 585 (2106)</td>
<td>1966/1,000/Steel 1966/1,000/Steel</td>
<td>1 May 1992</td>
<td>NO FURTHER ACTION&lt;br&gt;Removed 60 CY soil</td>
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<td>4i</td>
<td>407</td>
<td>1969/8,000/Steel</td>
<td>19 Jul 1991</td>
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<td>457 460</td>
<td>1962/1,000/Steel 1962/1,000/Steel</td>
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<td>460</td>
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<td>4m</td>
<td>2221</td>
<td>1960/5,000/Steel</td>
<td>26 May 1992</td>
<td>NO FURTHER ACTION&lt;br&gt;Removed 1600 CY soil</td>
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<td>Solid Waste Management Unit (SWMU)</td>
<td>Building Number</td>
<td>Installation Date/ Capacity(gallons)/ Material</td>
<td>Removal Date</td>
<td>Status</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------</td>
<td>--------------</td>
<td>--------</td>
</tr>
<tr>
<td>4n 4o</td>
<td>407</td>
<td>1963/1,500/Steel 1959/1,500/Steel</td>
<td>19 Jul 1991</td>
<td>CONTAMINATION REMAINS IN PLACE Placed under SWMU 3 (LTM)</td>
</tr>
<tr>
<td>4p</td>
<td>1076</td>
<td>1980/3,000/Steel</td>
<td>29 Sep 1997</td>
<td>CONTAMINATION REMAINS IN PLACE Removed 30 CY soil, placed under AOC B</td>
</tr>
<tr>
<td>4q</td>
<td>869</td>
<td>1983/500/Steel</td>
<td>31 Oct 1995</td>
<td>NO FURTHER ACTION Removed 20 CY soil</td>
</tr>
<tr>
<td>4r</td>
<td>476</td>
<td>1983/550/Fiberglass</td>
<td>2 Dec 1993</td>
<td>NO FURTHER ACTION Removed 340 CY soil</td>
</tr>
<tr>
<td>4s</td>
<td>2038</td>
<td>1983/550/Steel</td>
<td>1 Oct 1992</td>
<td>NO FURTHER ACTION Removed soil</td>
</tr>
<tr>
<td>4t</td>
<td>761 (2214)</td>
<td>1985/1,000/Steel</td>
<td>24 Jun 1996</td>
<td>CONTAMINATION REMAINS IN PLACE</td>
</tr>
<tr>
<td>4u</td>
<td>761 (2216)</td>
<td>1985/1,000/Steel</td>
<td>27 Jun 1996</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4v</td>
<td>1134 (1134-0)</td>
<td>1988/8,000/Steel</td>
<td>8 Apr 1999</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4w</td>
<td>1135</td>
<td>1988/550/Steel</td>
<td>13 May 1997</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4x</td>
<td>970</td>
<td>1988/1,500/Steel</td>
<td>5 Aug 1997</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4y</td>
<td>748</td>
<td>1982/550/Steel</td>
<td>29 Aug 1994</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4z</td>
<td>767</td>
<td>1984/550/Steel</td>
<td>10 Sep 1994</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4aa</td>
<td>870</td>
<td>1989/550/Steel</td>
<td>1 Nov 1995</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4bb</td>
<td>1144</td>
<td>1988/1,000/Steel</td>
<td>19 May 1997</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4cc</td>
<td>2035</td>
<td>1979/550/Steel</td>
<td>27 May 1992</td>
<td>NO FURTHER ACTION</td>
</tr>
<tr>
<td>4dd</td>
<td>761 (1819)</td>
<td>1985/6,000/Steel</td>
<td>4 Jun 1992</td>
<td>CONTAMINATION REMAINS IN PLACE Removed 890 CY soil</td>
</tr>
<tr>
<td>4ee 4ff</td>
<td>585 (2166-1)</td>
<td>1966/10,000/ Steel 1966/10,000/Steel</td>
<td>23 Jul 1991</td>
<td>NO FURTHER ACTION Removed 600 CY soil</td>
</tr>
<tr>
<td></td>
<td>585 (2166-2)</td>
<td></td>
<td>23 Jul 1991</td>
<td></td>
</tr>
</tbody>
</table>


**16.0 CONCLUSION**

16.1 The selected remedy for the USTs, where practical, was the removal and treatment of the contaminated soil. Removal and treatment of contaminated soil was protective of human health and the environment by eliminating the contaminants of concern, thus eliminating human exposure and preventing migration of contaminants.

16.2 At those contaminated sites which were technically impracticable to remediate due to existing structures, the presence of the contaminated soil has been documented and will be removed if/when the impeding structures are removed.

16.3 In summary, all contamination at the USTs designated as SWMU 4a-ii that was technically feasible and practical to remove has been removed and treated to reduce the contamination to below regulatory and risk base levels. At those sites where contamination remains under the structures, further corrective measures will be implemented when access to the soils is possible due to structures demolition/reconstruction. The eleven UST sites listed under paragraph 16.0 shall be closed since the UST and associated contamination has been removed. The sites remain open under adjacent OWS SWMU or are consolidated under corresponding /related SWMU as referenced in the table with the column entitled “Contamination Status” under paragraph 20. No further action is required at any of these SWMU at this time.
This addendum specifically addresses SWMU 4s which is addressed in NDDH Decision Document for SWMU 4a-dd dated May 7, 1999, updated March 17, 2008 (see above).

Site OW545 encompasses the former location of underground used oil storage tank 4s and the oil/water separator designated 7q. The underground storage tank was removed on October 1, 1992, and approximately 3,400 cubic yards of petroleum contaminated soil was also excavated and removed. As noted in the cited NDDH Decision Document, sampling results indicated that all contamination technically feasible and practical to remove had been removed and treated to reduce the contamination to below regulatory and risk base levels. Accordingly, it was determined that no further action was required and the status of OW545 could be considered closed in the context of the Minot AFB environmental restoration program (ERP).

However, while installing temporary monitoring wells at site OW545 during June of 2015, field staff of ARGO/LRS JV—the Upper Midwest Performance Based Remediation contractor—noted soil contamination (i.e., elevated photoionization detector (PID) readings and black coloring of soil) in the bore logs. Consequently, Site OW545—to include SWMU 4s and 7q—is no longer considered closed.

Accordingly, for OW545, the Air Force has programmed for a Remedial Investigation/Feasibility Study in 2019 and a Proposed Plan/Record of Decision in 2020 to respectively determine the nature and extent of contamination in both soil and groundwater and identify appropriate remedial activities.
UNDERGROUND STORAGE TANK 2,000 GALLON
REMOVED 29 SEPT. 1997
(SWMU 4A) CONNECTED TO FLIGHT LINE O/W SEPARATOR

SWMU 4A
NE CORNER OF BLDG 1072

UST
- RED: OPERATIONAL TANK
- GREEN: REMOVED TANK CLEAN SITE
- BLUE: REMOVED TANK CONTAMINATED SITE

SCALE 1" = 50'-0"
UNDERGROUND STORAGE TANK 2,000 GALLON
REMOVED 29 SEPT. 1997
(SWMU 4B) CONNECTED TO FLIGHT LINE O/W SEPARATOR

SWMU 4B
NE CORNER OF BLDG 1074

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SCALE 1" =50'-0"
UNDERGROUND STORAGE TANK 2,000 GALLON
REMOVED 7 AUG. 1996
(SWMU 4C)

UNDERGROUND STORAGE TANKS 8,000 (SWMU 4I) AND
(2) 1,500 GALLON
(SWMU 4N & 4O)
REMOVED 19 JUL. 1991

SWMU 4C, 4I, 4N, 4O
WEST AND SOUTH EAST OF 407

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SCALE 1" = 50'-0"
RCRA PERMIT APPLICATION

MINOT AIR FORCE BASE
NORTH DAKOTA

UNDERGROUND STORAGE TANK 800 GALLON
REMOVED 9 JUN. 1995
(SWMU 4F)

UST

- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SWMU 4F
EAST OF 718

SCALE 1" = 50'-0"
UNDERGROUND STORAGE TANK (OLD FIRE PIT)
5,000 CALLON
REMOVED 26 MAY 1992
(SWMU 4M)
UNDERGROUND STORAGE TANK 3,000 GALLON
REMOVED 29 SEPT, 1997
(SWMU 4P) CONNECTED TO FLIGHT LINE O/W SEPARATOR

SWMU 4P NORTH EAST OF 1076

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SCALE 1" = 50' - 0"

149
UNDERGROUND STORAGE TANK 500 GALLON
REMOVED 31 OCT. 1995
(SWMU 4Q)
UNDERGROUND STORAGE TANK 550 GALLON
REMOVED 2 DEC 1993
(SWMU 4R)

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE
Underground storage tank 6,000 gallon removed 4 Jun. 1992 (SWMU 4DD)

Underground storage tank 1,000 gallon removed 24 Jun. 1996 (SWMU 41)

Underground storage tank 1,000 gallon removed 27 Jun. 1996 (SWMU 4U)

UST
- Operational Tank
- Removed Tank Clean Site
- Removed Tank Contaminated Site

Scale 1" = 50'-0"
UNDERGROUND STORAGE TANK 8,000 GALLON
REMOVED, 8 APRIL 1999
(SWMU 4V)

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SWMU 4V
WEST OF 1134

SCALE 1" = 50'-0"
UNDERGROUND STORAGE TANK 1,500 GALLON
REMOVED 5 AUG. 1997
(SWMU 4X)

SWMU 4X
EAST OF BLDG 970 AND
SOUTH OF BLDG 974

UST

- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SCALE 1" = 50'-0"
UNDERGROUND STORAGE TANK 550 GALLON
REMOVED 29 AUG. 1994
(SWMU 4Y)

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SCALE 1" = 50'-0"
UNDERGROUND STORAGE TANK 550 GALLON
REMOVED 29 AUG. 1994 (SWMU 4Y)

SWMU 4Y
NORTH OF BLDG 748

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SCALE 1" =50'-0"
UNDERGROUND STORAGE TANK 550 GALLON
REMOVED 1 NOV. 1995
(SWMU 4AA)

SWMU 4AA
WEST OF BLDG 870

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SCALE 1" = 50' - 0"
UNDERGROUND STORAGE TANK 1,000 GALLON
REMOVED 19 MAY 1997
(SWMU 4BB)

SWMU 4RR
EAST OF BLDG 1144

UST
- OPERATIONAL TANK
- REMOVED TANK CLEAN SITE
- REMOVED TANK CONTAMINATED SITE

SCALE 1" = 50'-0"
Closure Documentation

SWMU 5

Drummed Hazardous Waste Accumulation/Collection Point

Building 748
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Ref File: Minot Air Force Base HW-021

April 13, 2000

KEVIN NELSON
5 CES/CEV
320 PEACEKEEPER PLACE
MINOT AFB ND 58705-5006

Dear Mr. Nelson:

This letter is written regarding Minot AFB’s submittal of Final Phase I and Phase II RFI Reports as required by Module IV.E.3.b. of the Corrective Action Module of the Minot AFB Hazardous Waste Permit.

The Division of Waste Management has reviewed the Division’s comments on the Draft Phase I and Phase II Reports. These comments have been addressed and are reflected in the Final Reports.

The Division of Waste Management accepts the Reports as submitted. The Division will notify MAFB if further corrective action is needed at any SWMU or AOC identified in these reports.

If you have any questions regarding these comments or conditions, please contact Robert Disney of this office.

Sincerely,

Neil M. Knatterud, Director
Division of Waste Management

NMK:RD:lk
Certified
cc: Wanda Taunton, USEPA Region VIII, Denver CO
Decision Document

SWMU 7a-7s

Basewide Oil Water Separators
0.0 Site and Location

0.1 Minot Air Force Base, North Dakota

0.2 SWMUs 7a-7s

1.0 Statement of Basis

1.1 The decision described herein concerns the selected remedy (SR) at 19 oil/water separators (OWS), identified as Solid Waste Management Units (SWMU) 7 a-s located at various locations throughout the installation. It is based on an evaluation of the results received from corrective action performed under the Resource Conservation Recovery Act (RCRA) Compliance Program and the United States Air Force Installation Restoration Program (IRP). Documented studies include the RCRA Facility Assessments of June 1989 and July 1992, Phase I RCRA Facility Investigation of 1995, and Corrective Measures Implementation 1992-1999.

2.0 Remedy Selection

2.1 A remedy was selected depending on the presence of contamination, its concentration, practical ability of remediation, and risks posed. The OWS were investigated and classified in one of three ways: 1. No contamination present. 2. Contamination present but removed. 3. Contamination present and above regulated levels. All accessible contamination was removed, however, some remains but it is technically impractical to remove.

2.2 At this time, no further action is necessary at any of the above mentioned sites.

3.0 Declaration of Consistency with CERLCA and NCP

3.1 This document presents the selected remedy for these sites developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, National Contingency Plan (NCP), and the Resource Conservation and Recovery Act (RCRA) of 1976, as amended.

4.0 Facility

4.1 Minot AFB (MAFB) is located approximately 12 miles north of Minot, North Dakota, in Ward County, as shown in Figure 1-1. Prior to 1955, the property comprising MAFB was farmland. The government purchased the land in 1955, and construction began approximately two years later. The main base area encompasses approximately 4,636 acres. The land use adjacent to the base is predominately agricultural.

4.2 Reference Table-1 for a list of the OWS removed under the RCRA Corrective Action Program and the IRP.

5.0 Physiography
5.1 MAFB is located within the Central Recharge Area, a 1,333 square mile, nearly flat expanse of glacial ground moraine. The Central Recharge Area is mantled by several hundred feet of glacial drift.
The ground surface slopes gently toward the northeast and contains thousands of small, poorly draining prairie potholes (Pettyjohn and Hutchinson 1971).

5.2 Imported vegetation and pavements have displaced the natural land surface and most native plant species on Minot AFB. Nonnative species such as barnyard grass, downy brome, green foxtail, and crested wheatgrass occur throughout the base. Spruce, green ash, Russian olive, and juniper trees have been planted to provide landscaping and windbreaks.

6.0 Adjacent Land Uses

6.1 MAFB is located in the Northern Great Plains native grassland (e.g. Blue grama and western wheat grass). Most of the area surrounding the base has been converted to agriculture (EA Engineering 1990).

7.0 Geology

7.1 MAFB is situated upon a laterally, and vertically extensive ground moraine plain. The ground moraine is a glacial sediment composed almost entirely of till. The till is characterized as an unstratified deposit of sediment with a particle size ranging from clay to boulders. However, clay and silt size particles account for the largest percentage of the sediment volume sample. The completed boring program confirmed that this till extends to a depth of at least 100 feet beneath MAFB. Deeper borings completed in the vicinity of MAFB indicate the till extends to depths ranging from 140 to 180 feet. Below that depth, the Paleozoic bedrock surface is encountered. Quaternary glacial sediments rest unconformably upon an irregular Paleozoic bedrock surface.

7.2 The only type of deposit other than till present within the glacial sediments is a minor occurrence of glacial sand and gravel. A review of available literature and the completed borings indicate that these sand and gravel deposits are discontinuous, lenticular, and contain a variety of sediment types. These sand and gravel deposits account for less than 5% of the total volume of the first 100 feet of glacial sediments. Generally, the sand and gravel deposits are scattered throughout the till.

7.3 The ground moraine plain beneath MAFB is part of what is referred to in the literature as the Central Recharge Area. The term recharge refers to the process in which water, emanating from precipitation, enters water-bearing units.

7.4 The results of geotechnical sampling completed during investigations at MAFB indicated the permeability of the glacial till to be approximately in the range of $10^{-6}$ to $10^{-8}$ cm/sec, which, in relative terms, is very low. This range is commensurate with the permeability values of glacial till reported in the literature. By use of this information and other information obtained during other on base investigations, it was determined that the rate of movement of water downward through this glacial till is in the range of a few centimeters to a few feet per year.

8.0 Hydrology

8.1 MAFB is located within the Souris River drainage system. The base is many miles upstream from this major river. MAFB is located within the Egg Creek drainage basin, which is an intermittent tributary basin of the Souris River. Egg Creek drains eastward about 30 miles to North Lake, which in turn drains north to the Souris River via Cut Bank Creek. Because Egg Creek is an intermittent Class III Stream, North Dakota's least stringent surface-water-quality standards apply (EA Engineering 1990). No area of MAFB is located in a designated floodplain, although ponding does occur in natural potholes on the base.
8.2 Regional surface drainage is controlled by the Souris River, which originates in Saskatchewan, Canada. The Souris River enters North Dakota flowing generally southeast. About 30 miles southeast of MAFB, it loops northeast, then north where it reenters Canada through Manitoba, eventually discharging into Hudson Bay. Flow is regulated by a U.S./Canada joint commission. Area runoff is sparse. The Souris River has one perennial tributary in North Dakota, the Des Lacs River (State of North Dakota 1984).

8.3 The Souris River is a Class IA stream. Its waters are suitable for domestic supply after conventional treatment and softening. The Des Lacs River is a Class II stream. Its waters are suitable for domestic supply after advanced treatment.

8.4 Deposits of outwash sands and gravels form very productive aquifers along the major river valleys (Winter et al. 1984) such as the Minot and Sundre buried channel aquifers occurring near the town of Minot. Typical aquifer thickness is less than 100 feet.

8.5 Several sedimentary bedrock aquifers, such as the Fort Union and Fox Hills-Hell Creek aquifers of Tertiary age, underlie the Minot area below the glacial deposits at depths usually greater than 200 feet. These aquifers are relatively productive, but their poor water quality limits their use to livestock watering and domestic consumption only in areas where no other source is available (Winter et al. 1984).

9.0 Surface Hydrology

9.1 Surface water drainage on the MAFB is restricted primarily to drainage ditches, pipes, and lines that drain to two ditches which flow north into Egg Creek. The western primary drainage ditch uses a glacial melt water channel to carry surface water runoff to Egg Creek. Some storm water runoff on the west end of the runway area flows west to a south flowing intermittent stream (Reynolds, 1984).

9.2 There are no perennial streams on MAFB. Surface water on the Base comes from surface runoff. Egg Creek which receives most of the surface drainage from MAFB, is designated as a Class III stream by the North Dakota Department of Health (NDDH). Class III streams are streams where the quality of water is adequate for industrial and agricultural uses such as cooling, washing, irrigation, and stock watering (NDDH, 1989).

10.0 Background

10.1 A RCRA Facility Assessment (RFA) was conducted for MAFB by the Environmental Protection Agency (EPA). Versar Inc. conducted a visual site inspection in conjunction with EPA and NDDH on June 29, 1989. The RFA identified four Solid Waste Management Units (SWMU): the Defense Reutilization and Marketing Office (DRMO), the Explosive Ordnance Disposal Area (EODA), the Fire Protection Training Area (FPTA), and the Sanitary Landfill Area (SLA).

10.2 Comparison of the MAFB RFA report with those performed at other Air Force bases indicated that the number and type of SWMU normally associated with an Air Force base were not identified. Based on this comparison, the EPA elected to perform as second RFA for MAFB in 1992 to ensure that all SWMU were identified and that the potential for release of hazardous constituents to the environment from these SWMU were evaluated.

10.3 The second RFA was performed by Science Applications International Corporation and A.T. Kearney, Inc., the visual site inspection was performed on July 23 and 24, 1992. Based on the results of this inspection, information acquired during State/Federal file searches, and data from the Part B Permit application, 150 SWMU and 2 Areas of Concern (AOC) were identified. Of these 150 SWMU, 63 SWMU were determined to require further
The OWSs were added to MAFB RCRA program as SWMU 7a-s. There were 19 OWS included in the 63 SWMU, all OWS were located underground.

10.4 The 19 OWS were located throughout MAFB, locations are noted the figures following the text of this decision document. The OWS managed wastewater discharged from their associated buildings. The buildings house various industrial operations to support current and past missions. The exact constituents in the wastewater vary from site to site, however the wastes generally consisted of fuels, oils, and greases.

10.5 The OWS were investigated under the MAFB Phase I RFI conducted in 1995. These sites were included as SWMU because of the potential to contaminate soil and/or groundwater.

10.6 During the RFI, borings were advanced and soil samples were collected for chemical analysis, headspace screening, and lithologic data. Soil and groundwater samples were analyzed for volatile organic compounds, total recoverable petroleum hydrocarbons (diesel range organics), and total cadmium, chromium, and lead.

10.7 During the Corrective Measures Implementation (CMI), samples were obtained and tested for total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, and xylenes (BTEX), chromium, and lead. These samples were used to verify the site was clean or dirty after the OWS was removed.

11.0 Public Community and Regulatory Agencies

11.1 An Administrative Record (AR) is the legal record of the physical situation at an installation by which response actions are reviewed and defended. An AR must be established at each installation which has conducted or is conducting IRP activities and must be available to the public at or near the installation. This record is maintained at the following location and is updated as needed by the base Remedial Project Manager.

5 CES/CEV
320 Peacekeeper Place
Minot AFB, ND 58705-5006

11.2 An Information Repository (IR) is a project file on IRP activities at AF installations. The repository is to be established for all remedial action sites and for all sites where removal actions last longer than 120 days. It is located either on or off base at a place convenient to the community and contains site information, investigatory reports, information about the sources and nature of the contaminants, and a schedule for cleanup operations. The IR is intended to address community relations requirements and is a source of reading material for the public. This is maintained at the following location and is updated as needed by the base Remedial Project Manager.

Minot State University
Library 500 University West
Minot, ND 58703

12.0 Technical Review Committees/Restoration Advisory Boards

12.1 A Technical Review Committee (TRC) was established at Minot AFB Apr 92 to review and comment on Department of Defense actions and proposed actions with respect to releases or threatened releases of hazardous substances into the environment at MAFB. The TRC was also established to ensure open communication and exchange of ideas with the general public about the MAFB IRP and CERCLA (1980), SARA (1986), and RCRA (1976).
12.2 The primary purpose and function of the TRC was informational, specifically to foster community and interagency awareness and understanding of MAFB IRP remedial actions related to the releases or threatened releases of hazardous substances at MAFB.

12.3 The TRC was replaced by the Restoration Advisory Board (RAB) in 1994, MAFB first meeting was held 8 Feb 95. The RAB is an advisory body designed to act as a focal point for the exchange of information between MAFB and the local community regarding restoration activities. RAB meetings are held every 6 months and notice of the meetings are placed in the Minot Daily News.

13.0 Selected Remedy

13.1 One remedy was selected for remediation of the contaminated media at the OWS. Contaminated soil is to be excavated and land treated at a permitted site until a level of 10 parts per million total petroleum hydrocarbons has been reached, at which time the soil is considered clean and reusable.

14.0 Evaluation of Selected Remedy

14.1 An analysis of the remedy was conducted to evaluate the remedy with respect to its relative performance in meeting nine criteria. These evaluation criteria are divided into three categories and have been developed by the EPA to address the technical and policy considerations that have proven important for selecting remedies. The nine criteria are found in (40 CFR 300.430(f)(1)(i)).

14.2 Threshold Criteria
1. Overall protection of human health and the environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARAR) Primary Balancing Criteria
3. Long-Term effectiveness and permanence.
4. Reduction of toxicity, mobility, or volume (TMV)
5. Short term effectiveness
6. Implementability
7. Cost Modifying Criteria
8. State Acceptance
9. Community Acceptance

14.3 Criterion 1: Overall Protection of Human Health and the Environment

a. Protectiveness is the primary requirement that remedial actions must meet under CERLCA. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed through each pathway at the site.

b. Remedy 1 – Excavation of the contaminated soil will remove the contamination from the immediate vicinity of the industrial area to an isolated treatment site. Remediation at the land treatment site will immediately begin to reduce and eliminate current risks posed by the contaminated soil and further prevent contamination of groundwater. The potential for human exposure to contamination at the OWS is eliminated.

14.4 Criterion 2: Compliance with ARAR

a. Compliance with ARAR is one of the statutory requirements of the remedy selection. Applicable requirements are cleanup standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. Relevant and
appropriate requirements address problems or situation sufficiently similar to those encountered at the site and thus their use is well suited to the environmental and technical factors at a particular site.

b. The primary ARAR at the OWS include site-specific contaminant levels, Land Treatment of Petroleum Contaminated Soils (Guidelines), Maximum Contaminant Level (MCL), and potentially the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act. Remedy 1 – This remedy seeks a cleanup level of 10 parts per million total petroleum hydrocarbons. Other contaminants will be reviewed on a case-by-case basis for determining corrective measures to be implemented. Land treatment according these guidelines, will reduce the contamination to below MCL. Proper management of the contaminated soil will prevent discharges in violation of the NPDES.

14.5 Criterion 3: Long Term Effectiveness and Permanence

a. This criterion reflects CERCLA emphasis on implementing remedies that will ensure protection of human health and the environment in the long term. The assessment of remedies against this criterion evaluates the residual risks at a site after completion of a remedial action.

b. Remedy 1 – This remedy will achieve long-term effectiveness and permanence through remediation of contaminated media to a "clean" condition. Upon completion, the residual risks will be less than industrial screening levels.

14.6 Criterion 4: Reduction of Toxicity, Mobility, and Volume (TMV)

a. This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies a remedy may employ.

b. Remedy 1 – Treatment of the contaminants in a permitted land treatment site through the activity of resident microorganisms in the soil has been shown effective in reducing the TMV. Petroleum hydrocarbons serve as food for the microorganisms. An increase in microbiological activity and numbers of organisms confirms the activity taking place. Analysis of contaminant concentrations will be reduced in response to the microbe activity.

14.7 Criterion 5: Short Term Effectiveness

a. This criterion addresses short-term impacts of the remedy. The assessment against this criterion examines the effectiveness of remedies in protecting human health and the environment during the construction and implementation of a remedy.

b. Remedy 1 – This remedy will create short-term exposure pathways during the excavation and land farming activity, during repair of OWS, and during well installation and sampling events.

14.8 Criterion 6: Implementability

a. The assessment against this criterion evaluates the technical and administrative feasibility of the remedy and the availability of the goods and services needed to implement them.
b. Remedy 1 – This remedy is technically low in goods and services needed for implementability and readily available. Administrative functions are minimal once a permitted land treatment site is established.

14.9 Criterion 7: Cost

a. Cost encompasses all engineering, construction, and operation and maintenance costs incurred over the life of the project. The assessment against this criterion is based on the present worth of these costs for each alternative.

b. Remedy 1- The cost for this remedy varies according to the amount of soil and the concentration of contamination at each oil/water separator location.

14.10 Criterion 8: State Acceptance

a. This criterion, which is an ongoing concern throughout the corrective action process, reflects the statutory requirement to provide for substantial and meaningful State involvement.

b. North Dakota Department of Health (NDDH) recognizes this remedy as an acceptable form of remedial action.

14.11 Criterion 9: Community Acceptance

a. This criterion reflects the community’s apparent preferences or concerns about remedies.

b. The RAB, and IR have been the avenues in which the base has informed the community of IRP and RCRA Corrective Action activities. RAB meetings are held twice each year to update members on corrective action activity. RAB meetings, and the IR have provided an opportunity for public comment/involvement in RCRA and IRP remediation activities. A 30-day notice of a 45-day public comment period regarding the permit to be issued and incorporating this selected remedy will be given.

c. The community members have been favorable toward this remedy.

15.0 SWMU Status

15.1 NO CONTAMINATION PRESENT: There are eight sites (7d, 7e, 7l, 7n, 7o, 7p, 7q, 7r) where no contamination was encountered. However, all the OWS (except 7-r) were removed from the ground and replaced with an aboveground Ultra-cept (oil/water separator), if the mission required an OWS. At 7r the OWS is used as a holding chamber and it was replaced by an aboveground ultra-cept. No further action is required at any of above reference sites.

15.2 CONTAMINATION PRESENT WAS REMOVED: There are two sites (7c, 7s) where contamination was present, and all associated contamination was removed when the OWS was removed. No Further Action is required at any of these sites.

15.3 CONTAMINATION PRESENT, ALL ACCESSIBLE CONTAMINATION REMOVED: There are nine sites (7a, 7b, 7f, 7g, 7h, 7i, 7j, 7k, 7m) where contamination was present, however all accessible contamination was removed when the OWS were removed. The OWS at 7k still remains in place inside the building. Contamination still remains under the foundations of these buildings, and it is technically impractical to remove until the building is taken out
of service, i.e., demolished. Therefore no further action is required at any of these sites until the buildings are taken out of service or demolished. At 7f, 7g, and 7h, very small amounts of contamination remain along the foundation, however it could not be removed without jeopardizing the building foundation.

15.4 All Oil/water separators (OWS) have been removed (except 7k), and all accessible contamination was removed. Lab analysis of all excavations and closure reports were sent to the North Dakota Department of Health and are also available and on file in 5th Civil Engineering’s, Environmental Engineering office. Currently no further action is required at any of these sites. Material of construction for OWS was either: Con = concrete, or Stl=steel.
<table>
<thead>
<tr>
<th>Solid Waste Management Unit (SWMU)</th>
<th>Bldg Number</th>
<th>Installation Date/Capacity (gal)/Material</th>
<th>Date Removed</th>
<th>Contamination Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>7a</td>
<td>457</td>
<td>1962/1,000/Con</td>
<td>26 May 1992</td>
<td>REMAINS Contamination under Foundation</td>
</tr>
<tr>
<td>7b</td>
<td>460</td>
<td>1963/1,000/Con</td>
<td>26 May 1992</td>
<td>REMAINS Contamination under Foundation and Utilities</td>
</tr>
<tr>
<td>7c</td>
<td>521</td>
<td>1982/1,400/Con</td>
<td>10 June 1996</td>
<td>REMOVED 120 CY, No Contamination Remains</td>
</tr>
<tr>
<td>7d</td>
<td>758</td>
<td>1957/2,900/Con</td>
<td>20 May 1997</td>
<td>NONE</td>
</tr>
<tr>
<td>7e</td>
<td>761</td>
<td>1985/8,550/Con</td>
<td>6 April 1999</td>
<td>NONE</td>
</tr>
<tr>
<td>7f</td>
<td>765</td>
<td>1978/500/Con</td>
<td>1993</td>
<td>REMAINS Removed 50 CY, Contamination Remains under Foundation</td>
</tr>
<tr>
<td>7g</td>
<td>837</td>
<td>1962/5,000/Con</td>
<td>9 Dec 1998</td>
<td>REMAINS Removed 200 CY, very minor amounts remain under Hanger Foundation</td>
</tr>
<tr>
<td>7h</td>
<td>836 &amp; 837</td>
<td>1977/6,000/Con</td>
<td>9 Dec 1998</td>
<td>SLIGHT Removed 200 CY</td>
</tr>
<tr>
<td>7i</td>
<td>862 &amp; 863</td>
<td>1959/2,900/Con</td>
<td>28 July 1999</td>
<td>REMOVED 80 CY, Contamination remains</td>
</tr>
<tr>
<td>7j</td>
<td>867 &amp; 868</td>
<td>1959/2,900/Con</td>
<td>Abandoned in Place 1991</td>
<td>CONTAMINATION REMAINS</td>
</tr>
<tr>
<td>7k</td>
<td>869</td>
<td>1983/50/Stl</td>
<td>Out of Service, OWS in floor of bldg</td>
<td>REMAINS Contamination under Foundation</td>
</tr>
</tbody>
</table>
### Solid Waste Management Unit (SWMU) Summary

<table>
<thead>
<tr>
<th>Solid Waste Management Unit (SWMU)</th>
<th>Bldg Number</th>
<th>Installation Date/Capacity (gal)/Material</th>
<th>Date Removed</th>
<th>Contamination Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>7l</td>
<td>870</td>
<td>1990/2,500/Stl</td>
<td>1 Nov 1995</td>
<td>NONE</td>
</tr>
<tr>
<td>7m</td>
<td>970</td>
<td>1988/5,000/Stl</td>
<td>22 March 1999</td>
<td>CONTAMINATION REMAINS</td>
</tr>
<tr>
<td>7n</td>
<td>1135</td>
<td>1988/4,000/Stl</td>
<td>13 May 1997</td>
<td>NONE</td>
</tr>
<tr>
<td>7o</td>
<td>1144</td>
<td>1988/4,000/Stl</td>
<td>19 May 1997</td>
<td>NONE</td>
</tr>
<tr>
<td>7p</td>
<td>2035</td>
<td>1979/500/Con</td>
<td>27 May 1992</td>
<td>NONE</td>
</tr>
<tr>
<td>7q</td>
<td>2038</td>
<td>1992/550/Stl</td>
<td>5 Dec 1998</td>
<td>NONE</td>
</tr>
<tr>
<td>7r</td>
<td>2196</td>
<td>1978/22,000</td>
<td>Used as a holding chamber</td>
<td>NONE</td>
</tr>
<tr>
<td>7s</td>
<td>2221</td>
<td>1960/5,000/Con</td>
<td>22 May 1992</td>
<td>NONE Associated Contamination was removed, Site was placed under SWMU 2</td>
</tr>
</tbody>
</table>

### CONCLUSION

16.1 The selected remedy for the contaminated OWS, where practical, was the removal and treatment of the contaminated soil. Removal and treatment of contaminated soil was protective of human health and the environment by eliminating the contaminants of concern, thus eliminating human exposure and preventing migration of contaminants.

16.2 At those contaminated sites, which were technically impractical to remediate due to existing structures, the presence of the contaminated soils has been documented and will be removed if/when the building is removed.

16.3 In summary, all contamination at the OWS designated as SWMU 7a-s that was technically feasible and practical to remove has been removed and treated to reduce the contamination to below regulatory and risk base levels. At those sites where contamination remains under the buildings, further corrective measures will be implemented when access to the soils is possible due to building demolition/reconstruction. No further action is required at any of these SWMU at this time.
This addendum specifically addresses SWMU 7q which is addressed in NDDH Decision Document for SWMU 7a-7s dated May 10, 1999, updated December 6, 2013 (see above).

Site OW545 encompasses the former location of oil water separator 7q and underground used oil storage tank 4s. The oil/water separator was removed December 5, 1998 during which no contamination was encountered. The underground storage tank was removed on 1 October 1992 along with 3,400 cubic yards of petroleum contaminated soil. Sampling results indicated that all contamination technically feasible and practical to remove had been removed and treated to reduce the contamination to below regulatory and risk base levels. Accordingly, it was determined that no further action was required and OW545 could be considered closed in the context of the Minot AFB environmental restoration program (ERP).

However, while installing temporary monitoring wells at site OW545 during June of 2015, field staff of ARGO/LRS JV—the Upper Midwest Performance Based Remediation contractor—noted soil contamination (i.e., elevated photoionization detector (PID) readings and black coloring of soil) in the bore logs. Consequently, Site OW545—to include SWMU 4s and 7q—is no longer considered closed.

Accordingly, for OW545, the Air Force has programmed for a Remedial Investigation/Feasibility Study in 2019 and a Proposed Plan/Record of Decision in 2020 to respectively determine the nature and extent of contamination in both soil and groundwater and identify appropriate remedial activities.
OIL/WATER SEPARATOR (SWMU 7A) REMOVED 26 MAY 1992

OIL/WATER SEPARATOR (SWMU 7B) REMOVED 26 MAY 1992

SWMU 7A AND 7B
WEST OF BLDG 457 AND
NORTH OF BLDG 460

SCALE 1" = 50'-0"

O/W Separators
- BLUE: REMOVED OIL WATER SEPARATOR (CONTAMINATED SITE)
- GREEN: REMOVED OIL WATER SEPARATOR (CLEAN SITE)
- LIGHT BLUE: OIL WATER SEPARATOR CONVERTED TO SUMP
OIL/WATER SEPARATOR (SWMU 7C) REMOVED 10 JUN 1996

SWMU 7C NORTH WEST OF BLDG 521

SCALE 1" = 50' - 0"

O/W Separators
- Blue: REMOVED OIL WATER SEPARATOR (CONTAMINATED SITE)
- Green: REMOVED OIL WATER SEPARATOR (CLEAN SITE)
- Light Blue: OIL WATER SEPARATOR CONVERTED TO SUMP
OIL/WATER SEPARATOR (SWMU 7E)
REMOVED 6 APRIL 1999

SWMU 7E
NORTH EAST OF BLDG 761

O/W Separators
- RED: REMOVED OIL WATER SEPARATOR (CONTAMINATED SITE)
- BLUE: OIL WATER SEPARATOR CONVERTED TO SUMP
- GREEN: REMOVED OIL WATER SEPARATOR (CLEAN SITE)

SCALE 1" = 50' 0"
(2) OIL/WATER SEPARATOR (SWMU 7G & 7H)
REMOVED 9 DEC 1998
OIL/WATER SEPARATOR (SWMU 71) REMOVED 28 JULY 1999

SCALE 1" = 50'-0"

O/W Separators
- 🔴 REMOVED OIL WATER SEPARATOR (CONTAMINATED SITE)
- 💚 OIL WATER SEPARATOR CONVERTED TO SUMP
- 🔵 REMOVED OIL WATER SEPARATOR (CLEAN SITE)
OIL/WATER SEPARATOR (SWMU 7J)
REMOVED 2 AUG 1999

SWMU 7J
NORTH OF BLDG 868

O/W Separators
- **Blue**: REMOVED OIL WATER SEPARATOR (CONTAMINATED SITE)
- **Green**: REMOVED OIL WATER SEPARATOR (CLEAN SITE)
- **Light Green**: OIL WATER SEPARATOR CONVERTED TO SUMP

SCALE 1" = 50'-0"
OIL/WATER SEPARATOR 869 (SWMU 7K) CONVERTED TO SUMP FOR ABOVE GROUND ULTRACEPT SEPARATOR CONTAMINATION REMAINS

SWMU 7K INSIDE OF BLDG 869

O/W Separators
-_removed oil/water separator (contaminated site)
- oil water separator converted to sump
- removed oil water separator (clean site)

SCALE 1" = 50'-0"
OIL/WATER SEPARATOR (SWMU 7M)
REMOVED 22 MAR 1999
OIL/WATER SEPARATOR (SWMU 7N)
REMOVED 13 MAY 1997

SCALE 1" = 50'-0"

O/W Separators
- REMOVE OIL WATER SEPARATOR (CONTAMINATED SITE)
- OIL WATER SEPARATOR CONVERTED TO SUMP
- REMOVE OIL WATER SEPARATOR (CLEAN SITE)
OIL/WATER SEPARATOR (SWMU 7P) REMOVED 27 MAY 1992

OIL/WATER SEPARATOR (SWMU 7Q) REMOVED 5 DEC 1998

SWMU 7P & 7Q
EAST OF BLDG 2038

SCALE 1" = 50'-0"

O/W Separators
- **REMOVED OIL WATER SEPARATOR (CONTAMINATED SITE)**
- **OIL WATER SEPARATOR CONVERTED TO SUMP**
- **REMOVED OIL WATER SEPARATOR (CLEAN SITE)**
OIL/WATER SEPARATOR 2196 (SWMU 7R) USED AS A HOLDING CHAMBER

SWMU 7R
EAST OF POL FARM (2196)

O/W Separators
- 🔴 REMOVED OIL WATER SEPARATOR (CONTAMINATED SITE)
- 🔵 OIL WATER SEPARATOR CONVERTED TO SUMP
- ⬠ REMOVED OIL WATER SEPARATOR (CLEAN SITE)

SCALE 1" = 50' - 0"
OIL/WATER SEPARATOR (SWMU 7S) REMOVED 22 MAY 1992

SWMU 7S
WEST SIDE OF OLD FIRE PROTECTION TRAINING AREA AND NEAR FLIGHT LINE DRIVE

O/W Separators
- REMOVED OIL WATER SEPARATOR (CONTAMINATED SITE)
- OIL WATER SEPARATOR CONVERTED TO SUMP
- REMOVED OIL WATER SEPARATOR (CLEAN SITE)

SCALE 1" = 50'-0"
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Decision Document

SWMU 7t-7aa

Basewide Oil Interceptors
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DECISION DOCUMENT
SOLID WASTE MANAGEMENT UNITS 7t, 7u, and 7w-aa
OIL INTERCEPTORS

May 10, 1999

0.0 Site and Location

0.1 Minot Air Force Base, North Dakota

1.0 Statement of Basis

1.1 The decision described herein concerns the selected remedy (SR) at seven Oil Interceptors (OI) identified as Solid Waste Management Units (SWMU) 7t, 7u, and 7w-aa located at various locations throughout the installation. It is based on an evaluation of the results received from corrective action performed under the Resource Conservation Recovery Act (RCRA) Compliance Program and the United States Air Force Installation Restoration Program (IRP). Documented studies include the RCRA Facility Assessments of June 1989 and July 1992, Phase I RCRA Facility Investigation 1995, and Corrective Measure Implementation 1997-1999.

2.0 Remedy Selection

2.1 A remedy was selected depending on the presence of contamination, its concentration, practical ability of remediation and risk posed. The OI were investigated and classified in one of five ways: 1. No contamination present. 2. Contamination present (Active Site), recommend consolidate under SWMU 3, which is already undergoing annual LTM. 3. Contamination present, all accessible contamination was removed. 4. Abandoned in place. 5. Active Sites, recommend reclassify as sand traps per December 1999 Pacific Environmental Services, Inc. Study.

3.0 Declaration of Consistency with CERCLA and NCP

3.1 This document presents the selected remedy for these sites developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, National Contingency Plan (NCP), and the Resource Conservation and Recovery Act (RCRA) of 1976, as amended.

4.0 Facility

4.1 Minot AFB (MAFB) is located approximately 12 miles north of Minot, North Dakota, in Ward County, as shown in Figure 1-1. Prior to 1955, the property comprising MAFB was farmland. The government purchased the land in 1955, and construction began approximately two years later. The main base area encompasses approximately 4,636 acres. The land use adjacent to the base is predominately agricultural.

4.2 Reference Table 1 for a list of the OI removed/abandoned under the RCRA Corrective Action Program and the IRP.

5.0 Physiography

5.1 MAFB is located within the Central Recharge Area, a 1,333 square mile, nearly flat expanse of glacial ground moraine. The Central Recharge Area is mantled by several hundred feet of glacial drift. The ground surface slopes gently toward the northeast and contains thousands of small, poorly draining prairie potholes (Pettyjohn and Hutchinson 1971).
5.2 Imported vegetation and pavements have displaced the natural land surface and most native plant species on Minot AFB. Nonnative species such as barnyard grass, downy brome, green foxtail, and crested wheatgrass occur throughout the base. Spruce, green ash, Russian olive, and juniper trees have been planted to provide landscaping and windbreaks.

6.0 Adjacent Land Uses

6.1 MAFB is located in the Northern Great Plains native grassland (e.g. Blue grama and western wheat grass). Most of the area surrounding the base has been converted to agriculture (EA Engineering 1990).

7.0 Geology

7.1 MAFB is situated upon a laterally, and vertically extensive ground moraine plain. The ground moraine is a glacial sediment composed almost entirely of till. The till is characterized as an unstratified deposit of sediment with a particle size ranging from clay to boulders. However, clay and silt size particles account for the largest percentage of the sediment volume sample. The completed boring program confirmed that this till extends to a depth of at least 100 feet beneath MAFB. Deeper borings completed in the vicinity of MAFB indicate the till extends to depths ranging from 140 to 180 feet. Below that depth, the Paleozoic bedrock surface is encountered. Quaternary glacial sediments rest unconformably upon an irregular Paleozoic bedrock surface.

7.2 The only type of deposit other than till present within the glacial sediments is a minor occurrence of glacial sand and gravel. A review of available literature and the completed borings indicate that these sand and gravel deposits are discontinuous, lenticular, and contain a variety of sediment types. These sand and gravel deposits account for less than 5% of the total volume of the first 100 feet of glacial sediments. Generally, the sand and gravel deposits are scattered throughout the till.

7.3 The ground moraine plain beneath MAFB is part of what is referred to in the literature as the Central Recharge Area. The term recharge refers to the process in which water, emanating from precipitation, enters water-bearing units.

7.4 The results of geotechnical sampling completed during investigations at MAFB indicated the permeability of the glacial till to be approximately in the range of 10(-6) to 10 (-8) cm/sec, which, in relative terms, is very low. This range is commensurate with the permeability values of glacial till reported in the literature. By use of this information and other information obtained during other on base investigations, it was determined that the rate of movement of water downward through this glacial till is in the range of a few centimeters to a few feet per year.

8.0 Hydrology

8.1 MAFB is located within the Souris River drainage system. The base is many miles upstream from this major river. MAFB is located within the Egg Creek drainage basin, which is an intermittent tributary basin of the Souris River. Egg Creek drains eastward about 30 miles to North Lake, which in turn drains north to the Souris River via Cut Bank Creek. Because Egg Creek is an intermittent Class III Stream, North Dakota’s least stringent surface-water-quality standards apply (EA Engineering 1990). No area of MAFB is located in a designated floodplain, although ponding does occur in natural potholes on the base.

8.2 Regional surface drainage is controlled by the Souris River, which originates in Saskatchewan, Canada. The Souris River enters North Dakota flowing generally southeast. About 30 miles southeast of MAFB, it loops northeast, then north where it reenters Canada
through Manitoba, eventually discharging into Hudson Bay. Flow is regulated by a U.S./Canada joint commission. Area runoff is sparse. The Souris River has one perennial tributary in North Dakota, the Des Lacs River (State of North Dakota 1984).

8.3 The Souris River is a Class IA stream. Its waters are suitable for domestic supply after conventional treatment and softening. The Des Lacs River is a Class II stream. Its waters are suitable for domestic supply after advanced treatment.

8.4 Deposits of outwash sands and gravels form very productive aquifers along the major river valleys (Winter et al. 1984) such as the Minot and Sundre buried channel aquifers occurring near the town of Minot (Figure 1-4). Typical aquifer thickness is less than 100 feet.

8.5 Several sedimentary bedrock aquifers, such as the Fort Union and Fox Hills-Hell Creek aquifers of Tertiary age, underlie the Minot area below the glacial deposits at depths usually greater than 200 feet. These aquifers are relatively productive, but their poor water quality limits their use to livestock watering and domestic consumption only in areas where no other source is available (Winter et al. 1984).

9.0 Surface Hydrology

9.1 Surface water drainage on MAFB is restricted primarily to drainage ditches, and lines that drain to two ditches which flow north into Egg Creek. The western primary drainage ditch uses a glacial melt water channel to carry surface water runoff to Egg Creek. Some storm water runoff on the west end of the runway area flows west to a south flowing intermittent stream (Reynolds, 1984).

9.2 There are no perennial steams on MAFB. Surface water on the Base comes from surface runoff. Egg Creek which receives most of the surface drainage from MAFB, is designated as a Class III stream by the North Dakota Department of Health (NDDH). Class III streams are streams where the quality of water is adequate for industrial and agricultural uses such as cooling, washing, irrigation, and stock watering (NDDH, 1989).

10.0 Background

10.1 A RCRA Facility Assessment (RFA) was conducted for MAFB by the Environmental Protection Agency (EPA). Versar Inc. conducted a visual site inspection in conjunction with EPA and the NDDH on June 29, 1989. The RFA identified four Solid Waste Management Units (SWMU): the Defense Reutilization and Marketing Office (DRMO), the Explosive Ordnance Disposal Area (EODA), the Fire Protection Training Area (FPTA), and the Sanitary Landfill Area (SLA).

10.2 Comparison of the MAFB RFA report with those performed at other Air Force Bases indicated that the number and type of SWMU normally associated with an Air Force Base were not identified. Based upon this comparison, the EPA elected to perform a second RFA for MAFB in 1992 to ensure that all SWMU were identified and that the potential for release of hazardous constituents to the environment from these SWMU were evaluated.

10.3 The second RFA was performed by Science Applications International Corporation and A.T. Kearney, Inc., the visual site inspection was performed on July 23 and 24, 1992. Based on the results of this inspection, information acquired during State/Federal file searches, and data from the Part B Permit application, 150 SWMU and 2 Areas of Concern (AOC) were identified. Of these 150 SWMU, 63 SWMU were determined to require further action. The OI were added to MAFB RCRA Program as SWMU 7 t–bb. There were nine OI, all of which were located underground, which were included in the 63 SWMUs.
10.4 The nine OI were located throughout MAFB, locations are noted in the following figures. The OI were used as oil storage tanks, the oil was skimmed off and the water was run through the OI, and then the oil collects above the water in the concrete OI.

10.5 The OI were investigated under the MAFB Phase I RFI conducted in 1995. These sites were included as SWMU because of the potential to contaminate soil and/or groundwater.

10.6 During the RFI, borings were advanced, groundwater monitor wells were installed and soil samples were collected for chemical analysis, headspace screening, and lithologic data. Soil and groundwater samples were analyzed for Volatile Organic Compounds, Total Recoverable Petroleum Hydrocarbons (Diesel Range Organics), and total Cadmium, Chromium, and Lead.

10.7 During the Corrective Measure Implementation (CMI), samples were obtained and tested for Total Petroleum Hydrocarbons (TPH), benzene, toluene, ethyl benzene, and xylene (BTEX), chromium and lead. These samples were used to verify the site was clean or dirty after the OI was removed or modified (piped straight on through, so the manway actually currently serves no purpose). Operations in corresponding buildings have changed and no longer warrant an OI, so water leaving the Bldg can be discharged to the sanitary sewer. Some buildings were retrofitted with an aboveground oil/water separator (ultracept).

11.0 Public Community and Regulatory Agencies

11.1 An Administrative Record (AR) is the legal record of the physical situation at an installation by which response actions are reviewed and defended. An AR must be established at each installation which has conducted or is conducting IRP activities and must be available to the public at or near the installation. This record is maintained at the following location and is updated as needed by the base Remedial Project Manager.

5 CES/CEV
320 Peacekeeper Place
Minot AFB, ND 58705-5006

11.2 An Information Repository (IR) is a project file on IRP activities at AF installations. The repository is to be established for all remedial action sites and for all sites where removal actions last longer than 120 days. It is located either on or off base at a place convenient to the community and contains site information, investigatory reports, information about the sources and nature of the contaminants, and a schedule for cleanup operations. The IR is intended to address community relations requirements and is a source of reading material for the public. This is maintained at the following location and is updated as needed by the base Remedial Project Manager.

Minot State University Library 500
University West
Minot, ND 58703

12.0 Technical Review Committees/Restoration Advisory Boards

12.1 A Technical Review Committee (TRC) was established at Minot AFB Apr 92 to review and comment on Department of Defense actions and proposed actions with respect to releases or threatened releases of hazardous substances into the environment at MAFB. The TRC was also established to ensure open communication and exchange of ideas with the general public about the MAFB IRP and CERCLA (1980), SARA (1986), and RCRA (1976).
12.2 The primary purpose and function of the TRC was informational, specifically to foster community and interagency awareness and understanding of MAFB IRP remedial actions related to the releases or threatened releases of hazardous substances at MAFB.

12.3 The TRC was replaced by the Restoration Advisory Board (RAB) in 1994, MAFB first meeting was held 8 Feb 95. The RAB is an advisory body designed to act as a focal point for the exchange of information between MAFB and the local community regarding restoration activities. RAB meetings are held every 6 months and notice of the meetings are placed in the Minot Daily News.

13.0 Selected Remedy

13.1 One remedy was selected for remediation of the contaminated soil at the OI. Contaminated soil was excavated and land treated at a permitted site until a level of 10 parts per million total petroleum hydrocarbons has been reached, at which time the soil was considered clean and reusable.

14.0 Evaluation of Selected Remedy

14.1 An analysis of the remedy was conducted to evaluate the remedy with respect to its relative performance in meeting nine criteria. These evaluation criteria are divided into three categories and have been developed by the EPA to address the technical and policy considerations that have proven important for selecting remedies. The nine criteria are found in (40 CFR 300.430(f)(1)(i)).

14.2 Threshold Criteria
   a. Overall protection of human health and the environment
   b. Compliance with Applicable or Relevant and Appropriate Requirements (ARAR)
      Primary Balancing Criteria
   c. Long-Term effectiveness and permanence.
   d. Reduction of toxicity, mobility, or volume (TMV)
   e. Short term effectiveness
   f. Implementability
   g. Cost Modifying Criteria
   h. State Acceptance
   i. Community Acceptance

14.3 Criterion 1: Overall Protection of Human Health and the Environment
   a. Protectiveness is the primary requirement that remedial actions must meet under CERLCA. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed through each pathway at the site.
   b. Remedy 1- Excavation of the contaminated soil will remove the contamination from the immediate vicinity of the industrial area to an isolated treatment site. Remediation at the land treatment site will immediately begin to reduce and eliminate current risks posed by the contaminated soil and prevents further contamination of ground water. The potential for human exposure to contamination at the OI is eliminated.

14.4 Criterion 2: Compliance with ARAR
   a. Compliance with ARAR is one of the statutory requirements of the remedy selection. Applicable requirements are cleanup standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. Relevant and
appropriate requirements address problems or situation sufficiently similar to those encountered at the site and thus their use is well suited to the environmental and technical factors at a particular site. The primary ARAR at the OI include site-specific contaminant levels, Land Treatment of Petroleum Contaminated Soil (Guidelines), Maximum Contaminant Level (MCL), and potentially the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act.

b. Remedy 1- This remedy seeks a cleanup level of ten parts per million total petroleum hydrocarbons. Other contaminants will be reviewed on a case-by-case basis for determining corrective measures to be implemented. Land treatment according to these guidelines, will reduce the contamination to below MCL. Proper management of the contaminated soil will prevent discharges in violation of the NPDES.

14.5 Criterion 3: Long Term Effectiveness and Permanence

a. This criterion reflects CERCLA emphasis on implementing remedies that will ensure protection of human health and the environment in the long term. The assessment of remedies against this criterion evaluates the residual risks at a site after completion of a remedial action. Remedy 1 – This remedy will achieve long-term effectiveness and permanence through remediation of contaminated media to a “clean” condition. Upon completion, the residual risks will be less than industrial screening levels.

14.6 Criterion 4: Reduction of Toxicity, Mobility, and Volume (TMV)

a. This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies a remedy may employ.

b. Remedy 1- Treatment of the contaminants in a permitted land treatment site through the activity of resident microorganisms in the soil has been shown effective in reducing the TMV. Petroleum hydrocarbons serve as food for the microorganisms. An increase in microbiological activity and numbers of organisms confirms the activity taking place. Analysis of contaminant concentrations will be reduced in response to microbe activity.

14.7 Criterion 5: Short Term Effectiveness

a. This criterion addresses short-term impacts of the remedy. The assessment against this criterion examines the effectiveness of remedies in protecting human health and the environment during the construction and implementation of a remedy.

b. Remedy 1- This remedy will create short-term exposure pathways during excavation, sampling events, and land farming activities.

14.8 Criterion 6: Implementability

a. The assessment against this criterion evaluates the technical and administrative feasibility of the remedy

b. Remedy 1 - This remedy is technically low in goods and services needed for implementation and are readily available. Administrative functions are minimal once a permitted land treatment site is established.
14.9  **Criterion 7: Cost**  
   a. Cost encompasses all engineering, construction, and operation and maintenance costs incurred over the life of the project. The assessment against this criterion is based on the present worth of these costs for each alternative.  
   b. Remedy 1- The cost for this remedy varies according to the amount of soil and the concentration of contamination at each OI location.

14.10  **Criterion 8: State Acceptance**  
   a. This criterion, which is an ongoing concern throughout the corrective action process, reflects the statutory requirement to provide for substantial and meaningful State involvement.  
   b. Remedy 1- North Dakota Department of Health (NDDH) recognizes this remedy as an acceptable form of remedial action.

14.11  **Criterion 9: Community Acceptance**  
   a. This criterion reflects the community’s apparent preferences or concerns about remedies.  
   b. The RAB, and IR have been the avenues in which the base has informed the community of IRP and RCRA Corrective Action activities. RAB meetings are held twice each year to update members on corrective action activity. RAB meetings, and the IR have provided an opportunity for public comment/involvement in RCRA and IRP remediation activities. A 30-day notice of a 45-day public comment period regarding the permit to be issued and incorporating this selected remedy will be given.  
   c. There has been little public interest in this activity based on the questions/comments posed by community members.  
   d. Remedy 1- The RAB members have been favorable toward this remedy.

15.0  **SWMU Status**  

15.1  **NO CONTAMINATION PRESENT.** There was one site, 7x, where no contamination was encountered.

15.2  **CONTAMINATION PRESENT BUT BELOW REGULATED LEVELS, ACTIVE SITE.** There was one site, 7t, where contamination was present. However 7t is located within the boundaries of SWMU 3, which is currently undergoing annual LTM. RCRA Phase I investigation recommended additional groundwater sampling. OI was converted into a sump to be used in conjunction with new aboveground ultracept installed. Recommend North Dakota Department of Health place 7t under SWMU 3.

15.3  **CONTAMINATION REMAINS IN PLACE, ALL ACCESSIBLE CONTAMINATION REMOVED.** There was one site (7y) that fell under this category. Remaining contamination is not accessible due to adjacent building foundation and/or utilities. Contamination remains in place. Contamination will be removed if/when the building is demolished.
15.4 ABANDONED IN PLACE. There is one site (7u) where OI was abandoned in place and the influent and effluent line were connected together with PVC pipe. No further action required per Phase I RCRA Facility Investigation at 7u.

15.5 ACTIVE SITE/NO FURTHER ACTION. There are three active sites (7w, 7z, and 7aa). Contractor Pacific Environmental Services Inc. (PES) performing OI study November 1999, recommended 7z and 7aa be reclassified as sand traps due to their size, very small sand/grease traps down to 20 pounds capacity. Sites 7w, 7z, and 7aa Require No Further Action per the NDDH.
SWMUs 7t, 7u, and 7w-aa—OIL INTERCEPTORS

<table>
<thead>
<tr>
<th>Solid Waste Management Unit (SWMU)</th>
<th>BLDG NUMBER</th>
<th>Installation Date/ Capacity (gal)/Material</th>
<th>OI Active/Abandoned/No Further Action/Removed</th>
<th>Contamination STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7t</td>
<td>418</td>
<td>1974/360/Con</td>
<td>NO FURTHER ACTION</td>
<td>Addressed under SWMU 3, undergoing LTM</td>
</tr>
<tr>
<td>7u</td>
<td>442</td>
<td>1963/900/Con</td>
<td>NO FURTHER ACTION</td>
<td>No Action Required. Site closed by NDDH.</td>
</tr>
<tr>
<td>7w</td>
<td>899</td>
<td>1986/550/Con</td>
<td>NO FURTHER ACTION</td>
<td>No Action Required per Phase I RFI</td>
</tr>
<tr>
<td>7x</td>
<td>971</td>
<td>1988/1500/Con</td>
<td>REMOVED/No Further Action</td>
<td>No Contamination Encountered</td>
</tr>
<tr>
<td>7y</td>
<td>995</td>
<td>1979/1000/Stee</td>
<td>REMOVED/Contamination in Place</td>
<td>Contaminated Soil Removed/Remains in Place Under Bldg</td>
</tr>
<tr>
<td>7z</td>
<td>1113</td>
<td>1974/&lt;20/Con</td>
<td>NO FURTHER ACTION</td>
<td>No Action Required per Phase I RFI</td>
</tr>
<tr>
<td>7aa</td>
<td>1122</td>
<td>1974/360/Con</td>
<td>NO FURTHER ACTION</td>
<td>No Action Required per Phase I RFI</td>
</tr>
</tbody>
</table>

16.0 CONCLUSION

16.1 The selected remedy for the OI, where practical was the removal and treatment of the contaminated soil. Removal and treatment of contaminated soil was protective of human health and the environment by eliminating the contaminants of concern, thus eliminating human exposure and preventing migration of contaminants.

16.2 At 7y were it was technically impracticable to remediate due to existing structures. The presence of the contaminated soil has been documented and will be removed if/when the building is removed. No further action is recommended at this time.

16.3 In summary, all contamination at the OI designated as SWMU 7t, 7u, 7w-7aa that was technically feasible and practical to remove has been removed and treated to reduce the contamination to below regulatory and risk base levels. Site 7t shall be placed under the LTM program for SWMU 3. Site 7u was abandoned in place and connected to sanitary sewer. At 7y where contamination remains under the buildings, further corrective measures will be implemented when access to the soils is possible due to building demolition/reconstruction. Recommend 7z and 7aa be reclassified as sand traps. No further action is required at any of other SWMU at this time.
OIL INTERCEPTOR CONVERTED TO SUMP (SWMU 7T)
360 GALLON

SWMU 7T
INSIDE BLDG 418

Oil/Water Interceptor

- OIL INTERCEPTOR CONVERTED TO SUMP
- REMOVED OIL INTERCEPTOR (CLEAN SITE)
- OPERATIONAL OIL INTERCEPTOR
- OIL INTERCEPTOR ABANDONED IN PLACE

SCALE 1" = 50'-0"
OIL INTERCEPTOR
900 GALLON (SWMU 7U)
ABANDONED IN PLACE

SWMU 7U
EAST OF BLDG 442

Oil/Water Interceptor

- OIL INTERCEPTOR CONVERTED TO SUMP
- REMOVED OIL INTERCEPTOR (CLEAN SITE)
- OPERATIONAL OIL INTERCEPTOR
- OIL INTERCEPTOR ABANDONED IN PLACE
Oil/Water Interceptor

- Oil Interceptor converted to sump
- Removed oil interceptor (clean site)
- Operational oil interceptor
- Oil interceptor abandoned in place

SWMU 7X
South of Bldg 971

Scale 1” = 50’-0”

Oil Interceptor

OIL INTERCEPTOR (SWMU 7X) 1500 GALLON
REMOVED 13 AUG 1999
Decision Document

SWMU 8

Former Sanitary Landfill

ERP Site LF-02
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May 11, 1995

DAVID R EVANS COL USAF
5 CES/CEV
320 PEACEKEEPER PLACE
MINOT AFB ND 58705-5006

Dear Col. Evans:

This regards correspondence from your office date May 4, 1995 concerning the closure of the Minot Air Force Base Sanitary Landfill (SU-097).

The Department has reviewed the documentation concerning the closure of the landfill and finds it acceptable. The decision document signed by Neil M. Knatterud, Director, Division of Waste Management, is enclosed.

The Department appreciates the efforts of you and your staff in properly closing the above-referenced landfill. We feel that the parties involved have been cooperative and diligent in all aspects of the landfill closure.

Should you have any questions concerning this matter, please contact me at (701) 328-5166.

Sincerely,

Kevin L. Solie, Env. Scientist
Solid Waste Program
Division of Waste Management

KLS-ilj
Enc.
cc: Kelly Dragseth, MAFB
AFFIDAVIT AND NOTICE OF DISPOSAL FACILITY

STATE OF NORTH DAKOTA
COUNTY OF WARD

The undersigned states that he is currently the 5th Support Group Commander for Minot Air Force Base, and makes this affidavit in that capacity and to satisfy the requirements of Section 23-29-13 of the North Dakota Century Code:

Minot AFB operated a landfill for the disposal of municipal and industrial waste from the initiation of base operations in 1957 until 1982. Operations after 1982 were restricted to construction/demolition rubble.

Minot AFB operated the landfill on the following described property in Ward County, North Dakota, NE 1/4 of NW 1/4 of Sec. 11 and the NE 1/4 of Sec11 TWP 157 N R 83W. The landfill consists of approximately one hundred twenty acres.

The main types of industrial waste generated by Minot AFB were: fuels, oils, solvents, paints, paint strippers, metal plating/treatment solutions, small amounts of explosives, and pesticides; waste fuel, oil, and solvents including JP-4, engine oil, PD 680, and acetone which were derived primarily from periodic maintenance and engine repair.

There are no records available regarding quantity of waste disposed of at the site. The facility did not receive any construction/demolition rubble after 5 Oct 92. Construction was completed on the closure project 15 Sep 94.

Landfill Operating Method:

Landfilling was performed by the traditional trench method. There are only partial and sketch like "plans of record" that show the sequence of filling, progression within the site, depths of trenches, areal location of filled areas, and depth of cover. It appears that trenches may have been designed for excavation to the 15 to 20 foot depth (reference attachment 1).

Available aerial photographs and information obtained from borings indicated that trenching and filling did not take place within the floodway of the drainage ditch through the site. The outer boundary of the filled area is limited by the lagoon embankment on the south and roadways on the north and east sides.

Landfill Closure:

The landfill site is bisected by a central drainage ditch. A 32 foot wide drainage ditch with an 8 foot wide concrete low flow liner was constructed within the central drainage ditch. The site was graded to fill and consolidate low spots and trench settlements and eliminate high spots. Run-off is directed toward the central drainage ditch and perimeter roadway ditches. A six inch trench drain was constructed between the lagoon and the landfill to intercept the flow of groundwater from the lagoons. This water is pumped back into the lagoon. The cap was constructed in two 12 inch layers (existing cover over the site ranged in depth from one to four feet): a lower barrier layer and a upper buffer layer. The barrier layer was placed in three 4 inch lifts and compacted to 95%. The buffer layer was placed in two six inch lifts and compacted to 90%. After completion of the buffer layer, a six inch layer of topsoil was spread evenly over the site, and the site was seeded to grass. A perimeter fence was constructed of 48
inch woven wire fabric and topped with two strands of barbed wire to enclose the site and discourage trespassing and vehicle traffic. Signs were also placed along the perimeter fence every 500 feet, stating “No Trespassing, Closed Landfill.” The site currently has 11 groundwater monitor wells around the perimeter of the landfill which will be monitored on a semiannual basis for the parameters addressed in the “Extended List of Parameters for Assessing Groundwater Quality at North Dakota Landfills-May 1993.” This sampling will continue for a period of five years and is subject to renewal for another five years, to continue for up to 30 years if required. Based on the results from each sampling round, the North Dakota State Department of Health will determine if the frequency of sampling needs to be increased and for how many years the sampling will be required.

The public is hereby notified that this facility, because of its prior use, is not suitable for building, earthmoving or tillage, except such actions as are necessary to ensure the long term integrity of the final cover, over the closed facility.

Date

[Signature]

DAVID R. EVANS, Colonel, USAF
Commander, 5th Support Group

State of North Dakota
County of Ward

On this 4th day of May in the year 1995, before me, the undersigned, a Notary Public in and for said county and state, personally appeared David R. Evans, Colonel, USAF. Known to me to be the person who is described in and who executed the within instrument, and acknowledged to me that he executed the same.

[Signature]

LORRAINE J. KING
Notary Public, Ward County, N Dakota
DECISION DOCUMENT

AOC B

Mass Parking Apron
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0.0 Site and Location

0.1 Minot Air Force Base, North Dakota

1.0 Statement of Basis

1.1 The decision described herein concerns the selected remedy (SR) for the Mass Parking Apron (MPA), identified as Area of Concern (AOC) B in the RCRA Part A Permit, which includes the MPA, removed pumphouses/USTs and 18,500 linear feet of underground hydrant refueling line extending from the POL area (SWMU 3) to the MPA. It is based on an evaluation of the results received from corrective action performed under the Resource, Conservation and Recovery Act (RCRA) Compliance Program.

2.0 Remedy Selection

2.1 The remedy was selected based on the presence of contamination, its concentration, practicality of remediation, and risk posed. The selected remedy for contamination under the concrete of the MPA is excavation and treatment of contaminated soils at the Base Corrective Action Management Unit (CAMU) or appropriate off-base land treatment area. Over 59,000 cubic yards of soil contaminated with JP-8 was excavated from the MPA between 2004 and 2006. This contaminated soil was land-farmed at the Base CAMU and treated to below 50 mg/kg Total Petroleum Hydrocarbons (TPH) as required by the North Dakota Department of Environmental Quality (NDDEQ). The treated soil was removed from the CAMU and stockpiled in the Base stockpile next to the CAMU for future use as clean soil. Contamination remains under concrete at the MPA where it is technically impractical to remove the soil which is under 18” thick concrete with both active and abandoned fuel lines, utilities and disruption of flight-line operations.

2.2 The selected remedy for contamination associated with the pumphouses will be addressed through a CERCLA Cleanup Process with a preliminary assessment (PA) and site inspection (SI) followed by a remedial investigation/feasibility study (RI/FS).

2.3 Where contamination remains for hazardous waste or hazardous constituents at levels that exceed established cleanup values, groundwater monitoring will be conducted to determine the impact and extent of contamination. Groundwater monitoring shall no longer be required when hazardous waste or hazardous constituents no longer exceed established cleanup values.

2.4 Long-term groundwater monitoring will be conducted as necessary to ensure hazardous waste or hazardous constituents are not migrating off-site.

3.0 Declaration of Consistency with CERLCA and NCP

3.1 This document presents the selected remedy for this site developed in accordance with the Resource, Conservation and Recovery Act (RCRA) of 1976, as amended.
4.0 Facility

4.1 Minot AFB (MAFB) is located approximately 12 miles north of Minot, North Dakota, in Ward County, as shown in Figure 1-1. Prior to 1955, the property comprising MAFB was farmland. The government purchased the land in 1955, and construction began approximately 2 years later.
The main base area encompasses approximately 4,636 acres. The land use adjacent to the base is predominately agricultural.

5.0 Physiography

5.1 MAFB is located within the Central Recharge Area, a 1,333 square-mile, nearly flat expanse of glacial ground moraine. The Central Recharge Area is mantled by several hundred feet of glacial drift. The ground surface slopes gently toward the northeast and contains thousands of small, poorly draining prairie potholes (Pettyjohn and Hutchinson 1971)

5.2 Imported vegetation and pavements have displaced the natural land surface and most native plant species on Minot AFB. Nonnative species such as barnyard grass, downy brome, green foxtail, and crested wheatgrass occur throughout the base. Spruce, green ash, Russian olive, and juniper trees have been planted to provide landscaping and windbreaks.

6.0 Adjacent Land Uses

6.1 MAFB is located in the Northern Great Plains native grassland (e.g. Blue grama and western wheat grass). Most of the area surrounding the base has been converted to agriculture (EA Engineering 1990).

7.0 Geology

7.1 MAFB is situated upon a laterally, and vertically extensive ground moraine plain. The ground moraine is glacial sediment composed almost entirely of till. The till is characterized as an unstratified deposit of sediment with a particle size ranging from clay to boulders. However, clay and silt size particles account for the largest percentage of the sediment volume sample. The completed boring program confirmed that this till extends to a depth of at least 100 feet beneath MAFB. Deeper borings completed in the vicinity of MAFB indicate the till extends to depths ranging from 140 to 180 feet. Below that depth, the Paleozoic bedrock surface is encountered. Quaternary glacial sediments rest unconformably upon an irregular Paleozoic bedrock surface.

7.2 The only type of deposit other than till present within the glacial sediments is a minor occurrence of glacial sand and gravel. A review of available literature and the completed borings indicate that these sand and gravel deposits are discontinuous, lenticular and contain a variety of sediment types. These sand and gravel deposits account for less than 5% of the total volume of the first 100 feet of glacial sediments. Generally, the sand and gravel deposits are scattered throughout the till.

7.3 The ground moraine plain beneath MAFB is part of what is referred to in the literature as the Central Recharge Area. The term recharge refers to the process in which water, emanating from precipitation, enters water-bearing units.

7.4 The results of geotechnical sampling completed during investigations at MAFB indicated the permeability of the glacial till to be approximately in the range of 10(-6) to 10 (-8) cm/sec, which, in relative terms, is very low. This range is commensurate with the permeability values of glacial till reported in the literature. By use of this information and other information obtained during other on base investigations, it was determined that the rate of movement of water downward through this glacial till is in the range of a few centimeters to a few feet per year.

8.0 Hydrology

8.1 MAFB is located within the Souris River drainage system. The base is many miles upstream from this major river. MAFB is located within the Egg Creek drainage basin, which is an
intermittent tributary basin of the Souris River. Egg Creek drains eastward about 30 miles to North Lake, which in turn drains north to the Souris River via Cut Bank Creek. Because Egg Creek is an intermittent Class III Stream, North Dakota’s least stringent surface-water-quality standards apply (EA Engineering 1990). No area of MAFB is located in a designated floodplain, although ponding does occur in natural potholes on the base.

8.2 Regional surface drainage is controlled by the Souris River, which originates in Saskatchewan, Canada. The Souris River enters North Dakota flowing generally southeast. About 30 miles southeast of MAFB, it loops northeast, then north where it reenters Canada through Manitoba, eventually discharging into Hudson Bay. Flow is regulated by a U.S./Canada joint commission. Area run-off is sparse. The Souris River has one perennial tributary in North Dakota, the Des Lacs River (State of North Dakota 1984).

8.3 The Souris River is a Class IA stream. Its waters are suitable for domestic supply after conventional treatment and softening. The Des Lacs River is a Class II stream. Its waters are suitable for domestic supply after advanced treatment.

8.4 Deposits of outwash sands and gravels form very productive aquifers along the major river valleys (Winter et al. 1984) such as the Minot and Sundre buried channel aquifers occurring near the town of Minot. Typical aquifer thickness is less than 100 feet.

8.5 Several sedimentary bedrock aquifers, such as the Fort Union and Fox Hills-Hell Creek aquifers of Tertiary age, underlie the Minot area below the glacial deposits at depths usually greater than 200 feet. These aquifers are relatively productive, but their poor water quality limits their use to livestock watering and domestic consumption only in areas where no other source is available (Winter et al. 1984).

9.0 Surface Hydrology

9.1 Surface water drainage on the MAFB is restricted primarily to drainage ditches, pipes, and lines that drain to two ditches which flow north into Egg Creek. The western primary drainage ditch uses a glacial melt water channel to carry surface water runoff to Egg Creek. Some storm water runoff on the west end of the runway area flows west to a south flowing intermittent stream (Reynolds, 1984).

9.2 There are no perennial streams on MAFB. Surface water on the base comes from surface runoff. Egg Creek which receives most of the surface drainage from MAFB, is designated as a Class III stream by the North Dakota Department of Environmental Quality (NDDEQ). Class III streams are streams where the quality of water is adequate for industrial and agricultural uses such as cooling, washing, irrigation, and stock watering (NDDEQ, 1989).

10.0 Background

10.1 A RCRA Facility Assessment (RFA) was conducted for MAFB by the Environmental Protection Agency (EPA). Versar Inc. conducted a visual site inspection in conjunction with EPA and the NDDEQ on June 29, 1989. The RFA identified four Solid Waste Management Units (SWMU): the Defense Reutilization and Marketing Office (DRMO), the Explosive Ordnance Disposal Area (EODA), the Firefighting Training Area (FTA), and the Sanitary Landfill Area (SLA).

10.2 Comparison of the MAFB RFA report with those performed at other Air Force Bases, indicated that the number and type of SWMU normally associated with an Air Force Base were not identified. Based upon this comparison, the EPA elected to perform a second RFA for MAFB.
in 1992 to ensure that all SWMU were identified and that the potential for release of hazardous constituents to the environment from these SWMU were evaluated.

10.3 The second RFA was performed by Science Applications International Corporation and A.T. Kearney, Inc., the visual site inspection was performed on July 23 and 24, 1992. Based on the results of this inspection, information acquired during State/Federal file searches, and data from the Part B Permit application, 150 SWMU and 2 Areas of Concern (AOC) were identified. Of these 150 SWMU, 63 SWMU were determined to require further action. This site was identified as an AOC during the investigation. The RCRA Phase I and II Facility Investigations did not identify any significant level of contamination. The contamination appears to be confined to the area directly below the Mass Parking Apron, in the sand bed underneath the airfield concrete.

10.4 During the RFI, borings were advanced, groundwater monitor wells were installed and soil samples were collected for chemical analysis, headspace screening, and lithologic data. Soil and groundwater samples were analyzed for Volatile Organic Compounds, Total Recoverable Petroleum Hydrocarbons (Diesel Range Organics), and total Cadmium, Chromium, and Lead.

10.5 During the Corrective Measure Implementation (CMI), samples were obtained and tested for Total Petroleum Hydrocarbons (TPH), benzene, toluene, ethyl benzene, and xylene (BTEX).

11.0 Public Community and Regulatory Agencies

11.1 An Administrative Record (AR) is the legal record of the physical situation at an installation by which response actions are reviewed and defended. An AR must be established at each installation which has conducted or is conducting IRP activities and must be available to the public at or near the installation. This record is maintained at the following location and is updated as needed by the base Remedial Project Manager.

5 CES/CEIE
445 Peacekeepers Place
Minot AFB, ND 58705-5006

11.2 An Information Repository (IR) is a project file on IRP activities at AF installations. The repository is to be established for all remedial action sites and for all sites where removal actions last longer than 120 days. It is located either on or off base at a place convenient to the community and contains site information, investigatory reports, information about the sources and nature of the contaminants, and a schedule for cleanup operations. The IR is intended to address community relations requirements and is a source of reading material for the public. This is maintained at the following location and is updated as needed by the base Remedial Project Manager.

Minot State University Library
500 University West
Minot, ND 58703

12.0 Technical Review Committees/Restoration Advisory Boards

12.1 A Technical Review Committee (TRC) was established at Minot AFB Apr 92 to review and comment on Department of Defense actions and proposed actions with respect to releases or threatened releases of hazardous substances into the environment at MAFB. The TRC was also established to ensure open communication and exchange of ideas with the general public about the MAFB IRP and CERCLA (1980), SARA (1986), and RCRA (1976).
12.2 The primary purpose and function of the TRC was informational, specifically to foster community and interagency awareness and understanding of MAFB IRP remedial actions related to the releases or threatened releases of hazardous substances at MAFB.

12.3 The TRC was replaced by the Restoration Advisory Board (RAB) in 1994, MAFB first meeting was held 8 Feb 95. The RAB is an advisory body designed to act as a focal point for the exchange of information between MAFB and the local community regarding restoration activities. RAB meetings were initially held quarterly, and later were held on a semi-annual basis until 2002. In 2003 the RAB meetings were held annually. In December 2004, Minot AFB requested and received permission to discontinue the RAB meetings, from the NDDEQ and Headquarters Air Combat Command (HQ ACC), due to lack of public participation.

13.0 Selected Remedy

13.1 A remedy was selected for remediation of the contaminated media at the MPA. Contaminated soil was excavated and treated on base in the CAMU, until an acceptable level of 50 parts per million total petroleum hydrocarbons was reached at which time the soil was considered clean and reusable. The contaminated soils remaining under the concrete at AOC B will be subject to corrective measures when the concrete is permanently removed.

14.0 Evaluation of Selected Remedy

14.1 An analysis of the remedy was conducted to evaluate the remedy with respect to its relative performance in meeting nine criteria. These evaluation criteria are divided into three categories and have been developed by the EPA to address the technical and policy considerations that have proven important for selecting remedies. The nine criteria are found in (40 CFR 300.430(f)(1)(i)).

14.2 Threshold Criteria
   a. Overall protection of human health and the environment
   b. Compliance with Applicable or Relevant and Appropriate Requirements (ARAR) Primary Balancing Criteria
   c. Long-Term effectiveness and permanence.
   d. Reduction of toxicity, mobility, or volume (TMV)
   e. Short term effectiveness
   f. Implementability
   g. Cost Modifying Criteria
   h. State Acceptance
   i. Community Acceptance

14.3 Criterion 1: Overall Protection of Human Health and the Environment
   a. Protectiveness is the primary requirement that remedial actions must meet under CERLCA. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed through each pathway at the site.
   b. Selected Remedy - Treatment of the contaminated soil will remove the contamination from the vicinity of the industrial area. Remediation at the CAMU will immediately begin to reduce and eliminate current risks posed by the contaminated soil and prevent contamination of ground water. The potential for human exposure to contamination at AOC B is eliminated.

14.4 Criterion 2: Compliance with ARAR
a. Compliance with ARAR is one of the statutory requirements of the remedy selection. Applicable requirements are cleanup standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. Relevant and appropriate requirements address problems or situation sufficiently similar to those encountered at the site and thus their use is well suited to the environmental and technical factors at a particular site. The primary ARAR at the MPA include site-specific contaminant levels, Land Treatment of Petroleum Contaminated Soil (Guidelines), Maximum Contaminant Level (MCL), and potentially the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act.

b. Selected Remedy- This remedy seeks a cleanup level of 50 parts per million total petroleum hydrocarbons. Proper management of the contaminated soil will prevent discharges in violation of the NPDES.

14.5 Criterion 3: Long Term Effectiveness and Permanence

a. This criterion reflects CERCLA emphasis on implementing remedies that will ensure protection of human health and the environment in the long term. The assessment of remedies against this criterion evaluates the residual risks at a site after completion of a remedial action.

b. Selected Remedy – This remedy will achieve long-term effectiveness and permanence through remediation of contaminated media to a “clean” condition.

14.6 Criterion 4: Reduction of Toxicity, Mobility, and Volume (TMV)

a. This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies a remedy may employ.

b. Selected Remedy - Treatment of the contaminants in the CAMU through the activity of resident microorganisms in the soil has been shown effective in reducing the TMV. Petroleum hydrocarbons serve as food for the microorganisms. An increase in microbiological activity and numbers of organisms confirms the activity taking place. Contaminant concentrations will be reduced in response to microbe activity.

14.7 Criterion 5: Short Term Effectiveness

a. This criterion addresses short-term impacts of the remedy. The assessment against this criterion examines the effectiveness of remedies in protecting human health and the environment during the construction and implementation of a remedy.

b. Selected Remedy - This remedy will create short-term exposure pathways during excavation, sampling events, and soil treatment activities.

14.8 Criterion 6: Implementability

a. The assessment against this criterion evaluates the technical and administrative feasibility of the remedy and the availability of the goods and services needed to implement them.

b. Selected Remedy - This remedy is technically low in goods and services needed for implementation and these are readily available. Administrative functions are minimal since a permitted CAMU has been established.
14.9 Criterion 7: Cost

a. Cost encompasses all engineering, construction, and operation and maintenance costs incurred over the life of the project. The assessment against this criterion is based on the present worth of these costs.

b. Selected Remedy - The cost for this remedy varies according to the amount of soil and the concentration of contamination however preliminary estimates are around $17 per cubic yard for an estimated 35,210 cubic yards.

14.10 Criterion 8: State Acceptance

a. This criterion, which is an ongoing concern throughout the corrective action process, reflects the statutory requirement to provide for substantial and meaningful State involvement.

b. Selected Remedy - NDDEQ recognizes this remedy as an acceptable form of remedial action.

14.11 Criterion 9: Community Acceptance

a. This criterion reflects the community’s apparent preferences or concerns about remedies.

b. The RAB, and IR have been the avenues in which the base has informed the community of IRP and RCRA Corrective Action activities. RAB meetings were held twice a year to update members on corrective action activity. RAB meetings, and the IR have provided an opportunity for public comment/involvement in RCRA and IRP remediation activities. A 45- day public comment period will be held to allow for public review, prior to selected remedy approval. December 2004, Minot AFB requested and received permission to discontinue the RAB meetings, from the NDDEQ and HQ ACC, due to virtually no public participation in the meetings.

c. There has been little public interest in this activity based on the questions/comments posed by community members.

d. Remedy- In the past, the response of the RAB members has been favorable toward this remedy.

15.0 CONTAMINATION PRESENT:

15.1 Contaminated soil discovered while excavating a new 10-inch fuel line under the Mass Parking Apron (MPA) in project “Construct Hydrant Fueling System” was removed in 2004 and again in 2006. This soil was excavated, stockpiled and treated at the CAMU. Contamination remains in place under the concrete at the Mass Parking Apron (MPA) making removal technically unfeasible.

15.2 Additional contamination was discovered while removing the underground storage tanks and associated lines under project “Remove Pumphouses.” This project removed the pumphouses 1072, 1074, and 1076 along with their foundations/driveways, sixteen 50,000-gallon USTs, and all associated piping. Contaminated soil was discovered throughout the sites. Contamination was placed back in the excavations and remains on-site.

16.0 STATUS OF AREA OF CONCERN: The removed contaminated soil associated with “Construct Hydrant Fueling System” has been remediated in the CAMU. Contamination remains in place under
the concrete of the MPA and around the location of the removed pumphouses. Contamination around the pumphouses will be addressed through a CERCLA Cleanup Process with a preliminary assessment (PA) and site inspection (SI) followed by a remedial investigation/feasibility study (RI/FS).

16.1 CONSTRUCTION OF CAMU:

   a. Six inches of topsoil were removed from the 17-acre CAMU and stockpiled until the CAMU is no longer needed at which time it will be redistributed on site.

   b. Excavation of every description, regardless of material encountered, within the grading limits of the project was performed to the lines and grades. Excavated material was transported to and placed in fill areas within the limits of the work. Unsuitable material encountered within the limits of the work was excavated below the grade shown and replaced with suitable material.

   c. Preparation of ground surface for fill. Stumps, logs and roots more than 1 1/2 inches in diameter were excavated from a depth of at least 18 inches below the original ground surface. Sloped ground surfaces steeper than one vertical to four horizontal on which fill was placed were plowed, steeped, or broken up, as directed, in such a manner that the fill material bonded with the existing surface.

   d. Fills and embankments herein designated as fills were constructed at the locations and to lines and grades indicated on the drawings. The completed fill corresponds to the finished grading plans shown on the drawings (reference atch. 1).

   e. During construction of the CAMU, where otherwise suitable material was too wet, it was aerated or dried to provide the moisture content specified for compaction. The material was placed in successive horizontal layers of 8 inches to 12 inches in depth for the full width of the cross section and compacted as described below. Each layer was compacted before the overlaying lift was placed.

   f. Compaction of CAMU. Each layer of fill constructed under this section except for topsoil was compacted to at least 90 percent of the maximum density. Cohesive soils were at a moisture content of between 1 percent below and 3 percent above optimum moisture when compacted.

   g. CAMU sub-grade preparation. The sub-grade was shaped to line, grade and cross section with approved compaction equipment to provide a minimum compacted sub-grade thickness of 6 inches. All boulders, rocks or ledge stone encountered in the excavation were removed or broken off to a depth of less than 6 inches below the sub-grade. The resulting area and all other low sections, holes, or depressions were brought to the required grade with suitable material and the entire sub-grade shaped to line, grade and cross section and thoroughly compacted.

   h. Constructed a minimum of a 24-inch berm around the 17-acre CAMU which will allow enough freeboard to contain a 25-year, 24-hour maximum rainfall event.

   i. Diverted all runoff from adjacent areas around the CAMU.

   j. Will place a maximum of a 12-inch lift of contaminated soil in the 17-acre CAMU.

16.2 OPERATION OF CAMU:

Normal operation of the CAMU shall include the following:
a. Placement of contaminated soil to receive land treatment in an evenly distributed layer, a maximum of 12 inches in depth over the prepared surface. Minot AFB or the designated Contractor will remove and replace the entire 12-inch lift when the entire thickness has been remediated to the required level of 50 PPM total petroleum hydrocarbons (TPH) or less.

b. Passive collection of storm-water in the retention area of the CAMU.

c. Optimize certain parameters (e.g. soil moisture content, pH, and oxygen requirements) for biodegradation. Minot AFB or the designated Contractor shall also provide nitrogen and phosphorus nutrients to the soil in the CAMU to aid in the growth of microorganisms. Baseline testing will be performed at the beginning and end of the land treatment process. Ten composite samples from the 17-acre CAMU plus one duplicate for each batch shall be collected and analyzed. Each batch for the CAMU shall be tested by an offsite laboratory for TPH every four weeks as a minimum. Soil nutrients for the CAMU shall be tested by an offsite laboratory every two weeks. The CAMU soil will be tested, once a week, for nutrients, using a field test kit to maintain the nutrient concentration in the required range. Testing will be suspended during the winter months. The composite samples shall be analyzed for the following:

<table>
<thead>
<tr>
<th>Laboratory TPH</th>
<th>TPH (total range)</th>
<th>M8015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory Nutrients</td>
<td>Nitrate (as N)</td>
<td>9200</td>
</tr>
<tr>
<td></td>
<td>Phosphate (as P)</td>
<td>365.1</td>
</tr>
<tr>
<td></td>
<td>Percent Moisture</td>
<td>9045B</td>
</tr>
<tr>
<td></td>
<td>pH</td>
<td>9045B</td>
</tr>
<tr>
<td></td>
<td>Heterotrophic Plate Count</td>
<td>(9215)</td>
</tr>
</tbody>
</table>

Field Nutrient

- Nitrate-Nitrogen
- Phosphorus
- Percent Moisture
- pH

The liquid limit and plastic limit (Atterberg limits) shall be determined for each type of soil in the batch. At least two (2) matrix spike (MS)/ matrix spike duplicates (MSD) shall be run for the TPH analyses. The Contractor shall diagram where samples are collected.

16.3 POOLED WATER IN CAMU:

Collected runoff shall be re-circulated back onto the CAMU to the extent possible. Any excess water not able to be used for obtaining optimum moisture content on the CAMU may be discharged to the sanitary sewer system after analysis, provided acceptable results are received. This water is then directed to the sanitary sewage lagoons.

16.4 SOIL MANAGEMENT:

**Soil Moisture:**
When natural precipitation is insufficient to maintain 40-70% of moisture content at field capacity for microbiological activity, irrigation will be necessary. This water may be placed on the CAMU by water truck or by irrigation and is up to the discretion of the Contractor treating the soil. Soil moisture content shall be sampled for and analyzed in accordance with Minot AFB specifications.

**Soil pH:**
Initially each lift of soil shall be adjusted, if required, to maintain a pH range of 6.0 to 8.0. Periodically the pH shall be checked and adjusted, if necessary, throughout the duration of the land treatment of each batch of soil.

Soil Nutrients:
Nutrients levels shall be maintained as follows:

<table>
<thead>
<tr>
<th>SOILS CONTAMINANT CONCENTRATION</th>
<th>Adjusted Fertility Requirements (lbs/acre per inch of thickness)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nitrate-Nitrogen</td>
</tr>
<tr>
<td>1000 ppm TPH</td>
<td>8.89</td>
</tr>
<tr>
<td>1500 ppm TPH</td>
<td>13.33</td>
</tr>
<tr>
<td>2000 ppm TPH</td>
<td>17.78</td>
</tr>
<tr>
<td>2500 ppm TPH</td>
<td>22.22</td>
</tr>
<tr>
<td>3000+ppm TPH</td>
<td>26.67</td>
</tr>
</tbody>
</table>

Soil Tilling/Plowing:
Minot AFB or the designated Contractor shall till or otherwise uniformly disturb all soil on the CAMU, as a minimum, to within 6 inches from the bottom of the lift, to raise oxygen levels in the lift as required. Soil shall be tilled within 48 hours of having applied nutrients. Frequency of tilling shall be no more often than once a week to ensure that no damage to the soil structure occurs, and so that requirements of the State of North Dakota are being met with respect to wind erosion and that soil moisture and compaction of soil are not a problem. The duration of the treatment of each lift is expected to last from a minimum of six weeks to a maximum of six months. Soils shall be treated until TPH lab results indicate an acceptable level, of less than 50 ppm TPH have been reached. The tilling/plowing shall not result in substantially changed surface elevation contours. Weeds on the site shall also be controlled.

Equipment Limitations
Use of low ground pressure (LGP) equipment is recommended to prevent re-compaction of the soil.

Monitoring Reports:
a. daily temperature during land treatment operations
b. daily rainfall during land treatment operations
c. tables of analytical results “Chemical Analysis and Chemical Data Quality Control”
d. dates of tilling operations
e. nutrient and moisture addition events and quantities
f. pH adjustment events

Berm Maintenance
All berms shall be inspected every time the land treatment area is tilled, and after any event which may affect the berm integrity, such as periods of heavy rainfall.

17.0 CONCLUSION

17.1 The selected remedy for AOC B, where practical, is the removal and/or treatment of the contaminated soil. In situations where removal and treatment of soil is not practical, additional/alternate remediation strategies may be implemented.

17.2 Contamination under the concrete of the MPA is technically impracticable to remediate due to existing airfield concrete and underground utilities.
17.3 The AF will initiate limited sampling to determine if free product is present along the abandoned fuel lines beneath the MPA concrete as each section of the concrete is removed for replacement. MPA workplan review and approval will be prioritized at the NDDEQ.

17.4 The limited sampling will be accomplished during the replacement/repair activities and an annual report on the results of the limited sampling will be provided to NDDEQ at the completion of each construction season.

17.5 Due to the presence of active underground utilities, contaminated soils will be removed/remediated only after the AF decommissions the MPA and no longer utilizes it for military missions.

17.6 Where contamination remains, groundwater monitoring will be conducted to determine the impact and extent of contamination. Long-term groundwater monitoring will be conducted as necessary to ensure that contamination is not migrating off-site.
The 10" thick concrete was cut to bury the new line. Contaminated soil disturbed during construction was removed. Remaining contaminated soil was left in place under the concrete. The removed soil was treated at the MAFB land farm between 2004 and 2006.

Project "Construction Hydrant System" in 2004 and into the existing 10" line and continued north to the new PCL tank farm.
Decision Document

AOC C

Buildings 510/511
0.0 Site and Location

0.1 Minot Air Force Base, North Dakota

1.0 Statement of Basis

1.1 The decision described herein concerns the selected remedy (SR) for the Underground Storage Tank (UST), identified as Area of Concern (AOC) C, Bldg 510/511, which was located at 315 Bomber Blvd. It is based on an evaluation of the results received from corrective action performed under the Resource Conservation Recovery Act (RCRA) Compliance Program.

2.0 Remedy Selection

2.1 The remedy was selected based on the presence of contamination, its concentration, practicality of remediation and risk posed. The selected remedy is excavation and treatment of contaminated soils in the Base Corrective Action Management Unit (CAMU). In 2004, 10,500 cubic yards JP-8 contaminated soil was excavated and removed from beneath Buildings 510 and 511. The soil was land-farmed in the Base CAMU and treated to below 50mg/kg Total Petroleum Hydrocarbons (TPH) as required by the North Dakota Department of Health (NDDH). The cleaned soil was removed from the CAMU and placed in the Base Stockpile in June 2006 for later use as clean soil.

2.2 Further action is required at this site at this time. More contamination remains and is accessible. Environmental Engineering Office will pursue additional funding to remove the remaining contaminated soil in FY 2008. All accessible contamination is scheduled for removal.

3.0 Declaration of Consistency with CERLCA and NCP

3.1 This document presents the selected remedy for this site developed in accordance with the Resource Conservation and Recovery Act of 1976, as amended.

4.0 Facility

4.1 Minot AFB (MAFB) is located approximately 12 miles north of Minot, North Dakota, in Ward County, as shown in Figure 1-1. Prior to 1955, the property comprising MAFB was farmland. The government purchased the land in 1955, and construction began approximately 2 years later. The main base area encompasses approximately 4,636 acres. The land use adjacent to the base is predominately agricultural.

5.0 Physiography

5.1 MAFB is located within the Central Recharge Area, a 1,333 square-mile, nearly flat expanse of glacial ground moraine. The Central Recharge Area is mantled by several hundred feet of
glacial drift. The ground surface slopes gently toward the northeast and contains thousands of small, poorly draining prairie potholes (Pettyjohn and Hutchinson 1971).
5.2 Imported vegetation and pavements have displaced the natural land surface and most native plant species on Minot AFB. Nonnative species such as barnyard grass, downy brome, green foxtail, and crested wheatgrass occur throughout the base. Spruce, green ash, Russian olive, and juniper trees have been planted to provide landscaping and windbreaks.

6.0 Adjacent Land Uses

6.1 MAFB is located in the Northern Great Plains native grassland (e.g. Blue grama and western wheat grass). Most of the area surrounding the base has been converted to agriculture (EA Engineering 1990).

7.0 Geology

7.1 MAFB is situated upon a laterally and vertically extensive ground moraine plain. The ground moraine is glacial sediment composed almost entirely of till. The till is characterized as an unstratified deposit of sediment with a particle size ranging from clay to boulders. However, clay and silt size particles account for the largest percentage of the sediment volume sample. The completed boring program confirmed that this till extends to a depth of at least 100 feet beneath MAFB. Deeper borings completed in the vicinity of MAFB indicate the till extends to depths ranging from 140 to 180 feet. Below that depth, the Paleozoic bedrock surface is encountered. Quaternary glacial sediments rest unconformably upon an irregular Paleozoic bedrock surface.

7.2 The only type of deposit other than till present within the glacial sediments is a minor occurrence of glacial sand and gravel. A review of available literature and the completed borings indicate that these sand and gravel deposits are discontinuous, lenticular, and contain a variety of sediment types. These sand and gravel deposits account for less than 5% of the total volume of the first 100 feet of glacial sediments. Generally, the sand and gravel deposits are scattered throughout the till.

7.3 The ground moraine plain beneath MAFB is part of what is referred to in the literature as the Central Recharge Area. The term recharge refers to the process in which water, emanating from precipitation, enters water-bearing units.

7.4 The results of geotechnical sampling completed during investigations at MAFB indicated the permeability of the glacial till to be approximately in the range of 10(-6) to 10 (-8) cm/sec, which, in relative terms, is very low. This range is commensurate with the permeability values of glacial till reported in the literature. By use of this information and other information obtained during other on base investigations, it was determined that the rate of movement of water downward through this glacial till is in the range of a few centimeters to a few feet per year.

8.0 Hydrology

8.1 MAFB is located within the Souris River drainage system. The base is many miles upstream from this major river. MAFB is located within the Egg Creek drainage basin, which is an intermittent tributary basin of the Souris River. Egg Creek drains eastward about 30 miles to North Lake, which in turn drains north to the Souris River via Cut Bank Creek. Because Egg Creek is an intermittent Class III Stream, North Dakota’s least stringent surface-water-quality standards apply (EA Engineering 1990). No area of MAFB is located in a designated floodplain, although ponding does occur in natural potholes on the base.

8.2 Regional surface drainage is controlled by the Souris River, which originates in Saskatchewan, Canada. The Souris River enters North Dakota flowing generally southeast. About 30 miles southeast of MAFB, it loops northeast, then north where it reenters Canada through Manitoba, eventually discharging into Hudson Bay. Flow is regulated by a
U.S./Canada joint commission. Area runoff is sparse. The Souris River has one perennial tributary in North Dakota, the Des Lacs River (State of North Dakota 1984).

8.3 The Souris River is a Class IA stream. Its waters are suitable for domestic supply after conventional treatment and softening. The Des Lacs River is a Class II stream. Its waters are suitable for domestic supply after advanced treatment.

8.4 Deposits of outwash sands and gravels form very productive aquifers along the major river valleys (Winter et al. 1984) such as the Minot and Sundre buried channel aquifers occurring near the town of Minot. Typical aquifer thickness is less than 100 feet.

8.5 Several sedimentary bedrock aquifers, such as the Fort Union and Fox Hills-Hell Creek aquifers of Tertiary age underlie the Minot area below the glacial deposits at depths usually greater than 200 feet. These aquifers are relatively productive, but their poor water quality limits their use to livestock watering and domestic consumption only in areas where no other source is available (Winter et al. 1984).

9.0 Surface Hydrology

9.1 Surface water drainage on MAFB is restricted primarily to drainage ditches, pipes, and lines that drain to two ditches which flow north into Egg Creek. The western primary drainage ditch uses a glacial melt water channel to carry surface water runoff to Egg Creek. Some storm water runoff on the west end of the runway area flows west to a south flowing intermittent stream (Reynolds, 1984).

9.2 There are no perennial steams on MAFB. Surface water on the base comes from surface runoff. Egg Creek which receives most of the surface drainage from MAFB is designated as a Class III stream by the North Dakota Department of Health (NDDH). Class III streams are streams where the quality of water is adequate for industrial and agricultural uses such as cooling, washing, irrigation, and stock watering (NDDH, 1989).

10.0 Background

10.1 A RCRA Facility Assessment (RFA) was conducted for MAFB by the Environmental Protection Agency (EPA). Versar Inc. conducted a visual site inspection in conjunction with EPA and the NDDH on June 29, 1989. The RFA identified four Solid Waste Management Units (SWMU): the Defense Reutilization and Marketing Office (DRMO), the Explosive Ordnance Disposal Area (EODA), the Firefighting Training Area (FTA), and the Sanitary Landfill Area (SLA).

10.2 Comparison of the MAFB RFA report with those performed at other Air Force Bases indicated that the number and type of SWMU normally associated with an Air Force Base were not identified. Based upon this comparison, the EPA elected to perform a second RFA for MAFB in 1992 to ensure that all SWMU were identified and that the potential for release of hazardous constituents to the environment from these SWMU were evaluated.

10.3 The second RFA was performed by Science Applications International Corporation and A.T. Kearney, Inc., the visual site inspection was performed on July 23 and 24, 1992. Based on the results of this inspection, information acquired during State/Federal file searches, and data from the Part B Permit application, 150 SWMU and 2 Areas of Concern (AOC) were identified. Of these 150 SWMU, 63 SWMU were determined to require further action. This site was not identified during the above referenced investigations. It was discovered while demolishing the foundation of the Bldg in December of 2001. The UST at this facility had been used as a heating oil tank for the building, and had been removed in 1987.
10.4 During the RFI, borings were advanced, groundwater monitor wells were installed and soil samples were collected for chemical analysis, headspace screening, and lithologic data. Soil and groundwater samples were analyzed for Volatile Organic Compounds, Total Recoverable Petroleum Hydrocarbons (Diesel Range Organics), and total Cadmium, Chromium, and Lead.

10.5 During the Corrective Measure Implementation (CMI), samples were obtained and tested for Total Petroleum Hydrocarbons (TPH), benzene, toluene, ethyl benzene, and xylene (BTEX).

11.0 Public Community and Regulatory Agencies

11.1 An Administrative Record (AR) is the legal record of the physical situation at an installation by which response actions are reviewed and defended. An AR must be established at each installation which has conducted or is conducting IRP activities and must be available to the public at or near the installation. This record is maintained at the following location and is updated as needed by the base Remedial Project Manager.

5 CES/CEV
320 Peacekeeper Place
Minot AFB, ND 58705-5006

11.2 An Information Repository (IR) is a project file on IRP activities at AF installations. The repository is to be established for all remedial action sites and for all sites where removal actions last longer than 120 days. It is located either on or off base at a place convenient to the community and contains site information, investigatory reports, information about the sources and nature of the contaminants, and a schedule for cleanup operations. The IR is intended to address community relations requirements and is a source of reading material for the public. This is maintained at the following location and is updated as needed by the base Remedial Project Manager.

Minot State University Library
500 University West
Minot, ND 58703

12.0 Technical Review Committees/Restoration Advisory Boards

12.1 A Technical Review Committee (TRC) was established at Minot AFB Apr 92 to review and comment on Department of Defense actions and proposed actions with respect to releases or threatened releases of hazardous substances into the environment at MAFB. The TRC was also established to ensure open communication and exchange of ideas with the general public about the MAFB IRP and CERCLA (1980), SARA (1986), and RCRA (1976).

12.2 The primary purpose and function of the TRC was informational, specifically to foster community and interagency awareness and understanding of MAFB IRP remedial actions related to the releases or threatened releases of hazardous substances at MAFB.

12.3 The TRC was replaced by the Restoration Advisory Board (RAB) in 1994, MAFB first meeting was held 8 Feb 95. The RAB is an advisory body designed to act as a focal point for the exchange of information between MAFB and the local community regarding restoration activities. RAB meetings were initially held quarterly, and later were held on a semi-annual basis until 2002. In 2003 the RAB meetings were held annually. In December 2004, Minot AFB requested and received permission to discontinue the RAB, from the NDDH and Headquarters Air Combat Command (HQ ACC), due to lack of public participation.

13.0 Selected Remedy
13.1 One remedy was selected for remediation of the contaminated media at AOC C. A large amount of the contaminated soil was excavated and treated on base in the CAMU, until an acceptable level of 50 parts per million total petroleum hydrocarbons was reached at which time the soil was considered clean and reusable. The remaining contaminated soils will be excavated and treated at the CAMU or appropriate off-base land treatment area in 2008. Funding is available for FY08, this funding is anticipated to be sufficient to complete the work. If contamination extends beyond current estimates, additional funding will be obtained.

14.0 Evaluation of Selected Remedy

14.1 An analysis of the remedy was conducted to evaluate the remedy with respect to its relative performance in meeting nine criteria. These evaluation criteria are divided into three categories and have been developed by the EPA to address the technical and policy considerations that have proven important for selecting remedies. The nine criteria are found in (40 CFR 300.430(f)(1)(i)).

14.2 Threshold Criteria
   a. Overall protection of human health and the environment
   b. Compliance with Applicable or Relevant and Appropriate Requirements (ARAR) Primary Balancing Criteria
   c. Long-Term effectiveness and permanence.
   d. Reduction of toxicity, mobility, or volume (TMV)
   e. Short term effectiveness
   f. Implementability
   g. Cost Modifying Criteria
   h. State Acceptance
   i. Community Acceptance

14.3 Criterion 1: Overall Protection of Human Health and the Environment

   a. Protectiveness is the primary requirement that remedial actions must meet under CERLCA. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed through each pathway at the site.

   b. Selected Remedy - Excavation of the contaminated soil will remove the contamination from the immediate vicinity of the industrial area. Remediation at the CAMU will immediately begin to reduce and eliminate current risks posed by the contaminated soil and prevent possible contamination of ground water. The potential for human exposure to contamination at the UST site is eliminated.

14.4 Criterion 2: Compliance with ARAR

   a. Compliance with ARAR is one of the statutory requirements of the remedy selection. Applicable requirements are cleanup standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. Relevant and appropriate requirements address problems or situation sufficiently similar to those encountered at the site and thus their use is well suited to the environmental and technical factors at a particular site. The primary ARAR at AOC C include site-specific contaminant levels, Land Treatment of Petroleum Contaminated Soil (Guidelines), Maximum Contaminant Level (MCL), and potentially the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act.
b. Selected Remedy - This remedy seeks a cleanup level of 50 parts per million total petroleum hydrocarbons. Proper management of the contaminated soil will prevent discharges in violation of the NPDES.

14.5 Criterion 3: Long Term Effectiveness and Permanence

a. This criterion reflects CERCLA emphasis on implementing remedies that will ensure protection of human health and the environment in the long term. The assessment of remedies against this criterion evaluates the residual risks at a site after completion of a remedial action.

b. Selected Remedy – This remedy will achieve long-term effectiveness and permanence through remediation of contaminated media to a “clean” condition.

14.6 Criterion 4: Reduction of Toxicity, Mobility, and Volume (TMV)

a. This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies a remedy may employ.

b. Selected Remedy - Treatment of the contaminants in the CAMU through the activity of resident microorganisms in the soil has been shown effective in reducing the TMV. Petroleum hydrocarbons serve as food for the microorganisms. An increase in microbiological activity and numbers of organisms confirms the activity taking place. Contaminant concentrations will be reduced in response to microbe activity.

14.7 Criterion 5: Short Term Effectiveness

a. This criterion addresses short-term impacts of the remedy. The assessment against this criterion examines the effectiveness of remedies in protecting human health and the environment during the construction and implementation of a remedy.

b. Selected Remedy - This remedy will create short-term exposure pathways during excavation, sampling events, and land farming activities.

14.8 Criterion 6: Implementability

a. The assessment against this criterion evaluates the technical and administrative feasibility of the remedy and the availability of the goods and services needed to implement them.

b. Selected Remedy - This remedy is technically low in goods and services needed for implementation and are readily available. Administrative functions are minimal since a CAMU has been established.

14.9 Criterion 7: Cost

a. Cost encompasses all engineering, construction, and operation and maintenance costs incurred over the life of the project. The assessment against this criterion is based on the present worth of these costs.

b. Selected Remedy - The cost for this remedy varies according to the amount of soil and the concentration of contamination however preliminary estimates are around $14 per cubic yard for an estimated 14,000 cubic yards.
14.10 Criterion 8: State Acceptance

a. This criterion, which is an ongoing concern throughout the corrective action process, reflects the statutory requirement to provide for substantial and meaningful State involvement.

b. Selected Remedy - NDDH recognizes this remedy as an acceptable form of remedial action.

14.11 Criterion 9: Community Acceptance

a. This criterion reflects the community’s apparent preferences or concerns about remedies.

b. The RAB, and IR have been the avenues in which the base has informed the community of IRP and RCRA Corrective Action activities. RAB meetings were held twice a year to update members on corrective action activity. RAB meetings and the IR have provided an opportunity for public comment/involvement in RCRA and IRP remediation activities. A 45-day public comment period will be held to allow for public review, prior to selected remedy approval. December 2004, Minot AFB requested and received permission to discontinue the RAB meetings, from HQ ACC and the NDDH, due to virtually no public participation in the meetings.

c. There has been little public interest in this activity based on the questions/comments posed by community members.

d. Remedy- In the past, the RAB members have been favorable toward this remedy.

15.0 CONTAMINATION PRESENT BUT REMOVED:

15.1 Contamination was present; however most of the contamination was removed. Further action is required at this site to clean up the remaining contaminated soil, and will be addressed in 2008.

16.0 STATUS OF AREA OF CONCERN: The contaminated soil is proposed to be remediated in the CAMU.

16.1 CONSTRUCTION OF CAMU:

a. Six inches of topsoil was removed from the 17-acre CAMU and stockpiled until the CAMU is no longer needed at which time it will be redistributed on site.

b. Excavation of every description, regardless of material encountered, within the grading limits of the project were performed to the lines and grades indicated on attachment (Attch) 1. Excavated material was transported to and placed in fill areas within the limits of the work. Unsuitable material encountered within the limits of the work was excavated below the grade shown and replaced with suitable material.

c. Preparation of ground surface for fill. Stumps, logs and roots more than 1 1/2 inches in diameter were excavated and removed to a depth not less than 18 inches below the original ground surface. Sloped ground surfaces steeper than one vertical to four horizontal on which fill was placed were plowed, steeped, or broken up, as directed, in such a manner that the fill material bonded with the existing surface.
d. Fills and embankments herein designated as fills were constructed at the locations and
to lines and grades indicated on the drawings. The completed fill corresponds to the
finished grading plans shown on the drawings (reference Attch 1).

e. During construction of the CAMU, where otherwise suitable material was too wet, it was
aerated or dried to provide the moisture content specified for compaction. The material
was placed in successive horizontal layers of 8 inches to 12 inches in loose depth for the
full width of the cross section, and compacted as described below. Each layer was
compacted before the overlaying lift was placed.

f. Compaction of CAMU. Each layer of fill constructed under this section except for topsoil
was compacted to at least 90 percent of the maximum density. Cohesive soils were at a
moisture content between 1 percent below and 3 percent above optimum moisture when
compacted.

g. CAMU sub-grade preparation. The sub-grade was shaped to line, grade and cross
section with approved compaction equipment to provide a minimum compacted sub-
grade thickness of 6 inches. All boulders, rocks or ledge stone encountered in the
excavation were removed or broken off to a depth of less than 6 inches below the sub-
grade. The resulting area and all other low sections, holes, or depressions were brought
to the required grade with suitable material and the entire sub-grade shaped to line,
grade and cross section and thoroughly compacted.

h. Constructed a minimum of a 24-inch berm around the 17-acre CAMU which will allow
enough freeboard to contain a 25-year, 24-hour maximum rainfall event.

i. Diverted all runoff from adjacent areas around the CAMU.

j. Place a maximum of a 12-inch lift of contaminated soil in the 17-acre CAMU.

16.2 OPERATION OF CAMU:

Normal operation of the CAMU, shall include the following:

a. Placement of contaminated soil to receive land treatment in an evenly distributed layer, a
maximum of 12 inches in depth over the prepared surface. Minot AFB or the designated
Contractor will remove and replace the entire 12-inch lift when the entire thickness has
been remediated to the required level of 50 ppm total petroleum hydrocarbons (TPH) or
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b. Passive collection of stormwater in the retention area of the CAMU.

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254
Laboratory Nutrients

- Nitrate (as N): 9200
- Phosphate (as P): 365.1
- Percent Moisture
- pH: 9045B
- Heterotrophic Plate Count (9215)

Field Nutrient

- Nitrate-Nitrogen
- Phosphorus
- Percent Moisture
- pH

The liquid limit and plastic limit (Atterberg limits) shall be determined for each type of soil in the batch. At least two (2) matrix spike (MS)/matrix spike duplicate (MSD) spikes shall be run for the TPH analyses. The Contractor shall diagram where samples are collected.

16.3 POOLED WATER IN CAMU:

Collected runoff shall be re-circulated back onto the CAMU to the extent possible. Any excess water not able to be used for obtaining optimum moisture content on the CAMU may be discharged to the sanitary sewer system after analysis, provided acceptable results are received. This water is then directed to the sanitary sewage lagoons.

16.4 SOIL MANAGEMENT:

Soil Moisture:
When natural precipitation is insufficient to maintain 40-70% of moisture content at field capacity for microbiological activity, irrigation will be necessary. This water may be placed on the CAMU by water truck or by irrigation and is up to the discretion of the Contractor treating the soil. Soil moisture content shall be sampled for and analyzed in accordance with Minot AFB specifications.

Soil pH:
Initially each lift of soil shall be adjusted, if required, to maintain a pH range of 6.0 to 8.0. Periodically the pH shall be checked and adjusted, if necessary, throughout the duration of the land treatment of each batch of soil.

Soil Nutrients:
Nutrients levels shall be maintained as follows:

<table>
<thead>
<tr>
<th>SOILS CONTAMINANT CONCENTRATION</th>
<th>Adjusted Fertility Requirements (lbs/acre per inch of thickness)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 ppm TPH</td>
<td>Nitrate-Nitrogen: 8.89, Phosphorus: 4.44-6.67</td>
</tr>
<tr>
<td>1500 ppm TPH</td>
<td>Nitrate-Nitrogen: 13.33, Phosphorus: 4.44-6.67</td>
</tr>
<tr>
<td>2500 ppm TPH</td>
<td>Nitrate-Nitrogen: 22.22, Phosphorus: 4.44-6.67</td>
</tr>
</tbody>
</table>

Soil Tilling/Plowing:
Minot AFB or the designated Contractor shall till or otherwise uniformly disturb all soil on the CAMU, as a minimum, to within 6 inches from the bottom of the lift, to raise oxygen levels in the lift as required. Soil shall be tilled within 48 hours of having applied nutrients. Frequency of tilling shall be no more often than once a week to ensure that no damage to the soil structure occurs, and so that requirements of the State of North Dakota are being met with
respect to wind erosion and that soil moisture and compaction of soil are not a problem. The duration of the treatment of each lift is expected to last from a minimum of six weeks to a maximum of six months. Soils shall be treated until TPH lab results indicate an acceptable TPH level, of less than 50 ppm TPH have been reached. The tilling/plowing shall not result in substantially changed surface elevation contours. Weeds on the site shall also be controlled.

**Equipment Limitations**
Use of low ground pressure (LGP) equipment is recommended to prevent re-compaction of the soil.

**Monitoring Reports:**
- daily temperature during land treatment operations
- daily rainfall during land treatment operations
- tables of analytical results "Chemical Analysis and Chemical Data Quality Control"
- dates of tilling operations
- nutrient and moisture addition events and quantities
- pH adjustment events

**Berm Maintenance**
All berms shall be inspected every time the land treatment area is tilled, and after any event which may affect the berm integrity, such as periods of heavy rainfall.

### 17.0 CONCLUSION

17.1 The selected remedy for AOC C/Bldg 510/511 where practical, is the removal and treatment of the contaminated soil. Removal and treatment of contaminated soil is protective of human health and the environment by eliminating the contaminants of concern, thus eliminating human exposure and preventing migration of contaminants.

17.2 In summary, all contamination remaining at AOC C that was technically feasible and practical to remove has been removed and treated to reduce the contamination to below regulatory and risk base levels at the CAMU. Contamination remains at this site and further corrective measures will be implemented when practical.
In 2004, 10,500 cubic yards of JP-8 contaminated soil was excavated and removed from beneath buildings 510 and 511. The soil was land-farmed in the Base CAMU and treated to below 50 mg/kg Total Petroleum Hydrocarbons (TPH) as required by the North Dakota Department of Health (NDDH).

In 2008, asphalt pavement will be removed to chase a plume. The extent of the plume is currently unknown. If the plume removal exceeds availability of FY08 funding, MAFB will request further funding.
Addendum I
Decision Document - Remedy Modification
IRP Site AOC C
Former Building 510/511
NDDH Permit HW-021

Introduction
This addendum updates the Decision Document (DD) dated December 21, 2007, for NDDH permit HW-021 at Installation Restoration Program (IRP) Site Area of Concern (AOC) C at Minot Air Force Base (MAFB). It also provides background information and justification for the proposed remedy. The remedy was developed in accordance with the Resource Conservation and Recovery Act of 1976, as amended.

Proposed Remedy Modification
The original permitted remedy for Site AOC C (Former Buildings 510/511) was removal of accessible contaminated soil and remediation to an acceptably clean level. Further development of technology has produced the means of remediation of contamination in-place. Approval for consideration of alternatives to the selected remedy was received after discussion and agreement with the North Dakota Department of Health (NDDH) on 14 May 2013. The reasons for updating the remedy are presented below.

Background
In 1962, two (1,000) gallon USTs were installed at Building 510/511 and used as heating oil tanks for the building. These tanks were removed in 1987. Fuel-contaminated soil was encountered during demolition of the foundation of the buildings in December 2001; sampling confirmed that the contamination was fuel oil.

In October 2002, approximately 14,000 cubic yards of contaminated soil was removed and subsequently treated in the on-base land treatment area (LTA), which was designated as a Corrective Action Management Unit (CAMU) by the NDDH. Due to funding limitations, not all of the contaminated soil from the excavation was removed. In 2008, an additional soil removal action was undertaken. Approximately 1,300 cubic yards of contaminated soil was removed during this event and treated in the LTA; however, contaminated soil still remained at the site.

To define the area of contamination remaining from the incomplete soil removal actions, a field investigation was performed in the fall of 2008 utilizing direct push equipment with a laser induced fluorescence (LIF) probe (Phase II Corrective Measures Implementation Report, Building 510/511, Area of Concern C, Minot AFB, July 2010, LKS federal LLC). The results of the investigation indicate that the contamination is found at approximately six to twelve feet below ground surface. This contamination appears to be located in two definable areas: one area in the vacant lot north of the existing Building 505 (Building 505 is located to the south/southwest of former Building 510/511) where soil removal has occurred in the past, and a second area which is located near the northwest corner of Building 505, and extends under the parking lot and the northwest portion of Building 503 (currently in use).

According to the Decision Document, the remaining accessible contaminated soil at the site must be removed and treated. Any inaccessible soils would be addressed when removal was technically feasible and practical, i.e. if Building 505 were demolished. Any soil excavation activities will leave contaminated soils in place under Building 505, immediately adjacent to Building 505 (in order to protect building and foundation structural integrity), and in areas where underground utilities are present.

Proposed Remedy
Based on a review of available information, a different remedy is proposed: bioremediation trenches to address contamination in situ, which was observed during the LIF investigation. Separate trenches will address each area of contamination identified by the LIF investigation, and will include areas where soil excavation is impracticable. In addition, indoor air sampling will be completed to assess potential risk to indoor workers from contaminated soils under Building 505.

**Justification For Remedy Modification**

The proposed alternative remedy is justified based upon the following considerations:

The Remedial Action Objective (RAO) for AOC C is to reduce risk to potential receptors and prevent further contaminant migration. The current risk to indoor site workers will be assessed through indoor air sampling in Building 505. The RAOs for benzene, toluene, ethylbenzene, and xylenes (BTEX) are the Target Indoor Air Concentrations (OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils, EPA, November 2002).

Prevention of further contaminant migration will be addressed though the proposed alternative remedy. As noted in the Background section, the original remedy (soil excavation) is incapable of addressing all contamination at AOC C at this time (and therefore potential risks to receptors remain). Soil contamination remains in place under Building 505, immediately adjacent to Building 505, and in areas where underground utilities are present. The proposed alternative remedy (bioremediation trenches) is a more comprehensive approach that will address a larger portion of contaminated soil, including areas of contamination inaccessible by excavation (inaccessible areas include those areas under Building 505, immediately adjacent to Building 505, and in areas where underground utilities are present). By addressing a larger portion of contaminated soil, the risk to potential receptors and the risk of further contaminant migration will invariably be reduced.

The proposed alternative remedy would include the installation of two bioremediation trenches (one constructed upgradient of the area of contamination in the vacant lot, and one constructed both downgradient of the area of contamination in the vacant lot and upgradient of the area of contamination under the parking lot and Building 505). The bioremediation trenches will be installed to the base of contamination, with the length of each trench based on the width of the area of contamination as determined by the LIF Investigation. Dedicated piping will be incorporated into the trench design, in order to add an oxygen releasing compound to enhance bioremediation of soil and groundwater. Regenesis ORC Filter Socks (permeable, fabric sleeves filled with ORC® material) will be placed into the dedicated piping. The filter socks will create an oxygenated reaction zone where aerobic biodegradation can occur. As groundwater passes through the highly permeable trench, the ORC® will create a reaction zone downgradient of each trench.

Once the bioremediation trenches have been installed, they will be operating as designed to prevent further contaminant migration. The indoor air samples will be used to confirm that there is no risk to indoor site workers from any remaining inaccessible soil contamination. Once these two actions have been completed, the RAO will be achieved (no risk to indoor site workers, and no risk of further contaminant migration).

\[ Q L W A L \]
DOUGLAS W. GILPIN, Lt Col, USAF
Commander, 5th Civil Engineer Squadron

\[ / D e c / 1 3 \]
Date
DECISION DOCUMENT

OW545

Basewide Underground Storage Tank SWMU 4s and

Basewide Oil Separator SWMU 7q
DECISION DOCUMENT

OW545

Solid Waste Management Units 4s and 7q associated with Building 2038

March 21, 2022

0.0 Site and Location

0.1 Minot Air Force Base (MAFB), North Dakota

1.0 Statement of Basis

1.1 The decision described herein concerns the selected remedy of In Situ Chemical Oxidation (ISCO) and Land Use Controls (LUCs) for Solid Waste Management Unit (SWMU) 4s, the underground storage tank (UST), and SWMU 7q, the oil/water separator (OWS) associated with Building 2038, collectively identified as OW545 in the Resource Conservation and Recovery Act (RCRA) (United States 1976) Part A Permit. The site is located within the flightline, east of former Building 2038.


2.0 Remedy Selection

2.1 The remedy was selected based on the presence of contamination, its concentration, practicality of remediation, and risk posed. The contamination remaining at the site consists of total petroleum hydrocarbons-diesel range organics (TPH-DRO) in soil and groundwater which must be addressed with a different remedy.

2.2 In accordance with the RCRA Permit Section II.H.2 and Section 33.1-24-06-12 of the North Dakota Administrative Code, the next step is for the Department to initiate a permit modification to incorporate this final remedy.

3.0 Declaration of Consistency with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (United States 1980) and National Contingency Plan

3.1 This document presents the selected remedy for this site developed in accordance with the RCRA of 1976, as amended. This selected remedy for these sites is consistent with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Contingency Plan (NCP).
4.0 Facility

4.1 MAFB is located approximately 12 miles north of Minot, North Dakota, in Ward County, as shown in Figure 4-1. Prior to 1955, the property comprising MAFB was farmland. The government purchased the land in 1955, and construction began approximately two years later. The main base area encompasses approximately 4,636 acres. The land use adjacent to the base is predominantly agricultural.

5.0 Physiography

5.1 MAFB is located within the Central Recharge Area—a 1,333 square-mile, nearly flat expanse of glacial ground moraine. The Central Recharge Area is mantled by several hundred feet of glacial drift. The ground surface slopes gently toward the northeast and contains thousands of small, poorly draining prairie potholes (Pettyjohn and Hutchinson 1971).

5.2 Imported vegetation and pavements have displaced the natural land surface and most native plant species on MAFB. Nonnative species such as barnyard grass, downy brome, green foxtail, and crested wheatgrass occur throughout the base. Spruce, green ash, Russian olive, and juniper trees have been planted to provide landscaping and windbreaks.

6.0 Adjacent Land Uses

6.1 MAFB is located in the Northern Great Plains native grassland (e.g., Blue grama and western wheatgrass). Most of the area surrounding the base has been converted to agriculture (EA Engineering 1994).

7.0 Geology

7.1 MAFB is situated upon a laterally and vertically extensive ground moraine. The ground moraine is glacial sediment composed almost entirely of till. The till is characterized as an unstratified deposit of sediment with a particle size ranging from clay to boulders. However, clay and silt size particles account for the largest percentage of the sediment volume sample. The completed boring program confirmed that this till extends to a depth of at least 100 feet beneath MAFB. Deeper borings completed in the vicinity of MAFB indicate the till extends to depths ranging from 140 to 180 feet bgs. Below that depth, the Paleozoic bedrock surface is encountered. Quaternary glacial sediments rest unconformably upon an irregular Paleozaic bedrock surface (NDDEQ 2019).

7.2 The only type of deposit other than till present within the glacial sediments is a minor occurrence of glacial sand and gravel. A review of available literature and the completed borings indicate that these sand and gravel deposits are discontinuous, lenticular, and contain a variety of sediment types. These sand and gravel deposits account for less than five percent of the total volume of the first 100 feet of glacial sediments. Generally, the sand and gravel deposits are scattered throughout the till (NDDEQ 2019).
7.3 The ground moraine beneath MAFB is part of what is referred to in the literature as the Central Recharge Area. The term recharge refers to the process in which water, emanating from precipitation, enters water-bearing units (NDDEQ 2019).

7.4 The results of geotechnical sampling completed during investigations at MAFB indicated the permeability of the glacial till to be approximately in the range of $10^{-6}$ to $10^{-8}$ centimeters per second, which, in relative terms, is very low. This range is commensurate with the permeability values of glacial till reported in the literature. By use of this information and other information obtained during other on base investigations, it was determined that the rate of movement of water downward through this glacial till is in the range of a few centimeters to a few feet per year (NDDEQ 2019).

7.5 The site-specific stratigraphy is composed almost entirely of fine-grained sediments characterized as silt and/or clay with a relatively minor amount of sand (less than 15% based on visual observation during the Supplemental RFI [URS 2020]). The near surface site geology can be characterized as follows:

7.5.1 Top Soil – A layer of black organic loam was present to a depth of approximately six inches at each of the boring locations.

7.5.2 Fill – A layer composed dominantly of fine-grained sediment was present to a depth range of 5 to 9 ft. The base of fill was defined by a dark black silt layer. The fill was composed of native borrow soil and no debris, such as wood or concrete, was observed. The soils were characterized as silts and clay with occasional sand.

7.5.3 Black Silt – This layer was logged in most borings but absent in others. The absence is likely due to remedial excavation activities conducted in these areas to a depth of approximately 10 ft bgs. This layer was identified as the ground surface prior to placement of fill, which was probably associated with the development of the flight line. The layer is less than 1-foot (ft) thick and often contained rootlets.

7.5.4 Till – The material underlying the black silt layer is identified as glacially derived till composed of clay sediments with occasional sand seams that were typically about an inch thick and had varied amounts of fines intermixed. Till was encountered to boring termination (15 ft bgs) in all borings.

7.6 With the exception of the black silt layer, there was poor correlation with specific soil classifications between the borings, which is typical of fill and till. No evidence of significant alluvium deposition was observed near the surface. Minor sand seams were observed within the till and occasional placement of sand in the fill (URS 2020).
8.0 Hydrology

8.1 MAFB is located within the Souris River drainage system. The base is many miles upstream from this major river. MAFB is located within the Egg Creek drainage basin, which is an intermittent tributary basin of the Souris River. Egg Creek drains eastward about 30 miles to North Lake, which in turn drains north to the Souris River via Cut Bank Creek. Because Egg Creek is an intermittent Class III Stream, North Dakota’s least stringent surface-water-quality standards apply (EA Engineering 1994). No area of MAFB is located in a designated floodplain, although ponding does occur in natural potholes on the base.

8.2 Regional surface drainage is controlled by the Souris River, which originates in Saskatchewan, Canada. The Souris River enters North Dakota flowing generally southeast. About 30 miles southeast of MAFB, it loops northeast, then north where it reenters Canada through Manitoba, eventually discharging into Hudson Bay. Flow is regulated by a U.S./Canada joint commission. Area run-off is sparse. The Souris River has one perennial tributary in North Dakota, the Des Lacs River (NDDEQ 2019).

8.3 The Souris River is a Class IA stream. Its waters are suitable for domestic supply after conventional treatment and softening. The Des Lacs River is a Class II stream. Its waters are suitable for domestic supply after advanced treatment.

8.4 Deposits of outwash sands and gravels form very productive aquifers along the major river valleys such as the Minot and Sundre buried channel aquifers occurring near the town of Minot (NDDEQ 2019). Typical aquifer thickness is less than 100 feet.

8.5 Several sedimentary bedrock aquifers, such as the Fort Union and Fox Hills-Hell Creek aquifers of Tertiary age, underlie the Minot area below the glacial deposits at depths usually greater than 200 feet. These aquifers are relatively productive, but their poor water quality limits their use to livestock watering and domestic consumption only in areas where no other source is available (NDDEQ 2019).

8.6 The stratigraphy observed during boring advancement is consistent with other environmental investigations completed at Minot AFB indicating the site is underlain by relatively low permeability clays. The clays are expected to have a hydraulic conductivity on the order of 10-4 to 10-6 cm/sec or 0.2835 to 0.0028 feet/day (ft/day) (URS 2020).

8.7 The presence of sand seams observed in the till present a potential preferred flow pathway. However, the effectiveness of the sand seams as providing a preferred flow pathway for off-site migration would be dependent on their lateral extent and interconnectedness between the sand seams and there is no evidence that the seams are laterally extensive or hydraulically interconnected. The hydraulic conductivity of the sand seams would be expected to be on the order of 10-3 cm/sec (2.835 ft/day) (URS 2020).

8.8 The elevation of the shallow groundwater table varies seasonally with rainfall/snow melt events. Depth to groundwater in monitoring wells ranged from 1.15 to 3.19 ft bgs in 2019, which correlates to an elevation of 1625.63 to 1627.45 ft above mean sea level (amsl).
potentiometric surface derived from groundwater elevations indicate that groundwater flow is to the east-southeast (URS 2020).

9.0 Surface Hydrology

9.1 Surface water drainage on MAFB is restricted primarily to drainage ditches, pipes, and lines that drain to two ditches which flow north into Egg Creek. The western primary drainage ditch uses a glacial melt water channel to carry surface water runoff to Egg Creek. Some storm water runoff on the west end of the runway area flows west to a south flowing intermittent stream (NDDEQ 2019).

9.2 There are no perennial streams on MAFB. Surface water on the base comes from surface runoff. Egg Creek, which receives most of the surface drainage from MAFB, is designated as a Class III stream by the North Dakota Department of Environmental Quality (NDDEQ). Class III streams are defined as streams where the quality of water is adequate for industrial and agricultural uses such as cooling, washing, irrigation, and stock watering (NDDEQ 2019).

9.3 Site OW545 is relatively flat and is surrounded by pavement on all sides. Ponding of water is observed for short periods following rainfall events indicating that rainfall on the site infiltrates into the ground. There are no engineered drainage controls for stormwater management. There are no surface water features near Site OW545. The closest include an off-base unnamed tributary located to the south and drainage ditches located to the west and east. Each are located approximately one-half mile from the site (URS 2020).

10.0 Site Background

10.1 OW545 is located next to the flight line at MAFB and includes SWMUs 4s and 7q (Figure 10-1). SWMU 4s was a former UST which received waste oil from an OWS; both the UST and OWS were installed in 1983 and removed in October 1992. The OWS was connected to a drain in Building 2038 which was used for the maintenance and testing of jet engines. During the operational period, various fuels, oils, hydraulic fluids, and cleaning compounds were washed down the drain. SWMU 7q was a second former OWS installed in 1993 and removed in December 1998 (URS Group, Inc. [URS] 2012, NDDEQ 2019) which received waste aircraft fuel and oils from jet engine testing operations at Building 2038 (EA Engineering 1994).

10.2 OW545 currently has only one small structure present. Building 2038 was previously located on a portion of Site OW545. Based on a review of historical aerial images, Building 2038 was removed sometime between 2010 and 2013. The former location of Building 2038 and approximate locations of SWMU 4s and 7q are shown on Figure 10-2. It should be noted that historical documentation (e.g., Sverdrup Environmental Inc. [Sverdrup] 2000, URS 2012, NDDEQ 2019) provides figures and detailed written descriptions as to the locations of the UST (SWMU 4s) and second OWS (SWMU 7q); however, the documentation as to the location of the original OWS is more general. Although there is uncertainty as to the exact location of the original OWS (removed in October 1992), the historical documentation
indicates it was in the same vicinity as SWMU 4s and 7q. After the UST and OWS removal actions in October 1992 and December 1998, SWMU 4s and SWMU 7q were considered closed with decision documents issued in 1999 (NDDEQ 2014).

10.3 In 2012, the Air Force performed an evaluation of OWSs to determine if further environmental investigation was eligible under the Defense Environmental Restoration Account (DERA). This evaluation noted that groundwater sampling from 1995 associated with the investigation of the original OWS showed exceedances of total chromium above the state action level but below the MCL and exceedances of TPH-DRO above the state action level of 500 parts per billion (ppb) at 2,950 ppb. The evaluation concluded that this OWS was eligible for DERA funding (URS 2012).

10.4 In 2015 and 2016, ARGO/LRS Joint Venture (ARGO/LRS JV), under Air Force Civil Engineer Center (AFCEC) Contract Number FA8903-10-D-8551, performed groundwater sampling activities to define the nature and extent of any remaining groundwater contamination at OW545. TPH-DRO was detected at a maximum concentration of 1.080 mg/L in a sample collected on 13 June 2016 from temporary well TW-07 (Figure 10-3), which is above the Cleanup Action Level of 0.5 mg/L (NDDEQ 2006). Total chromium (hexavalent and trivalent chromium) was detected at a maximum observed concentration of 0.0158 mg/L which is below the NDDEQ groundwater Cleanup Action Level (0.05 mg/L) and the Maximum Contaminant Level (0.1 mg/L) (ARGO/LRS JV 2017). Therefore, chromium does not present an unacceptable risk to human health and the environment; TPH-DRO is the only contaminant of concern for these sites.

10.5 In addition to the groundwater results, during the temporary well installation in 2015 the contractor’s field staff noted the possible presence of soil contamination based on elevated photoionization detector field measurements and soil discoloration. No soil samples were collected or analyzed. When the information concerning the possible presence of remaining soil contamination at the site became known to the Air Force in 2017, it was relayed to the NDDEQ. As a result of the failure to report the possible presence of soil contamination at the site in 2015, NDDEQ issued a notice of violation of the RCRA permit (AFCEC 2018). Addenda to the decision documents for SWMU 4s and SWMU 7q were added to indicate that OW545, which includes SWMU 4s and 7q, are no longer considered closed. This discovery of potential soil and groundwater contamination prompted the need for a Supplemental RCRA Facility Investigation (RFI) to fully delineate the nature and extent of the potential TPH-DRO and chromium contamination (NDDEQ 2019).

10.6 The Supplemental RFI (URS 2020) included soil sampling in August 2019 and groundwater sampling in August and October 2019. The soil and groundwater sampling results are shown on Figure 10-3 and Figure 10-4, respectively. The analytical results indicated that total chromium concentrations were below screening levels for soil and groundwater; however, TPH-DRO was present above NDDEQ Cleanup Action Levels in both soil and groundwater. The maximum concentration observed in soil was 130 mg/kg at a depth of 10.5 to 11.5 feet bgs at TW-08. The maximum concentration observed in groundwater was 2.1 mg/L in a screening level groundwater sample collected from temporary well TW-11. The maximum
concentration observed in a groundwater sample from a permanent well was 0.7 mg/L from well OW545-MW1.

10.7 A corrective measures study was completed in November 2020 to develop and evaluate corrective action alternatives at OW545. The alternatives developed were Closure to Site-Specific Cleanup Action Levels, Monitored Natural Attenuation, and Enhanced Aerobic Bioremediation. The study recommended Enhanced Aerobic Bioremediation for implementation due to its high ratings for technical performance, reliability, and institutional acceptance (URS 2020).

11.0 Public Community and Regulatory Agencies

11.1 The Administrative Record (AR) is the legal record of the physical situation at an installation by which response actions are reviewed and defended. An AR must be established at each installation which has conducted or is conducting Installation Restoration Program (IRP) activities and must be available to the public at or near the installation. This record is maintained at the following location and is updated as needed by the base Remedial Project Manager.

5 CES/CEIE
445 Peacekeeper Place
Minot AFB, ND 58705-5006

11.2 An information repository (IR) is a project file on IRP activities at Air Force installations. The repository is to be established for all remedial action sites and for all sites where removal actions last longer than 120 days. It is located either on or off base at a place convenient to the community and contains site information, investigatory reports, information about the sources and nature of the contaminants, and a schedule for cleanup operations. The IR is intended to address community relations requirements and is a source of reading material for the public. This is maintained at the following location and is updated as needed by the base Remedial Project Manager.

Minot Public Library
516 2nd Ave SW
Minot, ND 58701

12.0 Technical Review Committees/Restoration Advisory Boards

12.1 A Technical Review Committee (TRC) was established at MAFB in April 1992 to review and comment on Department of Defense actions and proposed actions with respect to releases or threatened releases of hazardous substances into the environment at MAFB. The TRC was also established to ensure open communication and exchange of ideas with the general public about the MAFB IRP and CERCLA (United States 1980), the Superfund Amendments and Reauthorization Act (United States 1986), and RCRA (United States 1976).
12.2 The primary purpose and function of the TRC was informational, specifically to foster community and interagency awareness and understanding of MAFB IRP remedial actions related to the releases or threatened releases of hazardous substances at MAFB.

12.3 The TRC was replaced by the Restoration Advisory Board (RAB) in 1994, and the MAFB RAB held its first meeting on 8 February 1995. The RAB is an advisory body designed to act as a focal point for the exchange of information between MAFB and the local community regarding restoration activities. RAB meetings were initially held quarterly, and later were held on a semi-annual basis until 2002. In 2003, the RAB meetings were held annually. In December 2004, MAFB requested and received permission to discontinue the RAB meetings, from the NDDEQ and Headquarters Air Combat, due to lack of public participation.

13.0 Selected Remedy

13.1 A remedy of ISCO injection and LUCs was selected for remediation of the contaminated media at OW545. ISCO injection will be used to achieve Cleanup Action Levels for TPH-DRO of 0.5 mg/L in groundwater and 100 mg/kg in soil.

13.2 The remedy will include continuation of existing access restrictions as LUCs to limit human exposure to soil and groundwater contaminated above the Cleanup Action Levels. The access restrictions are required to remain in place until TPH-DRO attains levels suitable for unlimited use and unrestricted exposure.

13.3 A baseline monitoring event prior to injection will be completed to determine the TPH-DRO concentrations in the five monitoring wells on site: 7MW2038A, OW545-MW1, OW545-MW2, OW545-MW3, OW545-MW4.

13.4 The ISCO injection will be completed over the entire area of contamination exceeding Cleanup Action Levels.

13.5 Quarterly groundwater monitoring will be completed during the first-year post-injection, followed by semi-annual monitoring at least during the second year to evaluate effectiveness of injections and demonstrate TPH-DRO remains below Cleanup Action Levels for two years. Monitoring will be completed at the same wells as during the baseline event.

13.6 After two years of TPH-DRO concentrations remaining below Cleanup Action Levels, annual groundwater monitoring will continue, as needed, for field parameters and TPH-DRO to demonstrate continued achievement of groundwater Cleanup Action Levels. Monitoring will continue through 2027 or until site closure is recommended and approved.

14.0 Evaluation of Selected Remedy

14.1 An analysis of the remedy was conducted to evaluate the remedy with respect to its relative performance in meeting nine criteria. These evaluation criteria are divided into three categories and have been developed by the United States Environmental Protection Agency to address the technical and policy considerations that have proven important for selecting remedies.

14.2.1 Threshold Criteria
   a. Overall protection of human health and the environment
   b. Compliance with Applicable or Relevant and Appropriate Requirements (ARAR)

14.2.2 Primary Balancing Criteria
   a. Long-Term effectiveness and permanence
   b. Reduction of toxicity, mobility, or volume (TMV)
   c. Short-term effectiveness
   d. Implementability
   e. Cost

14.2.3 Modifying Criteria
   a. State Acceptance
   b. Community Acceptance

14.3 Criterion 1: Overall Protection of Human Health and the Environment

   a. Protectiveness is a threshold criteria that remedial actions must meet under CERCLA. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed through each pathway at the site.

   b. Selected Remedy – ISCO injection will remediate TPH-DRO in groundwater and soil, reducing concentrations to below Cleanup Action Levels. The reduction in TPH-DRO concentrations will mitigate any unacceptable risk to human health. Administrative controls will be in place to protect human health receptors from exposure until TPH-DRO concentrations reach levels suitable for unlimited use and unrestricted exposure. There was no ecological risk identified during the previously completed risk assessment.

14.4 Criterion 2: Compliance with ARAR

   a. Compliance with ARAR is one of the statutory requirements of the remedy selection. Applicable requirements are cleanup standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site. Relevant and appropriate requirements address problems or situations sufficiently similar to those encountered at the site and thus their use is well suited to the environmental and technical factors at a particular site. The identified ARARs at OW545 are the NDDEQ Cleanup Action Levels for TPH-DRO.

   b. Selected Remedy – This remedy seeks TPH-DRO concentrations below 100 mg/kg in soil and below 0.5 mg/L in groundwater. ISCO injection will reduce concentrations to below these levels.
14.5 Criterion 3: Long-Term Effectiveness and Permanence

a. This criterion reflects CERCLA emphasis on implementing remedies that will ensure protection of human health and the environment in the long term. The assessment of remedies against this criterion evaluates the residual risks at a site after completion of a remedial action.

b. Selected Remedy – This remedy will achieve long-term effectiveness and permanence through remediation of contaminated media at the site to below Cleanup Action Levels.

14.6 Criterion 4: Reduction of Toxicity, Mobility, and Volume

a. This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies a remedy may employ.

b. Selected Remedy – This remedy will implement an active corrective measure (ISCO injection). The treatment of soil and groundwater with the injected material has been shown effective in reducing toxicity, mobility, and volume.

14.7 Criterion 4: Short-Term Effectiveness

a. This criterion addresses short-term impacts of the remedy. The assessment against this criterion examines the effectiveness of remedies in protecting human health and the environment during the construction and implementation of a remedy.

b. Selected Remedy – This remedy will be effective in the short-term by using access restrictions to mitigate any potential human exposures to contaminated site media. The access restrictions will reliably prevent human exposures to subsurface contamination exceeding Cleanup Action Levels. There will be short-term risks associated with implementation of the remedy, but these risks are limited to site workers who will be equipped with proper training, safety equipment, and personal protective equipment to effectively mitigate these risks.

14.8 Criterion 6: Implementability

a. The assessment against this criterion evaluates the technical and administrative feasibility of the remedy and the availability of the goods and services needed to implement them.

b. Selected Remedy – This remedy is technically and administratively feasible as it is a common practice in remediation. The goods and services needed to implement the remedy are readily available.
14.9 Criterion 7: Cost

a. Cost encompasses all engineering, construction, and operation and maintenance costs incurred over the life of the project. The assessment against this criterion is based on the present worth of these costs.

b. Selected Remedy – The cost for this remedy can vary greatly based on many different factors including, but not limited to labor, injection material used, the amount injected, and laboratory analysis, etc. The cost has already been accepted in an existing contract.

14.10 Criterion 8: State Acceptance

a. This criterion, which is an ongoing concern throughout the corrective action process, reflects the statutory requirement to provide for substantial and meaningful State involvement.

b. Selected Remedy – This remedy is recognized by NDDEQ as an acceptable form of remedial action.

14.11 Criterion 9: Community Acceptance

a. This criterion reflects the community's apparent preferences or concerns about remedies.

b. The IR is the avenue through which the base has informed the community of IRP and RCRA Corrective Action activities. A RAB was previously in place, but the RAB was dissolved in 2004 due to a lack of public participation. The IR has provided an opportunity for public comment/involvement in RCRA and IRP remediation activities. A 45-day public comment period will be held to allow for public review, prior to selected remedy approval.

c. Historically, there has been little public interest in this activity based on the questions/comments posed by community members.

d. Selected Remedy – It is anticipated that, due to the unobtrusive and highly localized nature of the remedy, the community will look favorably upon its implementation.

15.0 Contamination Present

15.1 Soil TPH-DRO contamination above the Cleanup Action Level of 100 mg/kg was observed in August 2019 at TW-08 at a concentration of 130 mg/kg, 10.5 to 11.5 feet bgs.

15.2 Groundwater TPH-DRO contamination above the Cleanup Action Level of 0.5 mg/L was observed in August 2019 at TW-08, TW-09, TW-11, TW-14, and OW545-MW1 at concentrations of 0.61, 0.60, 2.1, 0.71, and 0.70 mg/L, respectively.

15.3 Figure 15-1 shows the location of these samples with an estimate of the extent of groundwater contamination. The figure also shows the estimated area of groundwater contamination above the Cleanup Action Level.
15.4 The single soil sample exceeding the Cleanup Action Level is within the groundwater contamination footprint. Based on the soil sample depth and depth to groundwater, the soil sample was likely collected from below the vadose zone.

16.0 Conclusion

16.1 The selected remedy for OW545 is ISCO injection using Direct Push Technology to inject oxidant throughout the estimated zone of soil and groundwater contamination to remediate TPH-DRO and achieve the concentrations below Cleanup Action Levels of 0.5 mg/L in groundwater and 100 mg/kg in soil. Groundwater sampling will be completed to monitor the effectiveness of the injections and for comparison to Cleanup Action Levels at OW545.
Figure 4-1

Base Location
Minot AFB, North Dakota

Decision Document

Project Number: 60634638
Drawn By: DPG
1. **Reason for Submittal** (Select only one.)

- [ ] Obtaining or updating an EPA ID number for an on-going regulated activity that will continue for a period of time. (Includes HSM activity)
- [ ] Submitting as a component of the Hazardous Waste Report for __________ (Reporting Year)
- [ ] Site was a TSD facility and/or generator of > 1,000 kg of hazardous waste, > 1 kg of acute hazardous waste, or > 100 kg of acute hazardous waste spill cleanup in one or more months of the reporting year (or State equivalent LGG regulations)
- [ ] Notifying that regulated activity is no longer occurring at this Site
- [ ] Obtaining or updating an EPA ID number for conducting Electronic Manifest Broker activities
- [x] Submitting a new or revised Part A Form

2. **Site EPA ID Number**

   ND 4 5 7 1 9 2 4 7 5 8

3. **Site Name**

   Minot Air Force Base

4. **Site Location Address**

   - **Street Address**: 145 Poshokooper Place, 5 CES/CEIE
   - **City, Town, or Village**: Minot AFB
   - **County**: Ward
   - **State**: ND
   - **Country**: USA
   - **Zip Code**: 88705

5. **Site Mailing Address**

   - [x] Same as Location Address

   - **Street Address**
   - **City, Town, or Village**
   - **State**
   - **Country**
   - **Zip Code**

6. **Site Land Type**

   - [ ] Private
   - [ ] County
   - [ ] District
   - [x] Federal
   - [ ] Tribal
   - [ ] Municipal
   - [ ] State
   - [ ] Other

7. **North American Industry Classification System (NAICS) Code(s) for the Site (at least 5-digit codes)**

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<th>B.</th>
<th>C.</th>
<th>D.</th>
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EPA Form 8700-12, 8700-13 A/B, 8700-23
### 8. Site Contact Information

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<thead>
<tr>
<th>Title</th>
<th>Restoration Program Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name</td>
<td>Douglas</td>
</tr>
<tr>
<td>Last Name</td>
<td>Chase</td>
</tr>
<tr>
<td>Street Address</td>
<td>106 Peacekeeper Dr, Ste 2N3</td>
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<tr>
<td>City, Town, or Village</td>
<td>Offutt AFB</td>
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<tr>
<td>State</td>
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<tr>
<td>Zip Code</td>
<td>68113-4000</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:douglas.chase.2@us.af.mil">douglas.chase.2@us.af.mil</a></td>
</tr>
<tr>
<td>Phone</td>
<td>402-294-1629</td>
</tr>
</tbody>
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### 9. Legal Owner and Operator of the Site

#### A. Name of Site’s Legal Owner

<table>
<thead>
<tr>
<th>Full Name</th>
<th>Bradley L. Cochran, Colonel, USAF</th>
<th>Date Became Owner (mm/dd/yyyy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner Type</td>
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<td>Street Address</td>
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<td>Zip Code</td>
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<td></td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:bradley.coehran@us.af.mil">bradley.coehran@us.af.mil</a></td>
<td></td>
</tr>
<tr>
<td>Phone</td>
<td>701-723-3115</td>
<td></td>
</tr>
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#### D. Name of Site’s Legal Operator

<table>
<thead>
<tr>
<th>Full Name</th>
<th>Lt Col Matthew R. Altman, 5 CES/CC</th>
<th>Date Became Operator (mm/dd/yyyy)</th>
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<td>City, Town, or Village</td>
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<td>Country</td>
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<tr>
<td>Zip Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:matthew.altman@us.af.mil">matthew.altman@us.af.mil</a></td>
<td></td>
</tr>
<tr>
<td>Phone</td>
<td>701-723-2434</td>
<td></td>
</tr>
</tbody>
</table>

Comments: Person is the Base Civil Engineer (BCE) and a new incumbent rotates in this position typically every two years.
10. Type of Regulated Waste Activity (at your site)
Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

1. Generator of Hazardous Waste—If "Yes", mark only one of the following—a, b, c
   
   a. LQG - Generates, in any calendar month (includes quantities imported by importer site) 1,000 kg/mo (2,200 lb/mo) or more of non-acute hazardous waste; or - Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or - Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.

   b. SQG - 100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.

   c. VSGQ - Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.

If "Yes" above, indicate other generator activities in 2 and 3, as applicable.

2. Short-Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section.

3. Mixed Waste (hazardous and radioactive) Generator

4. Treater, Storer or Disposer of Hazardous Waste—Note: A hazardous waste Part B permit is required for these activities.

5. Receives Hazardous Waste from Off-site

6. Recycler of Hazardous Waste
   
   a. Recycler who stores prior to recycling
   
   b. Recycler who does not store prior to recycling

7. Exempt Boiler and/or Industrial Furnace—If "Yes", mark all that apply.
   
   a. Small Quantity On-site Burner Exemption
   
   b. Smelting, Melting, and Refining Furnace Exemption

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.
12. Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR 262 Subpart K.

A. Opting into or currently operating under 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories—If "Yes", mark all that apply. Note: See the item-by-item instructions for definitions of types of eligible academic entities.

☐ 1. College or University

☐ 2. Teaching Hospital that is owned by or has a formal written affiliation with a college or university

☐ 3. Non-profit Institute that is owned by or has a formal written affiliation with a college or university

B. Withdrawing from 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories.

13. Episodic Generation

☐ Y ☐ N Are you an SQG or VSOG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves you to a higher generator category? If "Yes", you must fill out the Addendum for Episodic Generator.

14. LQG Consolidation of VSOG Hazardous Waste

☐ Y ☐ N Are you an LQG notifying of consolidating VSOG Hazardous Waste Under the Control of the Same Person pursuant to 40 CFR 262.17(f)? If "Yes", you must fill out the Addendum for LQG Consolidation of VSQGs hazardous waste.

15. Notification of LQG Site Closure for a Central Accumulation Area (CAA) (optional) OR Entire Facility (required)

☐ Y ☐ N LQG Site Closure of a Central Accumulation Area (CAA) or Entire Facility.

A. Central Accumulation Area (CAA) ☐ Entire Facility

B. Expected closure date: mm/dd/yyyy

C. Requesting new closure date: mm/dd/yyyy

D. Date closed: mm/dd/yyyy

☐ 1. In compliance with the closure performance standards 40 CFR 262.17(a)(8)

☐ 2. Not in compliance with the closure performance standards 40 CFR 262.17(a)(8)


☐ Y ☐ N Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 260.30, 40 CFR 261.4(23), (24), or (27)? If "Yes", you must fill out the Addendum to the Site Identification Form for Manageable Hazardous Secondary Material.

☐ Y ☐ N Are you notifying under 40 CFR 260.43(a)(4) that the product of your recycling process has levels of hazardous constituents that are not comparable to or unable to be compared to a legitimate product or intermediate but that the recycling is still legitimate? If "Yes", you may provide explanation in Comments section. You must also document that your recycling is still legitimate and maintain that documentation on site.

17. Electronic Manifest Broker

☐ Y ☐ N Are you notifying as a person, as defined in 40 CFR 260.10, electing to use the EPA electronic manifest system to obtain, complete, and transmit an electronic manifest under a contractual relationship with a hazardous waste generator?
18. Comments (include item number for each comment)

19. Certification I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowingly violations. Note: For the RCRA Hazardous Waste Part A permit Application, all owners and operators must sign (see 40 CFR 270.10(b) and 270.11).

<table>
<thead>
<tr>
<th>Signature of legal owner, operator or authorized representative</th>
<th>Date (mm/dd/yyyy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bradley Cochran, Colonel, USAF</td>
<td>08/06/2018</td>
</tr>
</tbody>
</table>

Printed Name (First, Middle Initial Last) | Title |
----------------------------------------|-------|
Bradley L. Cochran, Colonel, USAF       | Commander, 5th Bomb Wing |

Email: bradley.cochran@us.af.mil

Signature of legal owner, operator or authorized representative

Printed Name (First, Middle Initial Last)

Email
ADDENDUM TO THE SITE IDENTIFICATION FORM:
NOTIFICATION OF HAZARDOUS SECONDARY MATERIAL ACTIVITY

ONLY fill out this form if:
- You are located in a State that allows you to manage excluded hazardous secondary material (HSM) under 40 CFR 261.2(30), 261.4(a)(23), (24), or (27) (or state equivalent); See https://www.epa.gov/eawaste/hazard/dist.html for a list of eligible states. AND
- You are or will be managing excluded HSM in compliance with 40 CFR 260.30, 261.4(a)(23), (24), or (27) (or state equivalent) or have stopped managing excluded HSM in compliance with the exclusion(s) and do not expect to manage any amount of excluded HSM under the exclusion(s) for at least one year. Do not include any information regarding your hazardous waste activities in this section. Note: If your facility was granted a solid waste variance under 40 CFR 260.30 prior to July 13, 2015, your management of HSM under 40 CFR 260.30 is grandfathered under the previous regulations and you are not required to notify for the HSM management activity excluded under 40 CFR 260.30.

1. Reason for Notification (Include dates where requested)
   - Facility will begin managing excluded HSM as of ____________ (mm/dd/yyyy).
   - Facility is still managing excluded HSM/re-notifying as required by March 1 of each even-numbered year.
   - Facility has stopped managing excluded HSM as of ____________ (mm/dd/yyyy) and is notifying as required.

2. Description of Excluded HSM Activity. Please list the appropriate codes (see Code List section of the instructions) and quantities, in short tons, to describe your excluded HSM activity ONLY (do not include any information regarding your hazardous wastes). Use additional pages if more space is needed.

<table>
<thead>
<tr>
<th>A. Facility Code</th>
<th>B. Waste Code(s) for HSM</th>
<th>C. Estimate Short Tons of excluded HSM to be managed annually</th>
<th>D. Actual Short Tons of excluded HSM that was managed during the most recent odd-numbered year</th>
<th>E. Land-based Unit Code</th>
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</thead>
<tbody>
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</table>

EPA Form 8700-12, 8700-13 A/B, 8700-23
ADDENDUM TO THE SITE IDENTIFICATION FORM:
EPISODIC GENERATOR

**ONLY fill out this form if:**
- You are an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves the generator to a higher generator category pursuant to 40 CFR 262 Subpart L.

Note: Only one planned and one unplanned episodic event are allowed within one year; otherwise, you must follow the requirements of the higher generator category. Use additional pages if more space is needed.

<table>
<thead>
<tr>
<th>Episodic Event</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Planned</td>
<td></td>
</tr>
<tr>
<td>- Excess chemical inventory removal</td>
<td></td>
</tr>
<tr>
<td>- Tank cleanouts</td>
<td></td>
</tr>
<tr>
<td>- Short-term construction or demolition</td>
<td></td>
</tr>
<tr>
<td>- Equipment maintenance during plant shutdowns</td>
<td></td>
</tr>
<tr>
<td>- Other</td>
<td></td>
</tr>
<tr>
<td>2. Unplanned</td>
<td></td>
</tr>
<tr>
<td>- Accidental spills</td>
<td></td>
</tr>
<tr>
<td>- Production process upsets</td>
<td></td>
</tr>
<tr>
<td>- Product recalls</td>
<td></td>
</tr>
<tr>
<td>- &quot;Acts of nature&quot; (Tornado, hurricane, flood, etc.)</td>
<td></td>
</tr>
<tr>
<td>- Other</td>
<td></td>
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</table>

|            |          |
| 3. Emergency Contact Phone              |          |
| 4. Emergency Contact Name               |          |

|            |          |
| 5. Beginning Date (mm/dd/yyyy)          | 6. End Date (mm/dd/yyyy) |

**Waste 1**

|            |          |
| 7. Waste Description                      | 8. Estimated Quantity (in pounds) |

|            |          |
| 9. Federal and/or State Hazardous Waste Codes |          |

**Waste 2**

|            |          |
| 7. Waste Description                      | 8. Estimated Quantity (in pounds) |

|            |          |
| 9. Federal and/or State Hazardous Waste Codes |          |

**Waste 3**

|            |          |
| 7. Waste Description                      | 8. Estimated Quantity (in pounds) |

|            |          |
| 9. Federal and/or State Hazardous Waste Codes |          |
ADDENDUM TO THE SITE IDENTIFICATION FORM:  
LQG CONSOLIDATION OF VSQG HAZARDOUS WASTE

ONLY fill out this form if:
- You are an LQG receiving hazardous waste from VSQGs under the control of the same person. Use additional pages if more space is needed.

<table>
<thead>
<tr>
<th>VSQG 1</th>
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</thead>
<tbody>
<tr>
<td>1. EPA ID Number:</td>
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</tr>
<tr>
<td>3. Street Address</td>
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</tr>
<tr>
<td>4. City, Town, or Village</td>
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<td>5. State</td>
</tr>
<tr>
<td>6. Zip Code</td>
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<td>8. Contact Name</td>
</tr>
<tr>
<td>7. Contact Phone Number</td>
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# United States Environmental Protection Agency

**HAZARDOUS WASTE REPORT _______ (reporting cycle)**

**WASTE GENERATION AND MANAGEMENT (GM) FORM**

## 1. Waste Characteristics

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<th>Code(s)</th>
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## 2. On-site Generation and Management of Hazardous Waste

<table>
<thead>
<tr>
<th>Process System 1</th>
<th>Management Method Code</th>
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<tbody>
<tr>
<td>Process System 2</td>
<td>Management Method Code</td>
<td>Quantity</td>
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</tbody>
</table>

## 3. Off-site Shipment of Hazardous Waste

<table>
<thead>
<tr>
<th>Site 1</th>
<th>EPA ID of facility to which waste was shipped</th>
<th>Management Method Code</th>
<th>Total Quantity Shipped</th>
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<tbody>
<tr>
<td>Site 2</td>
<td>EPA ID of facility to which waste was shipped</td>
<td>Management Method Code</td>
<td>Total Quantity Shipped</td>
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<tr>
<td>Site 3</td>
<td>EPA ID of facility to which waste was shipped</td>
<td>Management Method Code</td>
<td>Total Quantity Shipped</td>
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## 4. Comments

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EPA Form 8700-12, 8700-13 A/B, 8700-23
## 1. Waste 1

A. Waste Description

B. EPA Hazardous Waste Code(s)

C. State Hazardous Waste Code(s)

D. EPA ID Number

E. Form Code

F. Management Code

G. Quantity | UOM | Density
--- | --- | ---

## 2. Waste 2

A. Waste Description:

B. EPA Hazardous Waste Code(s)

C. State Hazardous Waste Code(s)

D. EPA ID Number

E. Form Code

F. Management Code

G. Quantity | UOM | Density
--- | --- | ---

## 3. Waste 3

A. Waste Description:

B. EPA Hazardous Waste Code(s)

C. State Hazardous Waste Code(s)

D. EPA ID Number

E. Form Code

F. Management Code

G. Quantity | UOM | Density
--- | --- | ---

## 4. Comments
<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
<th>Comments</th>
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<tbody>
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</tbody>
</table>

EPA Form 8700-12, 8700-13 A/B, 8700-23
United States Environmental Protection Agency
HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name: Douglas
Middle Initial: J
Last Name: Chase
Title: Restoration Program Manager
Email: douglas.chase.2@us.af.mil
Phone: 402-294-1629
Ext: 
Fax: 

2. Facility Permit Contact Mailing Address

Street Address: 106 Peacekeeper Dr, Ste 2N3
City, Town, or Village: Offutt AFB
State: NE
City: Offutt AFB
State: NE
Zip Code: 68113-4000

3. Facility Existence Date (mm/dd/yyyy)

1/1/1957

4. Other Environmental Permits

<table>
<thead>
<tr>
<th>A. Permit Type</th>
<th>B. Permit Number</th>
<th>C. Description</th>
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</thead>
<tbody>
<tr>
<td>N N D 0 0 2 3 4 8 8 4</td>
<td>NPDES (Missile Sites Wastewater)</td>
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</tr>
<tr>
<td>N N D 0 0 3 4 4 8 8 4</td>
<td>NPDES (Base Wastewater)</td>
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<tr>
<td>N N D R 1 0 0 0 0 0 0</td>
<td>NPDES (Base Construction Activities)</td>
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<tr>
<td>N N D R 0 0 0 0 0 3 1 5</td>
<td>Base Stormwater</td>
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<tr>
<td>E F 7 8 0 0 1</td>
<td>Air Pollution control Permit</td>
<td></td>
</tr>
<tr>
<td>E M R 0 5 0 6 6 5 0</td>
<td>US Fish and Wildlife Salvage</td>
<td></td>
</tr>
<tr>
<td>E M B 0 5 2 7 3 5 - 0</td>
<td>US Fish and Wildlife Depredation</td>
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</tbody>
</table>

5. Nature of Business

Minot AFD is an active Air Force Installation which supports both Combat and Missile Wing. All activities provide for national defense.

EPA Form 8700-12, 8700-13 A/B, 8700-23
6. Process Codes and Design Capacities

<table>
<thead>
<tr>
<th>Line Number</th>
<th>A. Process Code</th>
<th>B. Process Design Capacity</th>
<th>C. Process Total</th>
<th>D. Unit Name</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1) Amount</td>
<td>Number of Units</td>
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<td></td>
<td>(2) Unit of Measure</td>
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</tbody>
</table>

7. Description of Hazardous Wastes

(Enter codes for Items 7.A, 7.C and 7.D(1))

<table>
<thead>
<tr>
<th>Line No.</th>
<th>A. EPA Hazardous Waste No.</th>
<th>B. Estimated Annual Qty of Waste</th>
<th>C. Unit of Measure</th>
<th>D. Processes</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>(1) Process Codes</td>
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8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

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