INSTALLATION RESTORATION PROGRAM
TWIN CITIES ARMY AMMUNITION PLANT

SITE F CLOSURE CERTIFICATION REPORT

VOLUME 2: APPENDICES A – J

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JULY 1999
FINAL REPORT

Appendix A

Excerpts from the RCRA Permit for the TCAAP Facility

- A.1 Excerpt from RCRA Permit Dated August 1991
- A.2 Excerpt from Revised RCRA Permit Dated May 1993
- A.3 Excerpt from Reissued RCRA Permit Dated October 1996

A.1 RCRA Permit Dated August 1991

FINAL PERMIT

FOR

UNITED STATES ARMY
(MN7213820908)

AND

ALLIANT TECHSYSTEMS, INCORPORATED
(MND000819268)

AND

FEDERAL CARTRIDGE COMPANY
(MN7213820908)

FOR A

HAZARDOUS WASTE STORAGE AND TREATMENT FACILITY

LOCATED AT

TWIN CITIES ARMY AMMUNITION PLANT

GARDEN HILLS, MINNESOTA

AUGUST 1991

MINNESOTA POLLUTION CONTROL AGENCY
520 LAFAYETTE ROAD
ST. PAUL, MINNESOTA 55155

STATE OF MINNESOTA

POLLUTION CONTROL AGENCY

HAZARDOUS WASTE STORAGE AND TREATMENT FACILITY PERMIT

FOR

UNITED STATES ARMY
(MN7213820908)

AND

ALLIANT TECHSYSTEMS, INCORPORATED
(MND000819268)

AND

FEDERAL CARTRIDGE COMPANY

(MN7213820908)
CO-PERMITTEES

TWIN CITIES ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

In accordance with the provisions of Minn. Stat. chs. 115 and 116, Minn. Rules pts. 7001.0010 - 7001.0730, and Minn. Rules pts. 7045.0100 - 7045.1380, a Hazardous Waste Storage and Treatment Facility Permit (Permit) is hereby issued to the United States Army (U.S. Army), Alliant Techsystems, Incorporated (ATI) formerly Honeywell, Incorporated (Honeywell), and Federal Cartridge Company (FCC) located at the Twin Cities Army Ammunition Plant (TCAAP) in Arden Hills, Minnesota. Honeywell's operations at the facility were acquired by ATI on September 28, 1990.

This Permit has been prepared based upon the information provided by ATI's most recent permit application including revisions received through December 14, 1990, and FCC's permit application received on October 5, 1984. ATI's permit application is referenced throughout this Permit and as such, is an integral and enforceable part of this Permit.

The U.S. Army is the owner of the Resource Conservation and Recovery Act (RCRA) facility which is defined to be the entire TCAAP described in Part I and delineated in Appendix I. ATI operates storage and treatment activities within certain buildings at the TCAAP. FCC is in the process of closing a nonoperational site previously used for open burning/open detonation of explosives. ATI is a tenant on TCAAP allowed to conduct various operations. FCC is the prime operating contractor under contract with the Army to conduct its respective operations. The Army, ATI, and FCC are all Permittees on this Permit and together they are referred to as the Co-Permittees. Specific Co-Permittees as identified in each respective part of this permit shall be jointly and severally liable for compliance with the terms and conditions of

this Permit. Compliance by one of the Co-Permittees will be considered compliance by all of the other Co-Permittees to whom the term or condition applies. Other terms and conditions apply to those persons who are included in the term or condition. Should one of the operators fail to comply with a term or condition of this permit, the U.S. Army shall, within a responsible period of time, ensure that compliance is achieved.

This Permit authorizes and requires the Co-Permittees to conduct the following activities at the TCAAP. ATI is authorized to conduct the following activities: 1) store hazardous wastes in an indoor bulk waste pile; 2) store hazardous wastes in ten (10) container storage areas; and 3) treat hazardous wastes in containers. FCC and the U.S. Army are required to close a former site used for open burning/open detonation of explosives. All three Co-Permittees are required to conduct corrective action on thirteen (13) identified Solid Waste Management Units (SWMUs) at the TCAAP. The MPCA shall look first to specific Co-Permittees as set out in Parts IX and X for closure of Site F and corrective action on the SWMUs. The Co-Permittees must at all times conduct their hazardous waste management activities at the TCAAP in accordance with the terms and conditions of this Permit and any other requirements imposed by law.

Under the terms and conditions of this permit, ATI is not responsible for any activities associated with Site F and FCC is not responsible for any of the on going storage and treatment activities being conducted by ATI.

This Permit shall become effective on the date of issuance by the Minnesota Pollution Control Agency Hazardous Waste Division Director.

This Permit is effective until five years from date of issuance or until terminated, revoked, or modified by the MPCA, whichever comes first. To obtain a reissued permit, the Co-Permittees shall request that the MPCA review and reissue the permit. In accordance with Minn. Rules pt. 7001.0040, subp. 3, an application for reissuance of this Permit must be submitted to the MPCA no later than 180 calendar days prior to the expiration date of this Permit.

DATE OF ISSUANCE: August 26, 1991

Richard Svanda

RICHARD A. SVANDA, P.E.
DIRECTOR, HAZARDOUS WASTE DIVISION

D. CERTIFICATION OF CLOSURE.

When closure is completed, ATI shall submit to the Commissioner a certification signed by ATI and an independent registered professional engineer that the facility has been closed in accordance with the closure plan.

PART IX.

CLOSURE/POST CLOSURE OF SITE F BY FCC AND THE U.S. ARMY

A. CLOSURE PLAN.

FCC and the U.S. Army shall close the former open burning/open detonation area known as Site F. To date the U.S. Army has submitted a Scope of Work Plan, a Plan of Investigation, and an on-site Remedial Investigation (RI) Report that is currently under review by the MPCA. The Site F Closure Plan will be developed based upon the Site F portion of the RI Report. Within thirty (30) days following approval of the RI Report by the MPCA, the U.S. Army shall submit a draft Site F Closure Plan prepared in accordance with Minn. Rules pts. 7045.0594 - 7045.0596. Once the Closure Plan is approved, it shall become an integral and enforceable part of this permit, and Site F shall be closed in accordance with the schedule in the approved Closure Plan.

The MPCA recognizes that the U.S. Army has the primary responsibility for closure of Site F. The MPCA will look to FCC for compliance with this Part IX of the permit only upon 60 days notice to FCC that the U.S. Army has failed to comply with Part IX of this permit.

B. POST CLOSURE PLAN.

If hazardous waste or hazardous constituents are to remain at Site F after closure, the U.S. Army must prepare a post closure plan in accordance with Minn. Rules pts. 7045.0600 - 7045.0614 and 7045.0638. The post closure plan may be submitted simultaneously with the closure plan. Only in the event that the U.S. Army fails to prepare a necessary post closure plan will the MPCA look to FCC for compliance with this requirement after giving FCC 60 days notice of the U.S. Army's failure to comply.

C. PERMIT MODIFICATION.

The MPCA will modify this permit in accordance to Minn. Rules pt. 7001.0190, to incorporate the specific technology used to close Site F. The major permit modification will allow for public comments regarding the proposed closure method.

PART X.

CORRECTIVE ACTION

The following Solid Waste Management Units (SWMUs) are subject to the corrective action requirements of this Part of the Permit:

Site A Site B Site C Site D Site E Site G Site H
Site I Site J Site K Site 129-3 Site 129-5 Site 129-15.

All of these sites are identified and described in Appendix I.

A.2 Revised RCRA Permit Dated May 1993

FINAL PERMIT

FOR

UNITED STATES ARMY
(MN7213820908)

AND

ALLIANT TECHSYSTEMS, INCORPORATED
(MND000819268)

AND

FEDERAL CARTRIDGE COMPANY
(MN7213820908)

FOR A

HAZARDOUS WASTE STORAGE AND TREATMENT FACILITY

LOCATED AT

TWIN CITIES ARMY AMMUNITION PLANT

ARDEN HILLS, MINNESOTA

AUGUST 1991

MINNESOTA POLLUTION CONTROL AGENCY
520 LAFAYETTE ROAD
ST. PAUL, MINNESOTA 55155

STATE OF MINNESOTA

POLLUTION CONTROL AGENCY

HAZARDOUS WASTE STORAGE AND TREATMENT FACILITY PERMIT

FOR

UNITED STATES ARMY
(MN7213820908)

AND

ALLIANT TECHSYSTEMS, INCORPORATED
(MND000819268)

AND

FEDERAL CARTRIDGE COMPANY

(MN7213820908)
CO-PERMITTEES

TWIN CITIES ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

In accordance with the provisions of Minn. Stat. chs. 115 and 116, Minn. Rules pts. 7001.0010 - 7001.0730, and Minn. Rules pts. 7045.0100 - 7045.1380, a Hazardous Waste Storage and Treatment Facility Permit (Permit) is hereby issued to the United States Army (U.S. Army), Alliant Techsystems, Incorporated (ATI) formerly Honeywell, Incorporated (Honeywell), and Federal Cartridge Company (FCC) located at the Twin Cities Army Ammunition Plant (TCAAP) in Arden Hills, Minnesota. Honeywell's operations at the facility were acquired by ATI on September 28, 1990.

This Permit has been prepared based upon the information provided by ATI's most recent permit application including revisions received through December 14, 1990, and FCC's permit application received on October 5, 1984. ATI's permit application is referenced throughout this Permit and as such, is an integral and enforceable part of this Permit.

The U.S. Army is the owner of the Resource Conservation and Recovery Act (RCRA) facility which is defined to be the entire TCAAP described in Part I and delineated in Appendix I. ATI operates storage and treatment activities within certain buildings at the TCAAP. FCC is in the process of closing a nonoperational site previously used for open burning/open detonation of explosives. ATI is a tenant on TCAAP allowed to conduct various operations. FCC is the prime operating contractor under contract with the Army to conduct its respective operations. The Army, ATI, and FCC are all Permittees on this Permit and together they are referred to as the Co-Permittees. Specific Co-Permittees as identified in each respective part of this permit shall be jointly and severally liable for compliance with the terms and conditions of

this Permit. Compliance by one of the Co-Permittees will be considered compliance by all of the other Co-Permittees to whom the term or condition applies. Other terms and conditions apply to those persons who are included in the term or condition. Should one of the operators fail to comply with a term or condition of this permit, the U.S. Army shall, within a responsible period of time, ensure that compliance is achieved.

This Permit authorizes and requires the Co-Permittees to conduct the following activities at the TCAAP. ATI is authorized to conduct the following activities: 1) store hazardous wastes in an indoor bulk waste pile; 2) store hazardous wastes in ten (10) container storage areas; and 3) treat hazardous wastes in containers. FCC and the U.S. Army are required to close a former site used for open burning/open detonation of explosives. All three Co-Permittees are required to conduct corrective action on thirteen (13) identified Solid Waste Management Units (SWMUs) at the TCAAP. The MPCA shall look first to specific Co-Permittees as set out in Parts IX and X for closure of Site F and corrective action on the SWMUs. The Co-Permittees must at all times conduct their hazardous waste management activities at the TCAAP in accordance with the terms and conditions of this Permit and any other requirements imposed by law.

Under the terms and conditions of this permit, ATI is not responsible for any activities associated with Site F and FCC is not responsible for any of the on going storage and treatment activities being conducted by ATI.

This Permit shall become effective on the date of issuance by the Minnesota Pollution Control Agency Hazardous Waste Division Director.

This Permit is effective until five years from date of issuance or until terminated, revoked, or modified by the MPCA, whichever comes first. To obtain a reissued permit, the Co-Permittees shall request that the MPCA review and reissue the permit. In accordance with Minn. Rules pt. 7001.0040, subp. 3, an application for reissuance of this Permit must be submitted to the MPCA no later than 180 calendar days prior to the expiration date of this Permit.

DATE OF ISSUANCE: August 26, 1991

Richard Svanda

RICHARD A. SVANDA, P.E.
DIRECTOR, HAZARDOUS WASTE DIVISION

PART IX.

CLOSURE OF SITE F BY FCC AND THE U.S. ARMY

Closure of Site F shall be conducted in accordance with Minn. Rules pts. 7045.0486 and 7045.0488, approved Closure Plan, and future design plans and construction specifications yet to be approved. By reference, the approved Closure Plan, design plans, and construction specifications shall be considered an integral and enforceable part of this Permit Modification.

A. SITE F BACKGROUND.

Site F is located in the south-central part of TCAAP encompassing approximately 10 acres (see Appendix I). The site was used for hazardous waste explosive storage, treatment by open burning/open detonation of waste munitions, and disposal by burial of cyanide pots, containers, mercury crack cases, and waste explosives.

B. SITE F INVESTIGATIONS.

Investigations at Sife F have identified lead and antimony as being the primary chemicals of concern for soil, with cadmium, chromium, copper, mercury, nickel, and silver being secondary chemicals of concern. No impacts to ground water have occurred as a result of Site F activities. No volatile organic compounds have been detected in soil samples taken at Site F.

During the period of February 1990 to April 1991, an Ecological Risk Assessment was performed which evaluated flora and fauna at TCAAP and concluded that there were no observations of adverse effects due to chemical contamination from Site F.

In 1992, a Human Health Risk Assessment was performed which identified antimony as the primary contributor to the total noncarcinogenic risk at Site F.

C. ALTERNATIVES EVALUATION.

The following closure alternatives were evaluated for Site F:

1. RCRA multimedia cap;
2. Ammunition removal/RCRA multimedia cap;
3. Ammunition removal/soil excavation/soil washing;
4. Ammunition removal/soil excavation/off-site disposal;
5. No action/access restriction;
6. Soil excavation/thermal encapsulation/off-site disposal;
7. Soil excavation/solidification/stabilization/off-site disposal;
8. Soil vitrification/monitoring;
9. Soil excavation/on-site storage of soils;
10. Bioremediation; and,
11. Chemical detoxification.

D. SELECTED REMEDY (#3 above).

Closure of Site F will consist of excavating metals-contaminated soil, removing ordnance, treating the soil on-site with a soil-washing system, regrading and revegetating the site. The soil washing process consists of density separation of particulate lead, followed by acid leaching. Treatment of the soil will generate lead residual suitable for recycling, wastewater, and treated soil.

E. REMEDIATION/CLEAN UP LEVELS.

Soil contaminated with lead will be cleaned up to a 300 mg/kg (ppm) level (bare soil standard on residential property and playgrounds) as required by Minn. Rules pt. 4760.0020. All other metals of concern will be cleaned up to "background" levels as required by Minn. Rules pt. 7045.0486 and 7045.0488.

F. CLOSURE PROCEDURE.

As described in Section VIII of the approved Closure Plan, closure of Site F will consist of:

1. Removal of abandoned natural gas and water utility lines;
2. Staking the exclusion zone;
3. Constructing a decontamination pad;
4. Removing six trees within the exclusion zone;
5. Demolishing Building 5530, Building 598, a wood storage shed, and a three-sided wood protective enclosure;
6. Excavating soil;
7. Removing the Site F knoll;
8. Removing ordnance;
9. Properly managing contamined soil;
10. Soil washing;
11. Decontaminating equipment;
12. Decontaminating soils washing equipment pad and decontamination pad;
13. Disposing equipment;
14. Removal of the Site F fence; and,
15. Restoring the site and regrading.

G. CLOSURE SCHEDULE.

Closure shall be conducted in accordance with the schedule shown in Section XII of the approved Closure Plan and the most current Site F schedule and Gantt chart developed by the U.S. Army.

H. CLOSURE CERTIFICATION.

WITHIN 60 DAYS of final closure, the U.S. Army and an independent registered professional engineer will certify closure in accordance with Section IX of the approved Closure Plan.

A.3 Reissued RCRA Permit Dated October 1996

FINAL REISSUED PERMIT

FOR

ALLIANT TECHSYSTEMS
MND000819268

AND

U.S. ARMY
MN7213820908

Co-Permittees

FOR A

HAZARDOUS WASTE **STORAGE** FACILITY

LOCATED AT

TWIN CITIES ARMY AMMUNITION PLANT

ARDEN HILLS, MINNESOTA

OCTOBER 1996

MINNESOTA POLLUTION CONTROL AGENCY
520 LAFAYETTE ROAD
ST. PAUL, MINNESOTA 55155-4194

STATE OF MINNESOTA

POLLUTION CONTROL AGENCY

HAZARDOUS WASTE **STORAGE** FACILITY PERMIT

FOR

ALLIANT TECHSYSTEMS
MND000819268

AND

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Co-Permittees

FOR A

HAZARDOUS WASTE **STORAGE** FACILITY

LOCATED AT

TWIN CITIES ARMY AMMUNITION PLANT

ARDEN HILLS, MINNESOTA

In accordance with the provisions of Minn. Stat. chs. 115 and 116, Minn. R. 7001.0010 - 7001.0730, and Minn. R. 7045.0100 - 7045.1380, a Hazardous Waste **Storage** Facility Permit (Permit) is hereby issued to Alliant Techsystems, Inc. (ATI) (**operator**), and the U.S. Army (**owner**) for a facility located at the Twin Cities Army Ammunition Plant, Arden Hills, Minnesota (the Facility).

This Permit comprises the Resource Conservation and Recovery Act (RCRA) Permit which has been prepared based upon the information provided by ATI's most recent Permit Application (Part A and Part B) including revisions received through July 1996. The Permit Application is referenced throughout this Permit and as such, is an integral and enforceable part of this Permit.

The U.S. Army is the owner, and ATI is the tenant operator at TCAAP; together they are referred to as the **Co-Permittees** hereafter. Specific operating, emergency, record keeping, reporting, and general conditions apply to all permitted and regulated hazardous waste management units as defined in this Permit. However, for the purposes of corrective action, the Facility includes all property owned or used by the **Co-Permittees** located at TCAAP. The Facility location is at latitude 45° 05' 17", longitude 93 ° 10' 38", township T30N, Range R23W, and Section 9, 15 and 16 in the municipality of Arden Hills, Ramsey County, Minnesota. The TCAAP is delineated by County Road I, Lexington Avenue, County Highway 96, U.S. Highway 10 and Interstate Highway 35W. The TCAAP comprises 2,370 acres (approximately four square miles). A map of TCAAP is located in **Appendix I** of this Permit. Hazardous waste is generated on-site; hence the Facility is considered an on-site Facility.

This Permit authorizes and requires the **Co-Permittees** to conduct the following hazardous waste management activities at TCAAP:

ATI may store hazardous waste in containers within indoor storage buildings (103, 576, 961, 962, 962A) and magazines (520, 522, 524A). The Retrievable Monitored Containment System (Building 962B) shall be closed as described n **Part III.P** of this Permit. The U.S. Army is required to complete closure of Site F in accordance with the approved closure plan, closure plan addendum's, and relevant correspondence. Both ATI and the U.S. Army are required to conduct corrective action (investigation and cleanup) for solid waste management units (SWMUs). In accordance with the Federal Facility Agreement (FFA) and **Part X** of this Permit, the following sites at TCAAP are SWMUs and Areas of Concern (AOCs) for which corrective action is presently and potentially required: Sites A, B, C, D, E, G, H, I, J, K, 129-3, 129-5, 129-15, Grenade Range, the Open Firing Range, the Housing Area, and the Trap Shoot Area. The **Co-Permittees** must at all times conduct their hazardous waste management activities in accordance with the terms and conditions of this Permit and any other requirements imposed by law or Minnesota Rules.

The **Co-Permittees** shall be jointly and severally liable for compliance with the terms and conditions of this Permit. Compliance by one of the **Co-Permittees** will be considered compliance by the other **Co-Permittee** to whom the term or condition applies. Other terms and conditions apply to those persons who are included in the term or condition. Should the operator fail to comply with a term or condition of this Permit, the owner shall ensure that compliance is achieved.

This Permit shall become effective on the date of reissuance by the manager of the Minnesota Pollution Control Agency's Hazardous Waste Division. The original Permit was issued on August 26, 1991.

This Permit is effective until five years from date of reissuance or until terminated, revoked, or modified by the MPCA, whichever comes first. To obtain a future reissued Permit, the **Co-Permittees** shall request that the MPCA review and reissue the Permit. In accordance with Minn. R. 7001.0040, subp. 3, an Application for reissuance of this Permit must be submitted to the MPCA no later than 180 calendar days prior to the expiration date of this Permit.

DATE OF REISSUANCE: 10/24/96

Timothy K. Scherkenbach

TIMOTHY K. SCHERKENBACH
DIVISION MANAGER
HAZARDOUS WASTE DIVISION

C. TIME ALLOWED FOR CLOSURE

After generating the final volume of hazardous waste at the Facility, the ATI shall remove all hazardous wastes in accordance with the closure plan schedule in effect at the time, which shall not exceed 180 days unless approved by the Commissioner. The present closure schedule is detailed in the closure plan set forth in **Section 7.0** of the Permit Application.

D. CERTIFICATION OF CLOSURE

WITHIN 60 DAYS after closure is completed, ATI shall submit to the Commissioner a certification signed by the **Co-Permittees** and by an independent registered professional engineer that the Facility has been closed in accordance with the MPCA-approved closure plan and any additional closure work plans if developed. The certification shall contain language as stated in Minn. R. 7001.0070 and 7001.0540.

PART VIII

CLOSURE OF SITE F

On July 28, 1987, the MPCA, U.S. Army, and the United States Environmental Protection Agency entered into a Federal Facility Agreement (FFA). In accordance with the FFA, the U.S. Army was required to close Site F (former OB/OD and disposal site) under RCRA. To date, the U.S. Army has used an innovative treatment technology of soil washing/soil leaching to treat metal contaminated soils excavated from Site F. The equipment used for treating contaminated soils removed from Site F was mobilized at Site D. Contaminated soils were transported from Site F to Site D for treatment. Metals were recovered from the treatment process and sent off-site to a smelter for reuse. Soils that underwent treatment and were deemed to meet applicable cleanup goals were returned to the site.

The metals treatment phase of closure has been completed and the soil washing/soil leaching mobile equipment has since been demobilized. However, additional testing of processed soil presently being stored in stockpiles at Site F, and additional testing of processed soils which have been back-filled at Site F must still be completed. This additional testing includes the determination of residual scattered ordnance and residual explosive compounds in soils. The ordnance and explosive compound testing and quantification shall be conducted by the U.S. Army in accordance with:

- MPCA correspondence dated October 4, 1995 - Explosive Testing of Site F Soils
- MPCA correspondence dated October 24, 1995 - Addendum 7 to Site F Closure Plan
- The February 29, 1996, revised Site F Closure Plan Addendum No. 7

- MPCA correspondence dated April 4, 1996 - Addendum No. 7 and Draft Property Deed Notice Approval

All other applicable Addendum's to the approved Site F closure plan, and requirements in relevant MPCA correspondence shall be followed, governing interim storage of "untreatable soils," and completion of all outstanding issues regarding Site F closure activities, including decontamination of Site D.

The U.S. Army shall follow the approved project schedule for completion of closure activities pertaining to Site D and Site F.

PART IX

CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS AND AREAS OF CONCERN

The following Solid Waste Management Units (SWMUs) are subject to the corrective action (investigation and cleanup) requirements of this Part of the Permit and are identified and described in **Appendix I** of this Permit.

Site A	Site B	Site C	Site D	Site E	Site G	Site H
Site I	Site K	Site 129-3	Site 129-5	Site 129-15	Grenade Range	Open Firing Range

The Housing Area, and Trap Shoot Area are Areas of Concern (AOCs) under investigation, and are potentially subject to corrective action.

In accordance with Minn. R. 7045.0485, the Co-Permittees are required to institute corrective action as necessary to protect human health and the environment for all releases of hazardous waste or constituents requiring corrective action from any solid or hazardous waste management units (as defined in Minn. R. 7045.0020, subp. 36a.) at the Facility.

The FFA found in **Enclosure II** of this Permit provides for investigation and cleanup of contamination sources (SWMUs) on the TCAAP, and regional ground water contamination on and off the TCAAP.

The FFA describes the remedial action process which the U.S. Army must follow in order to clean up regional aquifer contamination caused by past disposal practices at the TCAAP. Specifically, the FFA sets forth a program according to which the U.S. Army shall remedy the release and threatened release of hazardous substances from the TCAAP.

Appendix B

Excerpts from the Federal Facility Agreement

Consistency. Following the Determination of Consistency, the Army shall implement the remedial action(s) in a manner which passes the Consistency Test and in accordance with the requirements and time schedules set forth in Attachment 5 to this Agreement. A dispute arising under this Part on any matter other than U.S. EPA's final selection of a remedial action shall be resolved pursuant to Part XV.

The purpose of the plan for remedial action is to establish procedures for implementation of selected response actions.

XIII.

Closure Requirements

The Army shall comply with closure requirements under the authorized State hazardous waste rules for sites D and F at TCAAP in accordance with the requirements and time schedules set forth in Attachment 6. Site G at TCAAP shall be closed in accordance with these rules, requirements, and time schedules unless the Army provides and MPCA approves certifications establishing that Site G is not subject to RCRA closure. Closure under this Part shall be regulated by the MPCA and shall not be subject to the Consistency Test of Part XIV or to the Dispute Resolution provision of Part XV.

The MPCA's closure requirements with respect to sites D, F and G may include source control measures such as capping, soil decontamination, and soil removal. Groundwater contamination from sites D, F, and G is intended to be addressed by the RI/FS,

intended to be remedied by the CERCLA/SARA processes established under this Agreement, and shall not be the subject of RCRA closure. The Army retains its rights to resolve disputes which arise over application of MPCA closure requirements in accordance with RCRA and State law.

XIV.

Review and Determination of Consistency of Submittals

The review of each submittal, document, report, or schedule (collectively referred to hereafter as "Submittal") which is required to be submitted to and reviewed by the U.S. EPA and the MPCA Director shall be as follows:

A. U.S. EPA and the MPCA Director shall review each Submittal made by the Army as required by this Agreement within forty (40) calendar days of receipt and notify the Army in writing by the forty-first (41) calendar day, or the first business day thereafter, of the results of the Consistency Test with respect to the Submittal. Certain complex Submittals, such as quality assurance project plans, may require a longer time for review, in which event the U.S. EPA and MPCA Director shall notify the Army of that fact. In the event that the Submittal passes the Consistency Test, it shall become an integral and enforceable part of this Agreement. In the event the Submittal fails the Consistency Test, in whole or part, the U.S. EPA and MPCA Director shall notify the Army, shall state the reasons therefor, and shall, as appropriate, recommend modification of the Submittal.

June 17, 1987

ATTACHMENT 6

RCRA Closure Requirements

The purpose of this Attachment is to set forth the requirements necessary to close TCAAP disposal Sites F and G and the waste pile at disposal Site D at the TCAAP facility. These requirements are in addition to those set forth in the TCAAP RI Scope of Work presented in Attachment 3. The Army shall close sites D, F, and G in accordance with current interim status rules set forth in Minnesota Rules pts. 7045.0594 - 7045.0618 (1986), or if the Minnesota closure rules are amended before the time of closure, in accordance with the rules as amended.

Closure will be accomplished in two phases, investigation activities and final closure activities. The Plan of Investigation for Closure shall include a proposal for conducting investigations to determine the extent and magnitude of contamination resulting from the release and threatened release of hazardous substances, pollutants, and contaminants at each site.

The final Closure Plan shall detail the work required to close the sites in a manner that minimizes the need for future maintenance and controls or eliminates all releases of hazardous constituent, leachate, and other contaminants into the environment. A Final Closure Plan shall include sampling and testing procedures criteria to be used for evaluating the extent and level of contamination, removal of any remaining waste, compliance with other steps needed to remediate the contamination, and a time schedule for actual closure. The final closure document shall also include a discussion of all past activities at each site.

1.0 Site D Waste Pile

1.1 Plan of Investigation for Closure

RCRA closure requirements apply only to the waste pile at Site D and the ground water or soils that it may affect. All references made to Site D in this Attachment are intended for the waste pile and all soils in contact with the waste pile.

Within sixty (60) days of the effective date of this Agreement, the Army shall submit for the MPCA review and approval a Plan of Investigation for Closure at Site D. This investigation plan shall include a procedure for determining if there has been any contaminant migration or release from the waste pile as well as a schedule for implementing proposed activities. If the MPCA Director determines that the requirements of the TCAPP RI Work Plan (see Attachment 3) satisfy RCRA requirements at Site D, the RI Work Plan can be utilized in lieu of the Plan of Investigation for Closure at Site. D. If the RI Work Plan does not satisfy all RCRA requirements at Site D, within thirty (30) days of receipt of the MPCA Director's approval the Army shall implement the Plan of Investigation.

1.2 Investigation Report

Within thirty (30) days of the completion of the Plan of Investigation, the Army shall prepare and submit to the MPCA Director, for review and approval, a report summarizing the results obtained during the investigation.

1.3 Final Closure Plan

Within thirty (30) days following approval of the Investigation Report by the MPCA Director, or review and approval of the RI final report by the

U.S. EPA and MCPA Director, the Army shall submit a Final Closure Plan for the waste pile at Site D for MPCA Director approval. This plan should include a time schedule for actual closure. Upon approval from the MPCA Director, the Army shall undertake and complete final closure activities at Site D in accordance with the approved plan. Upon completion of final closure activities, the Army shall have the closure certified by an independent professional engineer and submit the certification to the MPCA.

2.0 Site F

2.1 Plan of Investigation for Closure

On June 19, 1986, the U.S. Army submitted to the MPCA a Plan of Investigation for Closure of Site F. The MPCA is currently reviewing additional information regarding the Plan of Investigation received from the Army on December 19, 1986. Within thirty (30) days of receipt of the MPCA Director's approval, the Army shall implement the Plan of Investigation.

2.2 Investigation Report

Within thirty (30) days of completion of the Plan of Investigation, the Army shall prepare and submit to the MPCA Director, for review and approval, a report summarizing the results obtained during the investigation.

2.3 Final Closure Plan

Within thirty (30) days following approval of the Investigation Report by the MPCA Director, the Army shall submit a Final Closure Plan for Site F for MPCA Director review and approval. This Plan should include a time schedule for actual closure. Upon approval from the MPCA Director, the Army shall undertake and complete final closure activities at Site F in accordance with

applicable State hazardous waste rules. Upon completion of final closure activities, the Army shall have the closure certified by an independent professional engineer and submit the certification to the MPCA.

3.0 Site G

3.1 Plan of Investigation for Closure

Within sixty (60) days of the effective date of this Agreement the Army shall submit for the MPCA Director's review and approval, a Plan of Investigation for Closure at Site G. This Investigation Plan shall include a time schedule for the investigation. If the MCPA Director determines that the requirements of the TCAPP RI Work Plan (see Attachment 3) satisfy RCRA requirement at Site G, the RI Work Plan shall be utilized in lieu of the Plan of Investigation for Closure at Site G. If the RI Work Plan does not satisfy all RCRA requirements at Site G, within thirty (30) days of receipt of the MPCA Director's approval, the Army shall implement the Plan of Investigation.

3.2 Investigation Report

Within thirty (30) days of the completion of the Plan of Investigation, the Army shall prepare and submit to the MPCA Director for review and approval, a report summarizing the results obtained during the investigation.

3.3 Final Closure Plan

Within thirty (30) days following approval of the Investigation Report by the MPCA Director, or review and approval of the RI Final Report by the U.S. EPA and MPCA Director, the Army shall submit a Final Closure Plan for Site G for MPCA Director review and approval. This plan should include a time schedule for actual closure. Upon approval from the MPCA Director, Army

shall undertake and complete final closure activities at Site G in accordance with applicable State hazardous waste rules. Upon completion of final closure activities, the Army must have the closure certified by an independent professional engineer and submit the certification to the MPCA.

Appendix C

MPCA Correspondence

- C.1 Addendum No. 1, Addendum No. 2, and Approval Letter
- C.2 Revised Cadmium Remediation Level, Oversize Sample Schedule, and Acceptance Testing Approvals
- C.3 Addendum No. 4 and Approval Letter
- C.4 Correction to Addendum No. 4 Property Deed Wording
- C.5 TCAAP Site F Closure Levels and Property Deed Restriction
- C.6 Letters of No Action-Extended Storage of High Explosives and Ordnance
- C.7 Addendum No. 5 and Approval Letter
- C.8 Addendum No. 3 and Approval Letter
- C.9 Addendum No. 6 and Approval Letter
- C.10 Substance Treatment by Soil Washing/Soil Leaching
- C.11 Site F Disposal Area Soil Sampling and Characterization
- C.12 Treated Soil Sampling Plan
- C.13 Oversize Sample Frequency Approval
- C.14 Addendum No. 7 and Approval Letters
- C.15 Site F Hazardous Soil Disposal - Operations Plans and Correspondence
- C.16 Addendum No. 8 and Approval Letter
- C.17 20-Ton Pile Correspondence
- C.18 Explosive Testing of Treated and Untreated Soils at Site F
- C.19 Site D Pad and Building 515 Pad Decontamination Correspondence
- C.20 Addendum No. 9 and Approval Letter

C.1 Addendum No. 1, Addendum No. 2, and Approval Letter

Environmental
Engineers

Wenck

Wenck Associates, Inc.
1800 Pioneer Creek Ctr.
Maple Plain, MN 55359

(612) 479-4200
Fax (612) 479-4242

July 7, 1993

Mr. Dan Card
Hazardous Waste Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155

Re: TCAAP Site F Closure Plan
Addendum No. 1
Wenck File No. 0003-06

Dear Mr. Card:

This Addendum to the Site F Closure Plan has been prepared to address two MPCA concerns:

1) Possible detections of mercury outside the planned area of excavation at Site F; and
2) Redetermination of the antimony remediation goal and target numbers based on soil sample analyses with lower detection limits.

The concerns were raised by the MPCA in a meeting on March 3, 1993, and in a comment letter dated March 19, 1993. As agreed, additional sampling and analysis has been performed to resolve these issues.

The concern regarding mercury resulted from detections of mercury in borings conducted by Roy F. Weston, Inc. (Weston) in 1984. However, the locations of these detections were sporadic. All locations were outside the area of activity for Site F and were also outside the planned area of excavation for Site F. It was suspected that these values were anomalous. Resampling was conducted at the 13 Weston boring locations which had indicated detections of mercury. Soil samples were collected on June 8, 1993, from the six-inch depth at the former Weston boring locations FS28, 29, 30, 31, 32, 35, 36, 38, 41, 46, 47, 48, and 49 (see Figure 5 of the Site F Closure Plan). Soil samples were analyzed for mercury by USAEC Method JB04 by Interpoll Laboratories, Inc., Circle Pines, Minnesota. All analyses were nondetect for mercury with a method detection limit of <0.095 $\mu g/g$ (see attached laboratory results). These results indicate that mercury is not present in soils outside the planned area of excavation at Site F. Therefore, no changes are needed to the limits of excavation as shown on Drawing 14 of the Site F Closure Plan.

C.1-2

Site-specific background values are being used as the cleanup level for antimony; however, historical analysis for antimony used relatively high method detection limits which resulted in a high background value. The MPCA requested that additional soil samples be analyzed for antimony, using lower method detection limits, in order to derive a more realistic site-specific background value. To refine the background soil antimony levels, soil samples were collected from the same 13 locations as for the mercury sampling described above. The samples were analyzed for antimony using SW-846 Method 7041, with a detection limit of 2.0 μg/g. Results for all analyses were nondetect (see attached laboratory results). Using the same statistical approach for determination of remediation goals and targets which was utilized in the Site F Closure Plan, the 13 new data points were used to define a new Site F antimony remediation goal of 2.0 μg/g. In this case, the remediation target for antimony will also be 2.0 μg/g. A revised antimony statistical analysis plot is attached to replace the antimony plot in Appendix H of the Site F Closure Plan. Table 14 of the Site F Closure Plan has also been revised to reflect the new antimony remediation goal and target and is attached. Table 14 shows that a background value of 2.0 μg/g is lower than the proposed health risk value of 4.02 μg/g for TCAAP in general.

This addendum should be inserted into the most current version of the Site F Closure Plan. If you have any questions regarding this information, please call Matt Bowers or me at (612) 479-4200.

Sincerely,

WENCK ASSOCIATES, INC.

Keith W. Benker

Keith W. Benker, P.E.

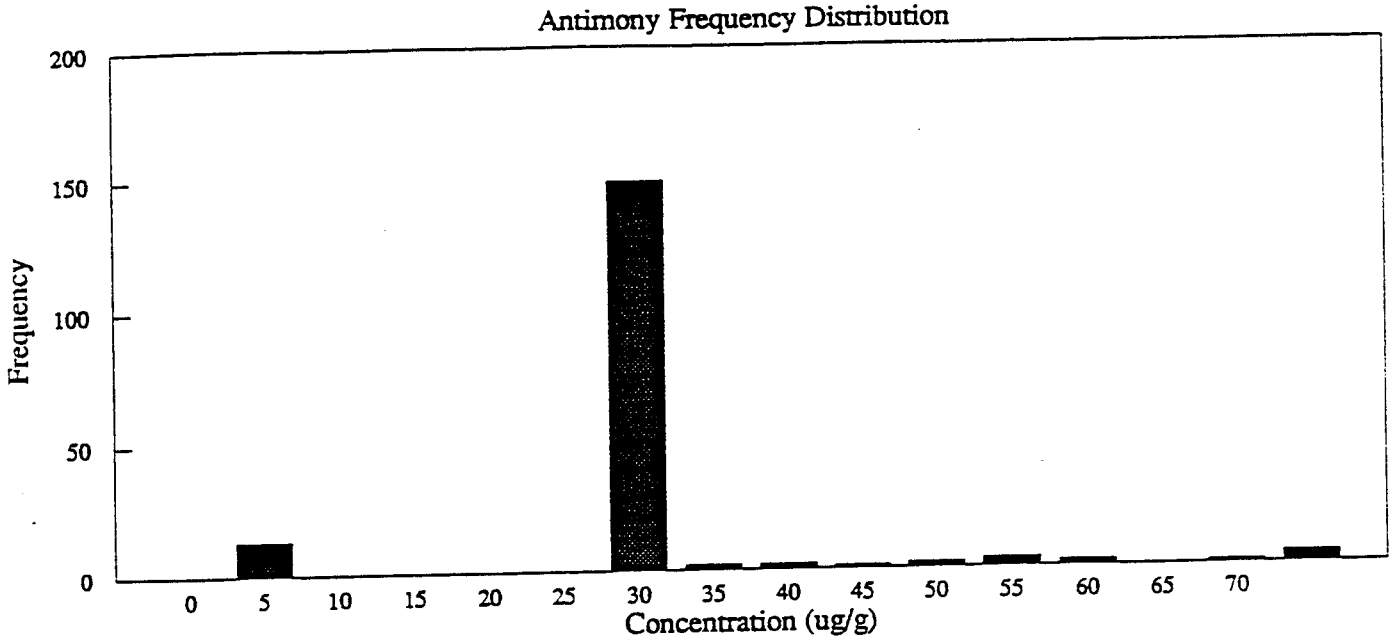
KWB/reg

Attachments

REVISED:
June 28, 1993

TCAAP Site F

Antimony Frequency Distribution



Statistical Values	
Mean	2.0
S.D.	0.0
95% C.I.	2.0
99% C.I.	2.0
Sample Size	13
Maximum Sample	2

Concentration	Frequency
0	0
5	13
10	0
15	0
20	0
25	0
30	148
35	2
40	2
45	1
50	2
55	3
60	2
65	0
70	1
>70	4

REVISED
June 28, 1993

TABLE 14

TCAAP Site F
Comparison of Remediation Goals

Metal	Wenck Site F Remediation Targets (µg/g)	Wenck Site F Remediation Goals (µg/g)[2]	TCAAP Preliminary Remediation Goals (ug/g)[1]
Antimony	2.0[3]	2.0[3]	4.02
Cadmium	0.4	1.2	7.53
Chromium	20.0	32.0	15,000
Copper	11.2	25.5	1,210
Lead	175	300	500
Mercury	0.1	0.1	4.52
Nickel	10.1	19.3	602
Silver	0.8	1.4	2,990

Notes:

(1) - From Attachment 1 from U.S.E.P.A. letter, see Appendix J.
(2) - Wenck Remediation Goals are the enforceable cleanup standards.
(3) - Antimony Remediation Goal and Target was modified based on additional soil sampling conducted on June 9, 1993.

interpoll

INTERPOLL LABORATORIES, INC.
4500 BALL ROAD N.E.
CIRCLE PINES, MINNESOTA 55014-1819
TEL: 612/786-6020
FAX: 612/786-7854

June 24, 1993

Wenck Associates, Inc.
1800 Pioneer Creek Dr.
Maple Plain, MN 55359

Attention: Cory E. Scott

PARAMETER: Antimony (Sb)
METHOD: SW-846, 7041
DETECTION LIMIT: 2.0
UNITS: ug/g
PREP DATE: 6/18/93
ANALYSIS DATE: 6/23/93
ANALYST: MB
WENCK PROJECT: #0003.06

Sample ID	Date Collected	Interpoll ID	USATHAMA ID	Result	Dilution Factor	% Moisture
FS-29	6/09/93	9107-01	BTJ004	< 2.0	1	10.7
FS-28	6/09/93	9107-02	BTJ005	< 2.0	1	11.0
FS-49	6/09/93	9107-03	BTJ006	< 2.0	1	15.7
FS-47	6/09/93	9107-04	BTJ007	< 2.0	1	13.0
FS-46	6/09/93	9107-05	BTJ008	< 2.0	1	16.0
FS-48	6/09/93	9107-06	BTJ009	< 2.0	1	8.8
FS-41	6/09/93	9107-07	BTJ010	< 2.0	1	18.0
FS-38	6/09/93	9107-08	BTJ011	< 2.0	1	13.7
FS-36	6/09/93	9107-09	BTJ012	< 2.0	1	10.2
FS-35	6/09/93	9107-10	BTJ013	< 2.0	1	14.4
FS-32	6/09/93	9107-11	BTJ014	< 2.0	1	17.5
FS-31	6/09/93	9107-12	BTJ015	< 2.0	1	14.9
FS-31 DUP	6/09/93	9107-13	BTJ016	< 2.0	1	16.4
FS-30	6/09/93	9107-14	BTJ017	< 2.0	1	15.2

C.1-6

Sample ID	Date Collected	Interpoll ID	USATHAMA ID	Result	Dilution Factor	% Moisture
High Spike			BTJ003	19.7		
High Spike True Value				19.8		
High Spike			BTJ018	19.0		
High Spike True Value				19.2		
Low Spike			BTJ002	9.7		
Low Spike True Value				9.7		
MQ Blank			BTJ001	< 2.0		

Respectfully submitted,

Jeannie F. O'Neil, Manager
Inorganic Chemistry Group

JFO/cg
< = less than

interpoll

INTERPOLL LABORATORIES, INC.
4500 BALL ROAD N.E.
CIRCLE PINES, MINNESOTA 55014-1819
TEL: 612/786-6020
FAX: 612/786-7854

June 24, 1993

Wenck Associates, Inc.
1800 Pioneer Creek Dr.
Maple Plain, MN 55359

Attention: Cory E. Scott

PARAMETER:	Mercury (Hg)
METHOD:	JB04
DETECTION LIMIT:	0.095
UNITS:	ug/g
PREP DATE:	6/22/93
ANALYSIS DATE:	6/22/93
ANALYST:	ARL
WENCK PROJECT:	#0003.06

Sample ID	Date Collected	Interpoll ID	USATHAMA ID	Result	Dilution Factor	% Moisture
FS-29	6/09/93	9107-01	BTI004	<0.095	1	10.7
FS-28	6/09/93	9107-02	BTI005	<0.095	1	11.0
FS-49	6/09/93	9107-03	BTI006	<0.095	1	15.7
FS-47	6/09/93	9107-04	BTI007	<0.095	1	13.0
FS-46	6/09/93	9107-05	BTI008	<0.095	1	16.0
FS-48	6/09/93	9107-06	BTI009	<0.095	1	8.8
FS-41	6/09/93	9107-07	BTI010	<0.095	1	18.0
FS-38	6/09/93	9107-08	BTI011	<0.095	1	13.7
FS-36	6/09/93	9107-09	BTI012	<0.095	1	10.2
FS-35	6/09/93	9107-10	BTI013	<0.095	1	14.4
FS-32	6/09/93	9107-11	BTI014	<0.095	1	17.5
FS-31	6/09/93	9107-12	BTI015	<0.095	1	14.9
FS-31 DUP	6/09/93	9107-13	BTI016	<0.095	1	16.4
FS-30	6/09/93	9107-14	BTI017	<0.095	1	15.2

C.1-8

Sample ID	Date Collected	Interpoll ID	USATHAMA ID	Result	Dilution Factor	% Moisture
High Spike			BTI018	0.985		
High Spike			BTI003	0.990		
High Spike True Value				1.00		
Low Spike			BTI002	0.215		
Low Spike True Value				0.20		
MQ Blank			BTI001	<0.095		

Respectfully submitted,

Jeannie F. O'Neil, Manager
Inorganic Chemistry Group

JFO/cg
< = less than

Wenck Associates, Inc.
1800 Pioneer Creek Dr.
Maple Plain, MN 55359
(612) 479-4200

CHAIN OF CUSTODY RECORD

FIELD COORDINATOR: Brian Holst

PROJ. NO.	PROJECT NAME	AIRBILL NO.
1003.01	TCAAP - Site F	

SAMPLERS (Signature): Cory E. Scott

REMARKS: MDL's: *0.1 µg/g - Hg; **2.0 µg/g - Sb

STA NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NUMBER OF CONTAINERS	MERCURY *	ANTIMONY **					
1	6/9			X	FS-29	1-4oz.	X	X					9107-01
2					FS-28								-02
3					FS-49								-03
4					FS-47								-04
5					FS-46								-05
6					FS-48								06
7					FS-41								07
8					FS-38								08
9					FS-36								09
10					FS-35								10
11					FS-32								11
12					FS-31								12
13					FS-31 duplicate								13
14					FS-30								14

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Cory E. Scott	06/10/93	1015					
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks	
				6/10/93	1200	10 DAY TURNAROUND!	

DISTRIBUTION: Original Accompanies Shipment; Copy to Coordinator Field Files

01-1-10

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA 55112-5700

REPLY TO ATTENTION OF

August 30, 1993

SMCTC-EV (200-1b)

SUBJECT: TCAAP Site F Closure Plan, Addendum No. 2

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
Permit Review Unit
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Sir:

This letter is intended to summarize recent events regarding revisions to remediation levels for closure of Site F at the Twin Cities Army Ammunition Plant (TCAAP). This letter, along with the enclosures, should be considered as Addendum No. 2 to the Site F Closure Plan and should be inserted into the "Addenda" section of that document.

Based on its review of the Site F soils data, the Army sought to review the remediation levels established for closure of Site F. In order to keep the project on schedule, it was necessary to expedite the request, review, and approval process. To accomplish this, a series of discussions were conducted between Minnesota Pollution Control Agency (MPCA) staff and Wenck Associates, Inc. (subcontractor to Federal Cartridge Company, the Army's remediation contractor). Based upon the discussions, the parties were able to mutually agree on revised remediation levels for Site F. The MPCA documented approval of the revised levels in a letter dated August 24, 1993 (enclosed).

In support of our request for revised remediation levels, Wenck Associates provided to you (via telefax) a table presenting a summary of applicable remediation levels. This table is included with the enclosed MPCA letter.

As a result of revising the remediation levels, Table 14 to the Site F Closure Plan has been modified. The revised Table 14 is also enclosed.

C.1-11

We would like to thank you and the other MPCA staff for responding to our request in a timely manner. Your cooperation has allowed us to keep the project on schedule. If you have any questions or need additional information, please contact Mr. Michael R. Fix or Mr. Martin R. McCleery, SMCTC-EV, (612) 633-2301, ext. 661 or 651.

Sincerely,

Michael R. Fix
Contracting Officer's Representative

Enclosure

Copies Furnished:

EPA, Region V, ATTN: Mr. Tom Barounis (w/encl)
MPCA, ATTN: Ms. Dagmar Romano (w/encl)
Cdr, AMCCOM, ATTN: AMSMC-EQ (w/encl)
Cdr, U.S. Army Environmental Center, ATTN: ENAEC-IR-A (w/encl)
Cdr, U.S. Army Environmental Hygiene Agency,
ATTN: HSHB-ME-SR, Mr. Keith Williams (w/encl)
U.S. Army Corps of Engineers, Omaha District,
215 N. 17th St., Omaha, NE 68102-4978
ATTN: CEMRO-MD-HA, Mr. Larry Woscyna (w/encl)
Alliant Techsystems Inc.,
ATTN: Mr. Doug Fullen/MN29-3553 (w/encl)
Montgomery Watson, Walnut Creek Office,
ATTN: Mr. Robert K. Marinai (w/encl)
Montgomery Watson, Wayzata Office, ATTN: Mr. Jeff LeBlanc (w/encl)
TCAAP Repositories
Plt Mgr, FCC-TCAAP, New Brighton, MN (w/encl)

C.1-12

REVISED
August 30, 1993

TABLE 14

TCAAP Site F
Comparison of Remediation Goals

Metal	Wenck Site F Remediation Targets (µg/g)	Wenck Site F Remediation Goals (µg/g)[2]	TCAAP Preliminary Remediation Goals (ug/g)[1]
Antimony	2.0[3]	4.0	4.02
Cadmium	0.4	1.2	7.53
Chromium	20.0	100	15,000
Copper	11.2	80	1,210
Lead	175	300	500
Mercury	0.1	0.3	4.52
Nickel	10.1	45	602
Silver	0.8	5	2,990

Notes:

(1) - From Attachment 1 from U.S.E.P.A. letter, see Appendix J.
(2) - Wenck Remediation Goals are the enforceable cleanup standards.
(3) - Antimony Remediation Target was modified based on additional soil sampling conducted on June 9, 1993.

Minnesota Pollution Control Agency

August 24, 1993

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

Dear Mr. Fix:

RE: SITE F APPROVED REMEDIATION LEVELS
TWIN CITIES ARMY AMMUNITION PLANT (TCAAP)
MN7213820908

Minnesota Pollution Control Agency (MPCA) staff has completed a review of your request to modify remediation contaminant levels for Site F. Comparison of human health based levels, literature data such as common ranges found in soils, U.S. Environmental Protection Agency Subpart S Action Levels, and other state and province soil cleanup levels were evaluated by your consultant. This evaluation was prepared in a table entitled "Attachment 1 Summary of Applicable Remediation Levels." Revised remediation levels were proposed with rationale given for any changes. This table will be incorporated as an attachment to the Final Approved Site F Closure Plan.

As such, MPCA staff has reviewed this data and has performed hazard index calculations for each toxic endpoint to account for additivity effects. This analysis verified the proposed remediation levels are acceptable. The effect of additivity of multiple metal elements does not appear to pose a significant threat to human health. Therefore, a risk management decision was made to approve the revised proposed remediation levels as follows (ug/g):

ANTIMONY	4.0
CADMIUM	1.2
CHROMIUM (total)	100.0
COPPER	80.0
LEAD	300.0
MERCURY	0.3
NICKEL	45.0
SILVER	5.0

C.1-14

You may contact Dan Card at 612/297-8379 or Jon Pollock at 612/297-8477 if you have any questions.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:rg

cc: Keith Benker, Wenck Associates, Maple Plain
Robert Fitzberg, Cognis, Incorporated, Santa Rosa, California
Charles Slaustas, U.S. EPA, Chicago
Joel Morbito, U.S. EPA, Chicago

Attachment 1

Summary of Applicable Remediation Levels

Metals	Site P Remediation Targets (1) (ug/g)	Site P Initial Proposed Remediation Level (2) (ug/g)	Proposed Human Health Based Level for TCAAP (ug/g)	Critical Effects	Common Range in Soils (7) (ug/g)	Average in Soils (7) (ug/g)	State or Province Action Levels (8) (ug/g)					State Action Level (9) MI (ug/g)	USEPA Action Level (10) (ug/g)	Rods (11)
							MN (a)	AZ (b)	OR (c)	Alb (d)	WI (e)			
Antimony (Sb)	2.0	2.0	12 (3)	blood (3)	2-10	-	-	47	-	-	-	91	30	•
Cadmium (Cd)	0.4	1.2	15.1 (3)	kidney (3)	.01-.7	.06	-	58	137	1	25	130	40	•
Chromium (Cr-Total)	20.0	32.0	150 (4) (Cr VI)	kidney (3)	1-1,000	100	-	1,700	-	100	-	-	400	•
Copper (Cu)	11.2	25.5	1,210 (3)	gastro intestinal (6)	2-100	30	-	22,000	10,100	80	-	9,800	-	•
Lead (Pb)	175	300	300 (5)	blood & behavioral disturbances	2-200	10	300	84	-	50	250	400	-	•
											-	78	2.0	•
Mercury (Hg)	0.1	0.1	9.04 (3)	kidney (6)	0.01-0.3	.03	-	35	82	0.2				
Nickel (Ni)	10.1	19.3	602 (3)	body/organ weight (6)	5-500	40	-	2,300	5,480	40	-	20,000	2,000	•
Silver (Ag)	0.8	1.4	2,990 (3)	argyria (6)	.01-5	.05	-	840	1,370	-	-	12,000	200	•

C-12

Attachment 1 (Cont.)

Summary of Applicable Remediation Levels

Metals	Site F Remediation Targets (1) (ug/g)	Site F Initial Proposed Remediation Level (2) (ug/g)	Proposed Human Health Based Level for TCAAP (ug/g)	Revised Proposed Remediation Levels for Site F (ug/g)	Rationale for Revised Remediation Levels
Antimony (Sb)	2.0	2.0	12 (3)	4.0	Low end of common range. Site specific target was based on limited data could be low. Equal to proposed TCAAP health risk value but less than other typical health risk values.
Cadmium (Cd)	0.4	1.2	15.1 (3)	1.2	No change from initial proposed remediation level. Site specific target is within common range. Less than proposed TCAAP health risk value.
Chromium (Cr-Total)	20.0	52.0	150 (4) (Cr VI)	100	Equal to the common average. Less than typical health risk values. Far below proposed TCAAP health risk value.
Copper (Cu)	11.2	25.5	1,210 (3)	80	Within common range. Far below proposed TCAAP health risk value and most other typical health risk values.
Lead (Pb)	175	300	300 (5)	300	No change from initial proposed remediation level. Current Minnesota Statutory level for bare soils.
Mercury (Hg)	0.1	0.1	9.04 (3)	0.3	Within common range. Below proposed TCAAP health risk value and most other typical health risk values.
Nickel (Ni)	10.1	19.3	602 (3)	45	Within common range. Below proposed TCAAP health risk value and most other typical health risk values.
Silver (Ag)	0.8	1.4	2,990 (3)	5	Within common range. Far below proposed TCAAP health risk value and other typical health risk values.

Attachment 1 (Cont.)

Summary of Applicable Remediation Levels

Notes: (all units are ug/g)

(1) These are site specific means, except for lead which was developed based on a soil washing treatability study.

(2) Table 14, TCAAP Site F Closure Plan, revised June 28, 1993.
These are site specific means plus two standard deviations, except for lead which has a statutory level.

(3) Appendix K, TCAAP Site F Closure Plan. Unadjusted, noncarcinogenic preliminary remediation goals for TCAAP. Developed by PRC under contract for USEPA Region V. Letter dated April 3, 1992.
Based upon the TCAAP Health Risk Assessment Report.

(4) Unadjusted, noncarcinogenic preliminary remediation goals for TCAAP. Developed by PRC under contract for USEPA Region V. Letter dated July 30, 1993.
For the purpose of addressing human health risks at Site F, all chromium was assumed to be chromium VI.

(5) Minnesota Rules Chapter 4760.0020, as proposed by the Minnesota Pollution Control Agency for TCAAP.

(6) Table 4.3, Final Report, Human Health Risk Assessment, New Brighton/Arden Hills Superfund Site Including Twin Cities Army Ammunition Plant, April 1991.

(7) Brown, et. al., 1983. Hazardous Waste Land Treatment. Brown, K.W., G.B. Evans, Jr., and B.D. Frentrup, eds. Butterworth Publishers: Woburn, Mt. p. 308.

(8) a - Minnesota Pollution Control Agency or Minnesota Department of Health, soil action or remediation levels.
b - Arizona Department of Environmental Quality, Health-Based Guidance levels, June 1992.
c - Oregon Environmental Quality Commission, Cleanup levels - residential, June 1992.
d - Alberta Canada, Environmental Protection Services, criteria for soil remediation, (Draft - 4/90; June 1992).
e - State of Wisconsin Department of Natural Resources, Comprehensive Environmental Cleanup Rule, April 1993 (nonindustrial setting).

(9) Michigan Environmental Response Act (Act 307), Operational Memorandum No. 8, Revision II, July 16, 1993, soil rule: 299.5711. Direct contact value in soil (do not consume level).

(10) USEPA Federal Register, 40 CFR Parts 264, 265, 270, and 271, Corrective Action for Solid Waste Management Units at Hazardous Waste Facilities, Proposed Rule, July 27, 1990.

(11) USEPA - Superfund Office of Program management, Record of Decision (ROD) FY91, data base (annual report) - 12 different RODs throughout the Continental US; there were no numeric performances given for soil remediation (States: MA, OR, AZ, NH, NY).

* = no numeric performance value.

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C.2 Revised Cadmium Remediation Level, Oversize Sample Schedule, and Acceptance Testing Approvals

Minnesota Pollution Control Agency

November 8, 1993

Mr. Michael Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

Dear Mr. Fix:

RE: Response to letters of October 15, 1993, and October 18, 1993:
- Oversize material
Response to letter of October 15, 1993:
- Summary of September 30, 1993, meeting

On September 30, 1993, Wenck Associates, Incorporated, (Wenck) and Cognis, Incorporated (Cognis) personnel met with Dan Card, Dave Belluck and Bruce Brott from the Hazardous Waste Division of the Minnesota Pollution Control Agency (MPCA). Four issues were discussed at the meeting:

1) Adjustment of the previously approved cadmium target and goal cleanup levels

2) Sampling of oversized material with a diameter greater than 0.25 inches

3) Completion of acceptance testing

4) Operating 24 hours per day

1) <u>Adjustment of the previously approved cadmium target and goal cleanup levels</u>

Due to soil variability, and limits of treatability and lab analysis, Cognis was unable to achieve the previously approved remediation "goal" ("background mean" plus two standard deviations) for cadmium of 1.2 ug/g during the acceptance test. Based on MPCA health assessment calculations, considering additivity affects, and allowing mixing of treated soil with resampling as discussed below, the remdiation goal for cadmium was revised from 1.2 ug/g to 4.0 ug/g. Correspondingly, the cadmium "target" ("background mean") was revised from 0.4 ug/g to 2.0 ug/g.

All treated units of soil (of whatever size) must be sampled to determine concentrations of cadmium. Any unit of treated soil with 2.0 ug/g of cadmium or less in all samples (not an average) can be backfilled with no deed restriction for cadmium placed on the property.

Any unit of treated soil exceeding the cleanup goal of 4.0 ug/g can be mixed with less contaminated treated soil to reduce the cadmium concentration. This mixture must be sampled, and if all samples (not an average) from the mixture are less than 2.0 ug/g, the soil can be backfilled with no deed restriction for cadmium placed on the property. If any soil sample from the

C.2-2

mixture is greater than 2 ug/g, but less than or equal to 4 ug/g, the treated soil may be backfilled with a deed restriction for cadmium placed on the property.

2) Sampling of oversized material with a diameter greater than 0.25 inches

On September 23, 1993, Mr. Keith Bencker with Wenck discussed the several methods of analyzing the coarse fraction (greater than 0.25 inch) of the washed soil with Mr. Jon Pollock of the MPCA. On September 24, 1993, Mr. Pollock contacted Mr. Bencker to discuss which method would be most appropriate. Considering which method would best represent future conditions at the site it was agreed that the total characteristic leaching procedure (TCLP) method on uncrushed rock would be the appropriate method to use and that the criteria in determining whether the material could be returned to Site F would be that the concentrations for each sample and each constituent would have to be equal to or less than the maximum concentrations in Minn. Rules 7045.0131 subp. 8.

Sampling of the coarse fraction shall continue throughout the entire remediation process as with the fine fraction. The Army should submit a proposed sampling frequency of the coarse material.

3) Completion of acceptance testing

Based upon the revised goal of 4.0 ug/g for cadmium, and the allowable mixing of treated soil scenarios discussed in item 1), the eight (8) day "Summary of Treated Soil Analytical Results" collected through September 30, 1993, (attachment 2 of your October 15, 1993, letter) documents the cleanup goal for each metal of concern was achieved. Review of this acceptance test period data completes the MPCA In Process System Review as discussed in our March 19, 1993 letter.

4) Operating 24 hours per day

It is understood that operating 24 hours per day as described on page 66 of the closure plan will not occur this fall, but may commence in the spring.

If you have any questions or comments please contact Dan Card at 612/297-8379 or Jon Pollock of my staff at 612/297-8477.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:mh

cc: Keith Benker, Wenck Associates
Charles Slaustus, EPA Region 5

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C.3 Addendum No. 4 and Approval Letter

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA 55112-5700

REPLY TO ATTENTION OF

May 9, 1994

SMCTC-EV (200-1b)

SUBJECT: Addendum 4, TCAAP Site F Closure Plan

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
Permit Review Unit
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Sir:

Please find enclosed Addendum No. 4 to the TCAAP Site F Closure Plan, July 1993. Revisions to this document have been made as per previous discussions. Upon your review, preparation of a letter of MPCA approval at your earliest convenience will be appreciated.

Upon written concurrence by your office, a copy of the Addendum will be provided to the individuals who have received the subject Closure Plan.

The POC is Mr. Martin R. McCleery, SMCTC-EV, or Mr. Michael R. Fix, SMCTC-CO, (612) 633-2301, ext. 651 or 661.

Sincerely,

Michael R. Fix
Commander's Representative

Enclosure

Copies Furnished:

Cdr, U.S. Army Environmental Center, ATTN: SFIM-AEC-IRA, Mr. Pete Rissell (wo/encl)
Cdr, U.S. Army Environmental Hygiene Agency,
ATTN: HSHB-ME-SR, Mr. Keith Williams (wo/encl)
U.S. Army Corps of Engineers, Omaha District, ATTN: CEMRO-ED-EC, Mr. Mark Ryan (wo/encl)
Plt Mgr, FCC-TCAAP (wo/encl)

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ADDENDUM NO. 4
TCAAP SITE F CLOSURE PLAN
May 5, 1994

I. INTRODUCTION

Since approval of the Site F Closure Plan by the Minnesota Pollution Control Agency (MPCA) in July 1993, site closure work was initiated in September 1993, but was temporarily suspended in November 1993 for the winter months. During the course of the work performed in fall 1993, a number of issues surfaced which either were not addressed in the original closure plan, or which were different from the closure plan. During the winter shut-down period, these issues were discussed with the MPCA. This addendum is intended to document the issues and describe changes to the closure work which will be performed in 1994.

II. CLEANUP LEVELS

During September and October 1993, discussions and correspondence took place on revising the cadmium cleanup "target" and "goal"; however the revision was never documented as an addendum. This section is written to document those correspondences and agreements regarding the cadmium cleanup level so that it becomes an addendum to the Site F Closure Plan.

In the closure plan, the enforceable cleanup "goal" for cadmium was 1.2 micrograms per gram (ug/g) and the cleanup "target" was 0.4 ug/g.

In a letter from Mr. Mike Fix of the U.S. Army dated October 15, 1993, a request was made to modify the cadmium goal from 1.2 ug/g to 4.0 ug/g and the cadmium target from 0.4 ug/g to 2.0 ug/g. The MPCA responded in a letter from Mr. Bruce Brott dated November 8, 1993, approving the revised cleanup levels as listed above. In addition, the letter detailed how soils with varying levels of cadmium would be regulated. This information is summarized below:

> Cadmium soils less than or equal to 2 ug/g - Can be backfilled at Site F with no deed restriction on property.
>
> Cadmium soils 2 to 4 ug/g - Can be backfilled at Site F with cadmium deed restriction on property, or treated soils can be mixed and resampled. If all samples

C.3-3

(not an average) from the mixture are less than 2 ug/g, the soils can be backfilled with no deed restriction for cadmium placed on property.

Cadmium soils greater than 4 ug/g - Cannot be backfilled unless mixed and resampled as discussed above.

Early in the 1993 treatment season, two batches of soil with cadmium concentrations greater than 2 ug/g but less than 4 ug/g were placed in the clean stockpiles. The other metal concentrations were below the cleanup goals.

The batches (Batch 4 and Batch 12) were placed along with other successfully treated batches in the stockpiles on the north end of Site F. For reference sake the two stockpiles will be designated "west" and "east". The treated batches were piled together such that it is not possible to identify or segregate individual batches. At the time, it was assumed that the stockpiles would be backfilled on Site F prior to testing for verification that mixing occurred. Subsequent discussions with the MPCA clarified that the testing should be done before backfilling. In hindsight, it would have been advantageous to keep Batch 4 and Batch 12 separate from the clean soil stockpiles to allow better control over mixing and testing. As it stands, it should be assumed that these two batches could be anywhere within the two stockpiles and that both stockpiles should be tested.

A total of 29 batches were successfully treated during 1993 and returned to the stockpiles at Site F. Based upon a visual inspection of the two stockpiles, the west stockpile is estimated to contain 18 batches (60%) and the east stockpile 11 batches (40%).

To test the stockpiles, it is proposed to collect a total of 56 samples or the approximate equivalent of 2 samples per batch. Fifty-six samples are proposed for simplicity of having equal numbers of samples for subpiles as described in the next paragraph.

Weighing the cost of sample collection and analysis versus the cost to subdivide the stockpiles into smaller piles, it is proposed to subdivide the combined quantity of the two stockpiles into 7, 8, or 14 subpiles. The exact number will depend upon the available space due to trees and steep slopes. The subpiles would be formed to be approximately equal in size based upon visual inspection.

After forming the subpiles, an equal number of samples will be collected from each pile such that the total number of samples is 56. As an example, if 8 subpiles were formed, then 7 samples will be collected per pile.

It is proposed to collect discrete grab samples at randomly selected locations within each subpile. The sample locations will be selected by:

C.3-4

1) establishing a coordinate system (x, y, z) for each pile; and
2) using a random numbers table to select the coordinates for each sample location.

Prior to sample collection, approval will be obtained from the MPCA regarding the number of piles formed and the sample locations within each pile.

The samples will be collected using a hand auger. In the event of difficulties associated with the borehole collapsing while augering to locations within the pile, a backhoe may be used to assist in getting soil from the desired locations.

The samples will be submitted to the laboratory for cadmium analysis using the same method as for testing of other soil samples at Site F.

The cadmium results will be interpreted as follows:

1) If the cadmium concentration is less than or equal to 2 ug/g for all samples within a given pile, then that pile may be backfilled at Site F.

2) If the cadmium concentration is greater than 2 ug/g for any (even as few as one) sample within a given pile, then that specific pile must either be remixed and tested, reprocessed through the treatment plant, or transported to an off-site landfill.

The MPCA will be notified of the testing results and the Army's plan for each pile prior to moving the soil.

III. RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) STORAGE FACILITY

The Army will pursue permitting of a RCRA storage facility for storage of hazardous waste. This building will be used for storage of hazardous waste from Site F and will potentially have future use for storage of hazardous waste from other TCAAP remediation sites. Hazardous wastes from Site F which may potentially be stored in the RCRA facility include:

1) Mercury-contaminated scrap and ordnance;
2) Mercury-contaminated soils;
3) Ordnance (non-mercury contaminated);
4) TCLP-hazardous soils which are not processed or fail to be processed to non-hazardous levels; and
5) Other hazardous substances excavated which cannot be treated.

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It is likely that an existing building on the TCAAP will be retrofitted and utilized for hazardous waste storage, as it would be the most cost-effective option. Modifications to the building will be made as necessary to meet permitting requirements (i.e., containment, etc.). Permitting of the facility will be a high priority since completion of the facility modifications and permitting prior to completion of work at Site F is desired.

IV. CONTAMINATED SOIL EXCAVATION AND VERIFICATION SAMPLING

Excavation of contaminated soil at Site F will continue to be conducted as described in the closure plan. Surficial soils (non-disposal area) soils will continue to be excavated in six-inch lifts with samples for XRF analysis collected at a frequency of approximately 1 per 625 square feet. The frequency of sample collection for laboratory analysis has been increased from 1 per 2500 square feet as stated in the closure plan to approximately 1 per 625 square feet. It is expected that the increased analytical cost will be offset by savings due to minimizing the quantity of soil to be excavated and treated.

At the time of the closure plan, only one disposal area was known to exist (Trench 038, subsequently referred to as Disposal Area 3). Additional disposal areas were identified with magnetometer work and exploratory test digging work performed in the fall of 1993. An additional 10 disposal areas were identified for a total of 11 disposal areas. These additional disposal areas will be excavated as described for Trench 038 in the Site F Closure Plan.

Disposal area samples for XRF analysis and for laboratory analysis will generally be collected as described for Trench 038 in the closure plan. For disposal areas which are deeper than 3 feet, sidewall samples for XRF analysis will be collected at depths (in feet) of 3, 6, 9. . . etc. as appropriate for the depth of excavation. Sidewall samples will be collected from a minimum of four locations around the excavation. Samples from the floor of the excavation will be collected from a minimum of two locations for XRF analysis. When XRF analysis indicates that excavation should be complete, 4 laboratory samples from excavation sidewalls and one laboratory sample from the excavation floor will be collected for verification of XRF results. If laboratory analysis indicates that further excavation is required, additional excavation and sampling will be conducted as required.

For disposal areas shallower than 3 feet, these areas will be considered as surficial soils and will be sampled for XRF and laboratory analysis as described for surficial soils.

Handling of other materials excavated from disposal areas (ordnance, scrap metal, etc.) is discussed in other sections of this addendum.

V. "SUBSTANCE" CHARACTERIZATION SAMPLING AND ANALYSIS

Characterization sampling and analysis has been, and will continue to be performed on non-native "substances" encountered at Site F. The definition of "substance" is loosely meant to include products or waste material in a container of some type (e.g., residue in a cast iron pot), or a layer of material buried within soil (e.g., seams of ash-like material ranging in thickness from less than 1-inch to approximately 1-foot), or discolored soil. As a practical matter, it is not feasible to excavate and completely segregate all of the "substances" from the surrounding soil.

A sampling protocol has been developed to ensure collection of representative samples for laboratory analysis in a manner which addresses applicable health and safety concerns before excavation of these substances. The sampling protocol will be reviewed by the Site Safety Officer who has overall responsibility for health and safety issues relative to the Site F Closure process. The sampling protocol will be consistent with the Site F Health and Safety Plan. The sampling protocol is currently being revised and will be submitted to the MPCA.

Laboratory analysis has been, and will continue to be performed on the substances to meet two objectives:

1. substance identification
2. hazardous waste determination

To meet the objectives listed above, the following laboratory analyses will be performed:

Substance Identification:

- Volatile analysis (EPA Method 8260 for MDH 465E parameter list))
- Semi Volatile Analysis (EPA Method 8270)
- Inorganic Analysis (EPA Method 6010)
- Cyanide Analysis (EPA Method 9010)
- Mercury Analysis (for solids EPA Method 7471), (for liquid EPA Method 7470)

Hazardous Waste Determination

- corrosivity analysis (for solids EPA Method 9045), (for liquids EPA Method 1110)
- ignitability analysis (ASTM D56)
- reactivity analysis (EPA Methods 9010 modified and 9030 modified)
- Toxicity Characteristic Leaching Procedure (TCLP) analysis for metals. (EPA Methods 7060, 6010, 7470, 7740)

Samples for TCLP metals analysis will be held by the laboratory while inorganic (total metals) analysis are being performed. Depending on the total metals analysis, a decision will be made by the Army on whether TCLP-metals analysis is necessary to facilitate disposal. In addition to the sampling and analysis of non-native substances performed to date, three additional substances encountered at the end of the 1993 treatment season will be characterized in 1994. The substances include a black substance in a round broken pot, a black substance in a rusted drum, and chunks of blue-grey material. These substances were all encountered in disposal area 11.

VI. "SUBSTANCE" MANAGEMENT AND DISPOSAL

Characterization analysis provides information necessary to evaluate the proper remediation or disposal alternative for each substance.

Of the substances characterized during 1993, three substances were drummed and shipped to the smelter due to their high lead content (blue/grey solids, blue/grey powder, and tan ash from Disposal Area 7). Three types of substances excavated from disposal areas were placed in drums during the 1993 treatment season and remain on-site as described below.

One substance, identified as cellulose nitrate, was encountered when excavating the test trench in Disposal Area 1. The cellulose nitrate encountered in digging the test trench was placed in a drum and sealed. Laboratory analysis has determined that the substance is a hazardous waste due to lead levels in exceedance of the TCLP limit. As such, the drum has been labeled a "Hazardous Waste". This partially filled drum is viewed as a satellite accumulation and will remain within the Site F exclusion zone until excavation activities are complete or until the drum is filled with additional cellulose nitrate, or until a RCRA storage facility has been permitted at TCAAP (see Section III). Once filled, or after project completion, the drum will be disposed of as hazardous waste. The substance will be processed at an off-site hazardous waste incinerator. The MPCA will be notified of the hazardous waste incineration facility prior to shipment.

The second substance placed in drums from Site F consisted of approximately 25 plastic and glass containers encountered when excavating Disposal Area 7. The containers were primarily empty, but three containers had sufficient quantities of liquids to allow for laboratory analysis. The analysis revealed water, trace concentrations of metals, and low levels of methylene chloride ($\leq$2 mg/l). Because of the presence of methylene chloride and the lack of information on the process which generated the waste, the MPCA has stated that the jars should be regulated as hazardous waste. As such, this drum will be handled in the same manner as the cellulose nitrate and maintained on-site as a satellite accumulation until the drum is full or excavation activities are complete. At that time, the drum will be processed at an off-site hazardous waste incinerator. The MPCA will be notified of the hazardous waste incineration facility prior to shipment.

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The third substance consisted of 1½ drums of white ash-like material excavated from Disposal Area 3. This substance was characterized as non-hazardous metal carbonates and metal oxides. These two drums were placed on the Site F decontamination pad pending a determination if the substance would be processed through the treatment plant. It is now the Army's intent to place these two drums on the new storage pad (see Section XI) pending transportation off-site to a landfill.

The various cast iron pots or kettles containing substances are covered within the Site F exclusion zone. All other "substances" have either not been excavated or have been stockpiled and covered within the exclusion zone.

For all of the "substances" remaining on-site, and for any others uncovered during 1994, it is the Army's intent to segregate these substances individually and store them on-site pending transportation off-site for disposal. MPCA will be notified upon discovery of a new substance and excavation work in this area will be halted until MPCA approval to proceed is received. None of the substances are proposed at this time to be processed through the treatment plant. The Army reserves the right to request at a later date, permission from the MPCA to treat some or all of the substance containing soils. The Army recognizes that approval would be conditional upon demonstration of treatment effectiveness and agreement upon a sampling plan.

Substances which are of a nature that they can be scraped out of containers or small quantities that can be easily excavated as unique entities, are intended to be placed in drums, labeled hazardous or non-hazardous based upon characterization, and placed on the new storage pad (see Section XI). A deliberate attempt will be made to excavate substances and place the substances in drums. Substances such as discolored soil, or where the substances cannot easily be separated from soil, will be stockpiled and covered either on the new storage pad or within the Site F exclusion boundary.

VII. HIGH-EXPLOSIVE MANAGEMENT AND DISPOSAL

High-explosive items including grenade charges and miscellaneous fuse types have been encountered during excavation activities at Site F. These materials were placed in steel ammunition bins and steel ammunition cans and transported by an explosives vehicle to the designated storage location. Chain of custody forms are completed to document transport and storage location of every ammunition bin and ammunition can. The materials are currently in secure storage in an underground explosives storage building (Building 530). The excavation, handling and transportation of the high-explosive items was performed under the direction of an ordnance and explosives waste services company. The Army will classify the explosive type and classification of the high-explosive items. Discussions are underway with Alliant Techsystems, Inc. to decommission the high-explosive items at their open burn/open detonation facility in Elk River, Minnesota. The high-explosives are being accumulated until the end of the closure process for safety concerns, to limit the number of

C.3-9

shipments of high-explosive. At the end of the Site F closure process, the high-explosives are expected to be transported to Alliant Techsystems' open burn/open detonation facility. All high-explosives transport will be done in accordance with Department of Transportation regulations. The MPCA will be notified prior to shipment. If additional high-explosive items are encountered during 1994, they will be managed in the same manner described above.

VIII. ORDNANCE MANAGEMENT AND DISPOSAL

The following ordnance items (excluding high-explosive items) have been encountered to date at Site F:

- live 30 and 50 caliber rounds
- primer caps
- brass casings with primer caps
- tracer and incendiary projectiles

To date, approximately 3 tons of ordnance and 3 tons of scrap metal have been excavated from Site F, placed in steel ammunition bins, and placed in secure storage in Building 189.

It is the Army's intent that these materials be:

- washed to remove soil particles
- sorted to segregate scrap metal from ordnance (scrap metal management and disposal is discussed in Section IX)
- replaced in steel ammunition bins and placed in secure storage in TCAAP Building 189.

Washing of the scrap metal/ordnance mix (listed above) will be conducted within the exclusion zone, directly adjacent to the Site F decontamination pad. The scrap metal/ordnance mix will be placed on a reinforced screening structure able to contain all sizes of scrap metal/ordnance mix encountered. The scrap metal/ordnance mix will be sprayed with a high pressure washer operated from the Site F decontamination pad to remove soils. Washwater will drain onto soils which will be later excavated and treated at the end of the project. Decontaminated scrap metal/ordnance mix will be sorted to segregate scrap and different ordnance types. These materials will be placed in steel ammunition bins and transported to Building 189 for secure storage.

Building 189 has been placarded to denote the explosive characteristics of the ordnance material. Chain of custody forms are completed to document transport and storage location of every ammunition bin. The ordnance will be managed as a hazardous waste. The Army will pursue permitting of a RCRA storage facility (see Section III). The ordnance will be placed into the storage facility once the permitting process is completed. The Army is

C.3-10

evaluating options for disposal of the ordnance. Hence, TCAAP will store this material as hazardous waste while it continues to investigate disposal options. A storage extension was requested in a March 9, 1994 letter from Scott Lantz of the Army to Mr. Roger Bjork of the MPCA.

Additional ordnance excavated at Site F during the 1994 treatment season will be washed and sorted as described above. Some ordnance will be recovered from the soil washing equipment at Site D which will also be sorted.

IX. SCRAP METAL MANAGEMENT AND DISPOSAL

The following types of scrap metal have been encountered during excavation activities at Site F:

- Brass casings without primers
- Lead projectiles
- Steel banding
- Miscellaneous steel debris
- Crushed steel drums
- Cast iron pots

During 1993, approximately 3 tons of scrap metal (excluding cast iron pots and crushed steel drums) have been excavated from Site F, placed in steel ammunition bins and placed in secure storage in Building 189. This scrap metal and ordnance will be transported from Building 189 to Site F, washed in the Site F exclusion zone just off the decontamination pad to remove soil particles, then sorted to separate the scrap metal from the ordnance, and transported back to Building 189.

Handling of scrap metal and ordnance excavated during the 1994 treatment season will include preliminary sorting at Site F to segregate scrap metal from ordnance prior to washing.

Washing of all types of scrap metal (listed above) will be conducted within the exclusion zone, directly adjacent to the Site F decontamination pad. Scrap metal will be placed on a reinforced screening structure able to contain all sizes of scrap metal encountered. The scrap metal will be sprayed with a high pressure washer operated from the Site F decontamination pad to remove soils. Washwater will drain onto soils which will be later excavated and treated at the end of the project. Decontaminated scrap metal will be placed in steel ammunition bins and transported to Building 189 for secure storage.

The scrap may be periodically transported to a scrap metal vendor for recycling or may be accumulated in Building 189 until the end of the project and transported at one time. A

scrap metal vendor has not yet been contracted. The MPCA will be notified of the scrap metal vendor chosen.

X. MERCURY-CONTAMINATED MATERIAL MANAGEMENT AND DISPOSAL

Mercury-contaminated materials have been encountered during excavation activities at Site F. The mercury-contaminated materials include both scrap metal and ordnance. A small amount of the material has been excavated, placed in steel ammunition bins, and is currently stored inside the Site F exclusion zone. Preliminary testing indicates that washed materials would have lead concentrations above the toxicity characteristic leaching procedure (TCLP) limit. Furthermore, washwater used to remove soil particles from the tested materials contained levels of mercury which would not allow the washwater to be used for the following purposes:

- dust suppression at Site F
- make-up water in soil treatment equipment
- sanitary sewer discharge

Therefore, the mercury contaminated materials will be sorted to separate scrap from ordnance, but the materials will not be washed. Sorting is planned because it may assist in future disposal of the material.

The Army is evaluating whether unwashed mercury-contaminated scrap metal can go to a scrap metal vendor for recycling. The mercury-contaminated ordnance will be transported and stored in Building 189. Similar to the ordnance disposal issues, the Army has not identified a feasible solution for the disposal of the mercury-contaminated ordnance. As such, the Army will store the mercury-contaminated ordnance as a hazardous waste while it continues to investigate disposal options. Upon completion and permitting of the RCRA storage facility (see Section III), the mercury-contaminated material would be transported to the RCRA facility for storage.

Additional mercury-contaminated materials which are excavated during the 1994 treatment season will also be sorted. The disposition of this material will be the same as described above.

XI. SOIL TREATMENT AND VERIFICATION SAMPLING

Prior to soil processing, plant modifications will be made to improve operations. A triple-start spiral will be added to remove more of the fine copper flecks and lead dust particles. Spirals are designed to remove smaller diameter particles than the current jig. The combined use of the jig and spiral should improve particulate removal. Better attrition and break down of clay lumps will be designed into the trommel. This will be necessary for the greater clay

C.3-12

content in the new disposal areas. Vegetative organic separation will be added to the clarifier to keep more root matter from going through the fines process. An acidification vessel will be added prior to the first fines-leaching clarifier to assist in lowering the pH faster. This will improve the leaching efficiency and should allow faster processing of the fines. A different series of pumps will be used to allow for faster input of acid. This should also allow faster processing of the fines. An improved neutralization process will be installed to ensure that the leached fines have been completely neutralized. Additional permanent ladders and catwalks will be built to allow safer operation of the plant. A larger centrifuge or two smaller centrifuges in parallel will be installed for increased capacity. The centrifuge capacity was the rate limiting step in the fall of 1993 and this change will thus improve the processing rate.

Soil processing is anticipated to take place 10 hours per day, Monday through Saturday. Maintenance activities may be performed on Sundays, but no soils will be processed. Processing rates are anticipated to be approximately 100 to 150 tons per day.

The MPCA has requested an increased sampling frequency for treated soil in their letter of December 6, 1993. In accordance with the request, the sampling frequency for laboratory analysis will be increased from 1 per 60 tons to 1 per 30 tons. In accordance with this frequency change, the batch size will thus be reduced to 30 tons such that one laboratory sample per batch continues to be collected. In accordance with the closure plan, 3 grab samples per batch will continue to be collected for XRF analysis of lead and a composite of these three samples will continue to be submitted for laboratory analysis for the eight metals of concern. At a processing rate of 100 to 150 tons per day and 10 hours per day of processing time, one 30-ton batch will be processed in approximately two to three hours. Samples for XRF analysis will thus be collected at approximately 40 to 60-minute intervals. In order to maximize treated soil compartment space and minimize repeated soil handling, two to three 30-ton batches may be stored in one soil compartment depending on compartment size. Batches will be separated by movable dividers constructed of PVC or wood frame covered with plastic tarp or similar materials. At project completion, dividers will be steam-cleaned and hauled off-site to a permitted solid waste or industrial waste landfill. Batches will continue to be labeled with signs mounted on fenceposts to ensure accurate tracking of batch numbers.

The identification of additional disposal areas (some containing much higher levels of metals than were generally observed in other areas of Site F) may result in the soil treatment being unable to reach the existing Site F cleanup goals for some soils. Soils which are not processed to below cleanup goals will likely be rendered non-hazardous through processing. As described in subsequent paragraphs, non-hazardous soils may be mixed and resampled. If the mixed soils are below cleanup goals, the mixed soils will be returned to Site F. This will allow the maximum amount of soils to be returned to the site. However, in order to complete remediation of Site F, it may be necessary to dispose of some non-hazardous soils in a permitted municipal solid waste or industrial waste landfill. The facility to be used for disposal will not be selected until all soils have been treated. Since disposal costs are

C.3-13

dependent upon total quantity, it is more cost effective to wait until soil processing is completed such that a known soil quantity (and soil quality) can be discussed with potential facilities for disposal cost negotiation. The MPCA will be notified of the facility selected.

Batches which do not meet Site F cleanup goals will be tested for TCLP metals to determine if the soil is hazardous. Logistically, the soil sample for TCLP analysis will be a composite sample from the three XRF grab samples from a batch (essentially a split sample of the total metals analysis sample) and will be sent to the laboratory at the same time as the total metals sample. The laboratory will hold the TCLP sample until total metal results are received (24-hour turnaround.) If total metals results show that cleanup goal(s) have not been met, the TCLP sample will be analyzed (48-hour turnaround).

While awaiting TCLP results, it is intended that the soil will be left in the compartment on the Site D pad. However, if compartment space is needed to continue treatment operations, the soil will be placed into plastic-lined, steel drop boxes. The empty drop boxes will be moved onto the Site D pad next to the treated soil compartments for loading of soil into the boxes. After loading, the drop boxes will likely be moved off of the Site D pad to a location adjacent to the pad due to space constraints on the pad. The boxes will be covered during precipitation events to prevent water from accumulating in the sealed box. Due to weight restrictions for pickup and movement of the drop boxes, each drop box will likely contain 10 tons of soil. Hence, a 30-ton batch which does not meet Site F cleanup goals may have to be placed into three drop boxes while awaiting TCLP results.

If the TCLP results indicate that the soil is hazardous, the soil will remain in the drop boxes adjacent to the Site D pad until the soil washing/soil leaching vendor is ready to reprocess the soil. At such time, the drop boxes will be moved to the feed stockpile section of the Site D pad where the soil will be unloaded from the drop boxes and placed on the feed stockpile.

If the TCLP results indicate that the soil is non-hazardous, the drop boxes will be transported to a mixing/storage pad to be constructed as a bituminous overlay on the existing Building 503 parking lot. The non-hazardous soil will be unloaded from the drop boxes onto the mixing/storage pad. Batches will be piled on the pad in rows with space between each batch and will be labeled with signs to track batch numbers. Additional pad construction details are described in a subsequent paragraph.

Mixing will only be conducted on non-hazardous soils. Mixing, if conducted, may take place soon after processing with a small number of batches mixed utilizing a front-end loader or comparable heavy equipment. The mixed stockpile will then be sampled at a frequency of 1 sample per 30 ton batch for any metal parameters which were above goals or in the case of cadmium, above the target. It is proposed to collect discrete grab samples at randomly selected locations within each mixed stockpile. The sample locations will be selected by:

1. establishing a coordinate system (x,y,z) for each pile; and
2. using a random numbers table to select the coordinates for each sample location.

C.3-14

The samples will be collected using a hand auger. If results from the mixed soils are below acceptable levels, these soils will be transported back to Site F for backfilling. Mixed soils which are still above acceptable levels will either be remixed and resampled, or prepared for off-site disposal.

If soil reprocessing is attempted on any non-hazardous batches, they will be hauled back to Site D and added to the feed stockpile for reprocessing.

Prior to treatment, if any soils are deemed to be untreatable (either through characterization work or through actual processing experience), these soils will be segregated and stockpiled in the Site F exclusion zone. If necessary, the hazardous soils will be placed in plastic-lined, steel drop boxes and transferred to the new mixing/storage pad until appropriate disposal alternative(s) are selected.

Vegetative organics removed from the clarifier will be placed in drums and a composite sample will be collected for TCLP analysis. The estimated quantity of vegetative organics to be handled in 1994, is approximately 10 drums. As verbally approved by the MPCA for vegetative organics removed in the fall 1993 treatment season, the analytical results will be compared with TCLP criteria. If less than this criteria, the material will be spread out and mixed with topsoil as part of the Site F final cover. If hazardous, drummed vegetative organics will be stored on the mixing/storage pad until they can be moved into the RCRA storage building or until appropriate disposal alternative(s) are selected.

The mixing/storage pad will be approximately 50,000 square feet in size. When completed, plans and specifications will be submitted to the MPCA for approval. The mixing/storage pad is not intended to be a long-term, permitted facility for hazardous waste; rather, it is intended to be an area which will assist in the process of soil mixing and staging for final disposal. Therefore, the mixing/storage pad is not intended to comply with all provisions of the Minnesota Hazardous Waste Rules (7045.0534 Waste Piles) and the Minnesota Specific Waste Facility Requirements (7035.2855 Solid Waste Storage Standards). However, to promote environmentally-sound storage methods, the mixing/storage pad design and operating procedures will be generally consistent with these rules. Specifically, the following design criteria and operating procedures will be utilized:

1. The location of the mixing/storage pad will not be in an area characterized by surficial karst features and will be entirely above the seasonal high water table.

2. The bituminous pad provides an impervious liner which will prevent contaminated soil and water drainage from contacting soils beneath the pad.

3. Bituminous curbing will be installed around the edges of the pad to prevent run-on to the pad. The curb will also prevent run-off from the pad. Curb

C.3-15

height and pad slope will be designed to contain the water volume resulting from a 24-hour, 10-year storm (4-inch rainfall).

4. Soils stored on the pad will generally be covered to prevent rainfall from infiltrating through the soils and to prevent dust emissions. However, in order to allow drying of soils (post-treatment soils contain approximately 30% water), batches may periodically be uncovered to allow for evaporation.

5. Run-off water generated on the mixing/storage pad (along with any water drainage from the soil piles) will preferably be discharged to the sanitary sewer in accordance with the MWCC special discharge permit. A second option is to place the water in the soil treatment make-up water tank for utilization in the soil washing process. If the plant cannot accept this water for any reason (i.e., volume limitations), this water would then be used as dust suppression in contaminated soil areas at Site F.

6. The mixing/storage pad will be inspected at least weekly and after storms to ensure run-on and run-off measures are working properly and soil pile covering is in place.

7. Non-hazardous soils which are not successfully mixed will be hauled to an off-site disposal facility within one year from initial pad use.

8. Hazardous soils, if stored on this pad, will be stored in plastic-lined, steel drop boxes with covers until a RCRA hazardous waste storage building can be completed and permitted (see Section III) or until off-site disposal arrangements are made. If necessary, these soils would then be moved to this building until appropriate disposal alternative(s) are selected.

9. Following mixing/storage pad construction and prior to storing soils on the pad, 5 pre-work pad wipe samples (baseline) will be collected for analysis for the 8 Site F metals of concern. Wipe sampling shall be conducted as described in the closure plan for other pads. At project completion and when all soils have been removed, the mixing/storage pad will be decontaminated by steam cleaning. Post-decontamination wipe samples will then be collected and compared with pre-work wipe samples for verification of decontamination. This pad will be left intact for potential future use for other TCAAP sites.

C.3-16

XII. MWCC SPECIAL DISCHARGE PERMIT

The MWCC special discharge permit expired in December 1993. This permit had allowed for authorized discharges of rainwater, decontamination water, and process water generated from Site F work. Extension of this special discharge permit through December 1, 1994, has been received from MWCC for continued work at Site F (MWCC letter of April 7, 1994). Discharges to MWCC will be made in accordance with this permit. The permit extension also provided approval for discharge of rainwater from the new mixing/storage pad when discharge criteria are met.

XIII. OVERSIZE SAMPLING

A number of correspondences have taken place regarding the sampling of oversize material from Site F, however, the sampling information was never documented as an addendum. This section is written to document those correspondences so that it becomes an addendum to the Site F Closure Plan.

In an October 15, 1993 letter from Mr. Michael Fix, U.S. Army, to Dan Card of the MPCA summarizing oversize sampling discussions, it was agreed that a modified Toxicity Characteristic Leaching Procedure (TCLP) would be used to verify oversize materials as clean. The agreed-to change is that the oversize material will not be crushed. A November 8, 1993 letter from Bruce Brott, MPCA, to Mr. Michael Fix, U.S. Army, concurred with the modified TCLP method. The letter further stated that sampling of the oversize should continue throughout the entire remediation process with the Army proposing a sampling schedule. The Army responded with a December 13, 1993 letter from Michael Fix, U.S. Army, to Mr. Dan Card, MPCA, summarizing the oversize sampling frequency. One sample per batch was collected for the first eight batches, and one sample per week continued thereafter throughout the 1993 treatment season. All samples passed the TCLP acceptance criteria thus oversize material will be backfilled at Site F. The Army therefore, proposed to reduce the oversize sampling frequency to one sample every three weeks. The MPCA responded in a January 5, 1994 letter from Bruce Brott, MPCA, to Mr. Michael Fix, U.S. Army, allowing a reduced sampling frequency of one sample per 240 tons of oversize material. 240 tons of oversize material is roughly equivalent to three weeks accumulation of oversized material.

Minnesota Pollution Control Agency

May 20, 1994

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

RE: Addendum No. 4, TCAAP Site F Closure Plan
Twin Cities Army Ammunition Plant (TCAAP)
MN7213820908

Dear Mr. Fix:

The Minnesota Pollution Control Agency (MPCA) staff have reviewed your May 9, 1994, TCAAP Site F Closure Plan Addendum. According to our records, this is addendum number 4. Addendum number 3 was issued on October 7, 1993, which approved open detonation of an unexploded fuse discovered at Site F. Major components of this Addendum included:

- o Cleanup levels for cadmium analysis.
- o Resource Conservation Recovery Act storage "facility."
- o Contaminated soil excavation and verification sampling.
- o "Substance" characterization sampling and analysis.
- o "Substance" management and disposal.
- o High-explosive management and disposal.
- o Ordnance management and disposal.
- o Scrap metal management and disposal.
- o Mercury contaminated material management and disposal.
- o Soil treatment and verification sampling.
- o MWCC special discharge permit.
- o Oversize sampling.

Based on numerous discussions with the Army and your consultant, it appears that MPCA staff comments were addressed in this final version. As such, this addendum is approved with all other conditions of the approved Site F Closure Plan, Work Plans and Specifications, and previous Closure Plan Addendums remaining in effect.

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C.3-18

You may contact Dan Card at 612/297-8379 or Beth Gawrys at 612/297-8376 if you have any questions.

Sincerely,

Frederick M. Kennessa, for

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:mk

cc: Keith Benker, Wenck Associates, Inc.
Charles Slaustas, U.S. EPA Region 5
Fayola Wright, U.S. EPA Region 5

C.4 Correction to Addendum No. 4 Property Deed Wording

Minnesota Pollution Control Agency

August 1, 1995

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

RE: Correction to Addendum No. 4, Twin Cities Army Ammunition Plant Site F Closure Plan

Dear Mr. Fix:

Addendum No. 4 dated May 9, 1994, was previously approved by the Minnesota Pollution Control Agency (MPCA) staff as evidenced by our letter to the Army dated May 20, 1994. At the request of Mr. Keith Benker (Wenk Associates, Inc.), we have reviewed the Addendum; the MPCA letter to the Army dated November 8, 1993; and the Army letter to the MPCA dated October 15, 1993. Based upon our review, we concur that the word restriction should have been notice for cadmium concentrations in soil greater than 2.0 ug/g, but less than 4.0 ug/g. Specifically, on pages 1 and 2 of the Addendum No. 4, dated May 9, 1994, the word restriction should be replaced with notice. It was never our intent to have a deed restriction for soils remediated to below and acceptable health risk based value.

By this letter, the MPCA approves this correction to Addendum No. 4.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:ts

C.4-2

C.5 TCAAP Site F Closure Levels and Property Deed Restriction

Minnesota Pollution Control Agency

December 10, 1993

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant (TCAAP)
New Brighton, Minnesota 55112-5700

Dear Mr. Fix:

RE: TCAAP SITE F CLOSURE LEVELS & PROPERTY DEED RESTRICTION
MN7213820908

On December 2, 1993, Bill Johnsen from Wenck Associates contacted me to determine at what level would the Minnesota Pollution Control Agency (MPCA) not impose a property deed restriction for lead? He suggested that I write a letter to the Department of the Army to document our conversation.

Specifically for lead, we require the 300 ug/g "enforceable cleanup goal" be achieved to avoid a property deed restriction. However, we encourage using the September 20, 1993, revised Minnesota Department of Health (MDH) residential property lead cleanup standard of 100 ug/g. Since the Site F lead cleanup level was established prior to the effective date of the revised MDH cleanup standard, it will remain at 300 ug/g.

Rational for our decision is as follows. When a hazardous waste facility can not achieve "clean closure to background" by removal or decontamination, the MPCA will require a property deed restriction if the hazardous waste or hazardous constituents are left in place and are determined to pose a potential risk to human health or the environment. Background metal concentrations for closure of Site F were originally established using Site F specific data rather than data from the entire TCAAP facility. Background metal concentrations were adjusted to represent excavation limits and cleanup levels as discussed in our letter of August 24, 1993. These revised background metal concentrations also took into consideration human health risk based cleanup levels. So in a sense the background metal concentrations are considered both clean closure levels and human health risk based levels. Our letter of November 8, 1993, documents the

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additional revised cleanup level for cadmium. Thus, to date the MPCA has established "clean closure to background" levels equivalent to the "enforceable goals"of (ug/g):

Antimony	4.0
Cadmium	4.0
Chromium	100.0
Copper	80.0
Lead	300.0
Mercury	0.3
Nickel	45.0
Silver	5.0

Therefore, a property deed restriction will not be required if these enforceable goal levels are achieved, with the exception of cadmium. As discussed in our November 8, 1993, letter, the "target" level for cadmium of 2.0 ug/g must be achieved to avoid a property deed restriction.

Lastly, I noticed the October 8, 1993, TCAAP Fact Sheet entitled "The Site F Closure Project" incorrectly show the cadmium "cleanup level (ppm)" i.e., "enforceable goal" of 2 rather than 4. Please make this correction for any future publications.

You may contact me or Jon Pollock at 612/297-8379 or 612/297-8477 respectively if you or Marty McCleery have further questions regarding this issue.

Sincerely,

Dan R. Card, Engineer
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

DRC:rg

cc: Keith Benker, Wenck Associates
Charles Slaustas, EPA Region 5

C.6 Letters of No Action-Extended Storage of High Explosives and Ordnance

Minnesota Pollution Control Agency

June 27, 1995

Mr. Michael R. Fix, P.E.
Commander's Representative
U.S. Department of the Army
SMCTC-CO
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112

RE: Letter of No Action - Extended Storage of High Explosive Ordnance
Generated From Site F Closure U.S. Army, Twin Cities Army Ammunition Plant
MN7213820908, Permitted Facility, Arden Hills

Dear Mr. Fix:

The staff of the Minnesota Pollution Control Agency has been involved in discussions with staff from the U. S. Department of the Army (Army), Federal Cartridge Corporation, and Wenck & Associates (Wenck), the Army's on-site contractor/consultant, regarding activities related to the clean-up and closure of Site F at the Army's Twin Cities Army Ammunition Plant. In these discussions, the Army and Wenck have requested that the Army be allowed to store hazardous wastes in Buildings 189 and 530 during closure activities at Site F, which is outside the scope of the approved Site F Closure Plan governing remediation and storage of hazardous waste at Sites D and F.

Since the initial request, it is our understanding that Building 189 is no longer being used for storage of hazardous waste such as mercury contaminated casings, projectiles etc. This ordnance has been shipped off-site for incineration and recovery.

Whereas, Building 530 is still being used to store high explosive ordnance generated from the closure of Site F. Pending completion of Site F excavation activities this summer, the high explosive ordnance will be shipped to the Alliant Techsystem Proving Ground in St. Francis, Minnesota for treatment.

C.6.2

Based upon our understanding of the facts as described above resulting from initial discussions, and subsequent telephone conversations with Army and Wenck staff, the Minnesota Pollution Control Agency will take no enforcement action against the Army for storage of hazardous wastes being stored in Building 530, pending compliance with the following conditions:

1) all hazardous wastes being stored in Building 530 will be placed in covered roll-off boxes, or other suitable containers, which will be kept closed, except when adding or removing wastes, and properly labeled in accordance with the Minnesota Hazardous Waste Rules; and

2) the Army, Federal Cartridge Corporation, or Wenck conducts, at a minimum, weekly inspections of all container storage areas.

This Letter of No Action covers only the storage of hazardous waste currently being stored in Building 530 and does not include wastes being stored at either Site F or Site D in accordance with the approved Closure Plan as part of the remedial activities. As per your request, the terms of this Letter of No Action shall continue until closure of Site F is completed this summer. Thank you for your patience and cooperation in this matter. If you have any questions, please contact Ray Bissonnette or Dan Card, both of my staff, at 612/297-8468, or 612/297-8379 respectively.

Sincerely,

Timothy K. Scherkenbach

Timothy K. Scherkenbach
Division Manager
Hazardous Waste Division

TKS:mln

C.6-3

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA 55112-5700

REPLY TO ATTENTION OF

July 17, 1995

SIOTC-EV (200-1b)

SUBJECT: Letter of No Action - Extended Storage of High Explosive Ordnance Generated From Site F Closure, U.S. Army, Twin Cities Army Ammunition Plant MN7213820908, Permitted Facility, Arden Hills

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
Permit Review Unit
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Sir:

This letter has been written to document comments provided to you by Mr. Bill Johnsen of Wenck Associates, Inc. (Army contractor) on the June 27, 1995 letter from Mr. Timothy K. Scherkenbach, MPCA, SAB.

The Army had anticipated being able to provide input into the wording of the letter before it was finalized. The Army requests a follow-up letter from MPCA which acknowledges the following points:

1. Page 1, 2nd Paragraph, 2nd Sentence
The ordnance referenced was removed from Building 189 in preparation of being shipped off-site. It is currently staged at Site F and will be shipped off-site for incineration and metals recovery in 1995.

2. Page 2, 1)
The Army would like to clarify that no wastes in Building 530 have or will be placed in roll-off boxes. All materials in Building 530 (high explosives) are being stored in ordnance containers with rubber-gasketed sealing covers.

3. Page 2, 2)
During an earlier site visit by Mr. Ray Bissonette and Mr. Dan Card, Wenck was instructed to perform monthly inspections of "container storage areas". As you stated in the July 10, 1995 conversation with Bill Johnsen of Wenck, monthly inspections should continue to be performed.

C.6 - 4

4. Per our conversation, it is our understanding you have concurred in Army's pursuit of the CAMU approach for the management of hazardous waste material from Site F, if necessary. At this time we do not anticipate any material being placed in a CAMU.

In addition to these specific materials discussed, it was agreed that other materials stored in the vicinity of Sites D and F while facilitating disposal do not need to be added to the "Letter of No Action" but should be noted on the Site F Progress Reports which are regularly provided to the MPCA.

Please refer any questions to Mr. Bill Johnsen of Wenck Associates, Inc. at (612) 479-4225, or Martin R. McCleery, SIOTC-EV, (612) 633-2301, ext. 651.

Sincerely,

Michael R. Fix
Commander's Representative

Copies Furnished:

Wenck Associates, Inc., ATTN: Mr. Keith Benker
Plt Mgr, FCC-TCAAP
FCC-TCAAP, ATTN: Ms. Bridgette Manderfeld

C.6-5

Minnesota Pollution Control Agency

August 4, 1995

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

RE: Response to Department of Army July 17, 1995, Letter
Letter of No Action (LONA) Correction and Clarifications for
Extended Storage of High Explosive Ordnance Generated from Site F Closure
Twin Cities Army Ammunition Plant (TCAAP)

Dear Mr. Fix:

As you requested in your letter of July 17, 1995, we acknlowedge the following correction and clarifications regarding the June 27, 1995, Minnesota Pollution Control Agency Letter of No Action (LONA).

Correction:

1. As previously agreed to verbally with the Minnesota Pollution Control Agency staff, the Army shall continue to inspect monthly, rather than weekly, container storage areas associated with Site F closure.

Clarifications:

1. Although ordnance such as mercury contaminated casings and projectiles were removed from Building 189, it has not been shipped off-site to date. It is currently being stored at Site F pending final arrangements for off-site incineration and metals recovery.

2. All high explosives in Building 530 are being stored in ordnance containers with rubber-gasketed sealing covers. This would fulfill the "other suitable container" clause as stipulated in the June 27, 1995, LONA.

C.6.6

We hope that this response addresses the previously agreed to decision for monthly inspections and clarifies any inadvertent misunderstandings. A separate letter is being prepared in response to the other two issues addressed in your July 17, 1995, letter that are unrelated to the LONA.

If you have any questions, please contact Dan Card of my staff at 612/297-8379.

Sincerely,

Timothy K. Scherkenbach
Division Manager
Hazardous Waste Division

TKS:mln

C.6-7

C.7 Addendum No. 5 and Approval Letter

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA 55112-5700

REPLY TO
ATTENTION OF

March 3, 1995

SMCTC-EV (200-1b)

SUBJECT: Site F Closure Plan Addendum No. 5

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
Permit Review Unit
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Sir:

References:

a. letter, SMCTC-EV, February 24, 1995, SAB.

b. telephone conversation between Mr. Dan Card (MPCA) and Mr. Keith Benker (Wenck Associates), March 2, 1995, SAB.

Enclosed for your action is revised Addendum No. 5, dated March 2, 1995, which supersedes the February 10, 1995 Addendum (forwarded to you as enclosure to referenced letter [ref a]). This revised Addendum contains the change you requested in referenced telephone conversation (ref b); that is, **V. SCRAP METAL AND CONCRETE**, ¶ 2, 3rd sentence has been changed to read *"Concrete debris will be power-washed inside the exclusion zone next to the decontamination pad prior to transport and disposal."*

With this revision, it is our understanding that the MPCA will provide an approval letter within 1-2 weeks to allow initiation of these activities.

C.1-2

If you have any questions or need additional information, please contact Mr. Martin R. McCleery, SMCTC-EV, or Mr. Michael R. Fix, SMCTC-CO, (612) 633-2301, ext. 651 or 661.

Sincerely,

Scott F. Lantz
Acting Commander's Representative

Enclosure

Copy Furnished:

Bridgette Manderfeld, FCC (wo/encl)

C.7-3

ADDENDUM NO. 5
TCAAP SITE F CLOSURE PLAN
March 2, 1995

I. INTRODUCTION

Two processing seasons have been completed to date: the first between September and November 1993 and the second between May and October 1994. Due to increased quantity of soil requiring treatment, soil processing must continue into a third processing season in 1995. During the course of project work, issues have developed which were different from or not included in the Site F Closure Plan which was approved by the Minnesota Pollution Control Agency (MPCA) in July 1993. Some of these issues were addressed in previous addenda to the closure plan. This addendum presents issues not previously addressed or incompletely addressed in the closure plan or previous addenda.

II. HAZARDOUS AND NON-HAZARDOUS SUBSTANCES

Since initiation of Site F closure work, a number of substances have been excavated at Site F. Where possible, these substances were segregated and placed in 55-gallon drums. Twenty-one different substances were sampled, characterized and managed in accordance with procedures described in Site F Closure Plan Addendum No. 4. All substances will be transported to an off-site facility for incineration. The name of the facility will be provided to the MPCA prior to disposal and will also be documented in the closure certification report. Since excavation of additional substances is not anticipated, the substances are scheduled for disposal at the beginning of the 1995 treatment season. If any additional substances are encountered, they will be incinerated at the same facility unless technical or regulatory constraints dictate a different disposal method.

C.7-4

III. ORDNANCE

Ordnance materials removed from Site F soils generally include small arms components (casings or projectiles) or live rounds (casing and projectile still intact). Some high-explosive ordnance items have also been removed, but are discussed separately in the next section. At the end of the 1994 treatment season, the project totals for the ordnance types were 285 bins of casings, 77 bins of projectiles, and 22 bins of live rounds (bin size is approximately 4¼ feet long by 2¼ feet wide by 1¼ feet high). Estimated total weight of this ordnance is approximately 100 tons. All of these ordnance items contain energetic materials (some of the casings have primer caps intact and some of the projectiles contain tracer or incendiary compounds). Most, if not all of the ordnance is believed to have some mercury on it based on testing of ordnance samples. As such, ordnance has not been washed (other than the ordnance which is removed by the soil washing/soil leaching plant) and is currently staged at Sites D and F in the bins and covered with plywood and plastic tarps. A limited number of bins were transported to Building 189 during the 1993 treatment season.

Initial review of disposal alternative for the ordnance materials had been complicated by the presence of both explosives and mercury in/on the same waste. However, off-site incineration has been identified as a feasible disposal method for these materials. All ordnance items will thus be transported to an off-site incinerator for disposal. Packaging and transport will be in accordance with Department of Transportation (DOT) and Department of Defense (DOD) regulations. Arrangements are being made for transportation and disposal of the ordnance currently staged at Sites D and F early in the 1995 treatment season. Additional ordnance accumulated in 1995 will be transported and disposed after completion of excavation and soil processing. The name of the incinerator will be provided to the MPCA prior to disposal and will also be documented in the closure certification report.

IV. HIGH-EXPLOSIVE ORDNANCE

Some high-explosive ordnance items, including grenade charges and fuzes, have been recovered from Site F. These items are placed in steel ammunition bins or steel ammunition cans prior to transport in an explosives vehicle to an on-post explosives storage building (Building 530) as described in Site F Closure Plan Addendum No. 4. High explosive items will be decommissioned at Alliant Techsystems' open burn/open detonation facility in Elk River, Minnesota. High explosives packaging and transport will be in accordance with DOT and DOD regulations and will be conducted at the end of the project to allow accumulation of all high-explosive items which might be encountered in the remaining soil excavation and processing work.

V. SCRAP METAL AND CONCRETE

Scrap metal consists of cast iron pots, crushed drums, cans, steel banding, nails, hinges, etc. An estimated 24 tons of scrap has been accumulated to date. Scrap materials are washed with a power washer inside the exclusion zone next to the decontamination pad. Scrap metal is contained in a 30 cubic yard drop box and in 39 bins staged at Site F. Chemical testing of the scrap has shown it to be TCLP non-hazardous. As such, the metal can be recycled at a steel mill. Scrap metal will continue to be accumulated until completion of soil excavation and processing work and will then be transported to the recycling facility. Alternatively, an earlier partial shipment of scrap might occur if deemed appropriate. The name of the recycling facility will be provided to the MPCA prior to the transport and will also be documented in the closure certification report.

Concrete debris, including building foundation material, has been excavated from Site F. Unwashed concrete samples have been shown to be non-hazardous by TCLP analysis. Concrete debris will be power-washed inside the exclusion zone next to the decontamination pad prior to transport and disposal. Concrete debris accumulated to date will be disposed of

early in the 1995 treatment season. Another concrete disposal event will occur at the end of the project. Disposal of the concrete will either be through utilization by an asphalt recycler (as had been done with concrete debris from Building 5530 demolition) or by placement in a demolition landfill. The name of the recycling or disposal facility will be provided to the MPCA prior to transporting the concrete and will also be documented in the closure certification report.

C.7-7

Minnesota Pollution Control Agency

March 9, 1995

Mr. Scott F. Lantz
Acting Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

RE: Addendum No. 5 - Site F Closure Plan
Twin Cites Army Ammunition Plant
MN7213820908

Dear Mr. Lantz:

The Minnesota Pollution Control Agency (MPCA) staff has reviewed, and approve your March 3, 1995, proposed Addendum No. 5 to the Twin Cities Army Ammunition Plant, Site F Closure Plan. This addendum addresses ultimate disposition of wastes and debris not previously approved in the Closure Plan such as:

- Hazardous and non-hazardous substances
- Mercury contaminated ordnance
- High-explosive ordnance
- Scrap metal and concrete debris

Regarding the scrap metal and concrete debris material, results of the TCLP analysis determined that these materials are not characteristically hazardous for metals, nor do they contain listed hazardous waste. Therefore, in accordance with Minn. Rules pt. 7045.0120, subp. 1, item V(2), they are not required to be managed as hazardous debris (as defined in Minn. Rules pt. 7045.0020, items 13C and 32B) and may be recycled or disposed in a demolition landfill or approved solid waste disposal facility.

Regarding off-site shipments of the hazardous waste substances and mercury contaminated ordnance for treatment by incineration, and the High-Explosive ordnance for open burning at Alliant Techsystems Proving Ground, all hazardous waste generator pretransport requirements (labeling etc.), and hazardous transportation requirements must be complied with.

520 Lafayette Rd. N.; St. Paul, MN 55155-4194; (612) 296-6300 (voice); (612) 282-5332 (TTY)
Regional Offices: Duluth • Brainerd • Detroit Lakes • Marshall • Rochester

C 7-8

All other conditions of the approved Site F Closure Plan, Work Plans, Specifications, and previous Closure Plan Addendums No. 1-4 remain in effect. You may contact Dan Card at 612/297-8379 or Beth Gawrys at 612/297-8376 of my staff if you have any questions.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:mk

cc: Keith Benker, Wenck Associates
George Hamper, Minnesota Section Resource Conservation Recovery Act, Permits, U.S. Environmental Protection Agency, Region 5, Chicago
Fayola Wright, Regulatory Development, U.S. Environmental Protection Agency, Region 5, Chicago

C.8 Addendum No. 3 and Approval Letter

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA 55112-5700

REPLY TO
ATTENTION OF

September 16, 1993

SMCTC-EV (200-1b)

SUBJECT: Amendment to the RCRA Permit Modification for Closure of Site F at Twin Cities Army Ammunition Plant for Detonation of Unexploded Ordnance

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
Permit Review Unit
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Sir:

Reference telephone conversation between Mr. Dan Card and Mr. Michael Fix on 16 September 1993, SAB.

While preparing Site F for closure activities, the site was swept to locate possible unexploded ordnance items. The result of the surface sweep has yielded several items of unexploded ordnance, including fuses and grenade bodies. The fuses are considered too hazardous to transport and therefore will be detonated on site as an emergency disposal action. The grenade bodies are not considered to be an immediate hazard from movement or transportation; however, the grenade bodies do represent a significant effort to relocate and properly store, properly transport, and perform proper disposal.

We are, therefore, requesting permission to perform on-site detonation of these grenade bodies as part of the Site F Closure activities in an effort to keep the closure process on schedule. Based on findings to date, the explosives-certified unexploded ordnance contractor proposes to detonate these items in less than three pounds explosive-weight detonations. It is proposed that, with your permission and approval, these detonations would be performed as required to keep the closure action moving, with proper notification to the local law enforcement authorities for information purposes.

As this issue is critical to the successful completion of the Site F Closure, we request that you give this item your earliest attention. We would be pleased to further discuss this request as necessary to proceed with our proposal.

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The POC is Mr. Michael R. Fix or Mr. Martin R. McCleery, SMCTC-EV, (612) 633-2301, ext. 661 or 651.

Sincerely,

for Michael R. Fix
Commander's Representative

Copy Furnished:

Plt Mgr, FCC-TCAAP

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DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA 55112-5700

REPLY TO
ATTENTION OF

September 28, 1993

SMCTC-EV (200-1b)

SUBJECT: Request for Permission to Dispose of Hazardous Explosive Items as Part of the Site F Closure Process

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
Permit Review Unit
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Sir:

Reference:

a. Letter, SMCTC-EV, September 16, 1993, subject: Amendment to the RCRA Permit Modification for Closure of Site F at Twin Cities Army Ammunition Plant for Detonation of Unexploded Ordnance.

b. Meeting, September 22, 1993, SAB.

At our September 22, 1993 meeting we learned that there was one unexploded ordnance item which could not be safely transported off-site for disposal and several items which could be safely transported over public highways for disposal. This letter is to request permission to dispose by detonation of the one fuse item on Site F. As was discussed, the disposal of the item on-site is the only safe method of disposal.

Also discussed was the size of the detonation, which was determined to be most probably a blasting cap attached to the fuse detonator. Therefore, permission is requested to detonate on-site not more than one pound of explosive for the event to destroy the fuse; and also request permission for future disposal needs on an as-needed basis, with prior approval by your office. At this time we do not anticipate any future needs; however, we wish to obtain your concurrence for our plan by response to this letter.

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As discussed, we will seek off-site disposal options for disposal of transportable ordnance items.

Your soonest attention and concurrence with our request is appreciated.

The POC is Mr. Michael R. Fix or Mr. Martin R. McCleery, SMCTC-EV, (612) 633-2301, ext. 661 or 651.

Sincerely,

Michael R. Fix
Commander's Representative

Copies Furnished:

Cdr, AMCCOM, ATTN: AMSMC-EQ, Mr. Rick McNulty
Cdr, U.S. Army Environmental Center, ATTN: SFIM-AEC-IRA, Mr. Pete Rissell
Plt Mgr, FCC-TCAAP, New Brighton, MN

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Minnesota Pollution Control Agency

October 7, 1993

Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

Dear Mr. Fix:

RE: Site F Closure Plan Addendum -
Approval For Open Detonation Of Explosive Items
Twin Cities Army Ammunition Plant
MN7213820908

As discussed in your letters of September 16, 1993, and September 28, 1993, one unexploded ordnance (UXO) item (fuse detonator) was discovered while preparing Site F for closure activities.

Based on a review your letters, and based on a concurrence with the described transportation hazards on public highways, the Minnesota Pollution Control Agency (MPCA) staff approve your request to detonate one fuse at Site F. It is our understanding that less than one pound of explosive-weight shall be used to detonate the fuse. Other conditions of this approval include:

- assurance that a properly trained explosives-certified UXO contractor conducts the open detonation,
- compliance with property distance requirements for open detonations,
- notification local emergency responders prior to detonation,
- minimize noise propagation related to the detonation.

Future UXO items discovered that pose a transportation hazard to off-site hazardous waste treatment facilities, may also be open detonated at Site F using less than one pound explosive-weight, if prior notification is given by the Department of the Army to the MPCA, and all of the above requirements are followed.

Other UXO items, such as granade bodies, not posing a transportation hazard shall be sent off-site for treatment.

This approval constitutes an addendum to the approved Site F Closure Work Plan. All other terms and conditions of the approved Site F Closure Plan, Work Plans and Specifications are still in effect.

You may contact Dan Card of my staff at 612/297-8379 for future notifications.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:mk

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C.9 Addendum No. 6 and Approval Letter

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA 55112-5700

REPLY TO
ATTENTION OF

July 24, 1995

SIOTC-EV (200-1b)

SUBJECT: Addendum No. 6, TCAAP Site F Closure Plan

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
Permit Review Unit
520 Lafayette Road
St. Paul, Minnesota 55155

Dear Sir:

Please find enclosed Addendum No. 6 to the TCAAP Site F Closure Plan, July 1993. This addendum addresses on-site detonation of high-explosive items uncovered during closure work at Site F. Upon your review, preparation of a letter of MPCA approval at your earliest convenience will be appreciated.

Upon written concurrence by your office, a copy of the Addendum will be provided to the individuals who have received the subject Closure Plan.

The POC is Mr. Martin R. McCleery, SIOTC-EV, or Mr. Michael R. Fix, SIOTC-CO, (612) 633-2301, ext. 651 or 661.

Sincerely,

Michael R. Fix
Commander's Representative

Enclosure

Copies Furnished:

Wenck Associates, Inc., ATTN: Mr. Keith Benker (wo/encl)
Plant Manager, FCC-TCAAP (wo/encl)

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Addendum No. 6

TCAAP Site F Closure Plan
July 19, 1995

L. On-Site Detonation of Unexploded Ordnance

Since initiation of Closure Work, a number of high explosive (HE) items have been excavated from Site F and placed in secure storage in Building 530. These items pose a risk because of uncertainty regarding their stability due to being exposed to heat/cold and precipitation associated with being outside. The Army's Standard Operating Procedure for items in this condition is to detonate the materials on-site. This allows for the safe treatment of the items in a manner which does not expose the general population to risk by transporting the items on a public roadway.

An inventory of the materials to be detonated is included in Attachment A. The net explosive weight of the HE items is approximately ten pounds.

The detonations will be performed at Site F by EOD Technology, Inc. (EODT), an explosive ordnance contractor. EODT provides the explosive ordnance oversight for the Site F Closure project and has the expertise to perform the on-site detonation of the accumulated materials.

The detonation protocol to be followed by EODT is included as Attachment B. EODT proposes to conduct four detonations to consume the explosive content of the HE items.

Each detonation would have a maximum net explosive weight of 25 pounds. The net explosive weight may seem high in contrast to previously approved detonations at TCAAP. This is because of the large number of HE items to be detonated which requires the use of a two-component explosive for detonation. The two component explosive has a higher net explosive weight then the jet perforators which were used previously.

The HE items will be detonated within the exclusion zone of Site F which satisfies the minimum property distance of 670 feet for 0-100 pounds per Minnesota Rules pt. 7045.0542, subp. 9. Furthermore, non-EODT personnel will be kept a minimum of 965 feet from the detonation site in accordance with Table A-1 of EODT's protocol (Attachment B). EODT intends to dig a hold 2-3 feet deep, place the HE items and detonation agents in the bottom, and backfill with 2-3 feet of soil. This procedure will minimize noise propagation and scatter of metal fragments. Two holes will actually be used with the four detonations alternating between the two holes. EODT estimates that the hole size after detonations will be 6-8 feet in diameter and four feet deep.

The detonations will be conducted in a manner to comply with the substantive RCRA permit requirements listed in Attachment C. With respect to post-detonation soil analysis, one composite sample (prepared from four grab samples) will be collected from each of the two holes used for detonation. The samples will be analyzed for the eight Site F metals (antimony, cadmium, copper, chromium, lead, mercury, nickel, and silver) and explosives (the standard list of analytes by EPA Method 8330). As indicated in Attachment C, the detonations and soil sampling results will be documented in the Site F Closure Report.

Attachment A

TCAAP High Explosives Categorization

Quantity	HE Description	Proper Shipping Name	IMCO Class	Identification Number	Packaging Group
20	Grenade Charges	Charges, Bursting, Plastics Bonded	1.2D	UN0458	Group 2
20	20-30mm Fuses	Fuses, Detonating	1.2D	UN0409	Group 2
1	Explosive Bellows	Articles, Explosive NOS	1.2D	UN0467	Group 2
1	Melted Cartridge Primers	Primers, Cap Type	1.1B	UN0377	Group 2
1	37 mm Fuse	Fuses, Detonating	1.2D	UN0409	Group 2
8	Mark 2 Hand Grenades	Grenades, Hand or Rifle, Fragmentation with Bursting Charge	1.1F	UN0292 DODIC G890/G892	Group 2
1	40mm HE Dual Purpose Round Without Fuse	Articles, Explosive NOS	1.1E	UN0464	Group 2
2	37mm Cartridge Primers	Primers, Cap Type	1.1B	UN0377	Group 2
1	Submunition Fuse	Fuses, Detonating	1.1B	UN0106	Group 2
1	Pound Block of High Explosives	Charges, Demolition	1.1D	UN0048	Group 2
1	MK-2 Fragmentation Grenade Without Safety Pin, Striker, Striker Spring and Activator Spoon	Grenades, Hand or Rifle, Fragmentation with Bursting Charge	1.1F	UN0292 DODIC G890/G892	Group 2
1	40mm Grenade Fuse	Fuses, Detonating	1.2B	UN0107	Group 2
3	Fuses	Fuses, Detonating	1.2D	UN0409	Group 2
2	40mm Grenade Balls	Articles, Explosive NOS	1.1E	UN0464	Group 2
1	20 mm Point detonation fuse	Fuses, Detonating	1.2B	UN0107	Group 2
1	Teargas grenade; partially burned, small amount of tear agent residue remaining. No fuse present (pyrotechnic device)	Grenades, Tear Gas	6.1	UN1700	Group 2
232	Electro Explosive Devices (EED's)	Primer, Cap Type	1.4B	UN378	Group 2
30	M43-HE Load Assembly (Balls)	Article, Explosives NOS	1.1E	UN0464	Group 2
1	Hand Grenade Fuse	Fuses, Detonating	1.2B	UN107	Group 2

Attachment A

TCAAP High Explosives Categorization

Quantity	HE Description	Proper Shipping Name	IMCO Class	Identification Number	Packaging Group
1	Pull release firing device with base coupling	Primer, Cap Type	1.4B	UN378	Group 2
1	Flash tube for 90 mm cartridge case with primer	Primer, Cap Type	1.1B	UN377	Group 2
3	20 mm fuzes	Fuses, Detonating	1.2D	UN409	Group 2
1	37 mm fuse	Fuses, Detonating	1.2D	UN409	Group 2
17	M218 Bomblet fuzes	Fuses, Detonating	1.1B	UN106	Group 2
1	Suspected submunition	Projectile	1.1D	UN168	Group 2
7	Containers of live primers	Primers, Cap Type	1.4S	UN044	Group 2
	Several rounds of 5:56 mm cases - primed/blanks/scrap and Miscellaneous (oil soaked)	Cases, Cartridge Empty with Primer	1.4S	UN055	Group 2
50	40mm Grenade Parts	Articles, Explosive NOS	1.1E	UN0464	Group 2
20	40mm Grenade Balls	Articles, Explosive NOS	1.1E	UN0464	Group 2
2	Mark 2 Hand Grenades	Grenades, Hand or Rifle, Fragmentation with Bursting Charge	1.1F	UN0292 DODIC G890/G892	Group 2
1	MK-2 Fuse	Fuses, Detonating	1.2B	UN0107	Group 2
1	M9 Rifle Grenade	Grenades	1.1D	UN0284	Group 2
4	Mortar Fuses	Fuses, Detonating	1.1B	UN0106	Group 2
2	M218 Submunition Fuses	Fuses, Detonating	1.1B	UN0106	Group 2
28	5:56 mm primed cases	Cases, Primer	1.4S	UN055	Group 2
Approx. 50 rounds	5:56 mm primed/blank cases and loaded cartridges	Cartridge for Weapons Blank or Small Arms	1.4C	UN339	Group 2

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ATTACHMENT B

CORPORATE SAFETY AND HEALTH PROGRAM (CSHP)

DEMOLITION/DISPOSAL RANGE OPERATIONS

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APPENDICES

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1.0 INTRODUCTION

Experience and on going training programs have proven to be the best management tool utilized by EODT for controlling site safety and health hazards, regardless of the type and nature of the hazard. Due to the inherently dangerous nature of demolition operations (demo ops), every effort must be focused on training and personal performance during demo ops, both on and off the demo range. Adherence to this and site-specific demo procedures will greatly enhance the overall success of demo tasks and will ensure the safety of all personnel involved. It is the responsibility of all employees to comply with this Standard Operating Procedure (SOP) and to alert supervisory personnel of any shortcomings that may jeopardize any facet of the operation.

2.0 OBJECTIVE AND APPLICATION

2.1 OBJECTIVE

The objective of this procedure is to provide instructions for destruction of unexploded ordnance/ordnance and explosive waste (UXO/OEW) by demolition. demo ops may involve the destruction of bulk explosives, HE loaded projectiles and components, propellants, and pyrotechnics.

2.2 APPLICATION

This SOP shall be applicable to all demo ops, which includes surface and subsurface removal of UXO/OEW from the ground, storage, transfer to demolition areas, unloading, unpacking, charging of demolition pits and detonation. This SOP shall also apply to the use of "blow-in-place" (BIP) operations for UXO/OEW identified as being unsafe to move due to it's design or physical condition. While this SOP applies to all ***EODT*** demo ops, the infinite variety of sites in conjunction with the myriad of complex and enigmatic situations and conditions which could arise precludes this SOP from covering all facets of all types of demo ops. Situations may exist that will warrant additional safety measures, such as fire trucks, medical personnel and protective clothing and barricades. Therefore, if warranted by the type of UXO/OEW and the nature of the site, this SOP shall be applied in conjunction with a site-specific Demolition/Range Plan (DRP) which is prepared by the Site Safety and Health Officer (SSHO), and approved by the ***EODT*** Director of Operations prior to initiating any BIP or demo range operations. The Senior UXO Site Supervisor (SR UXO SS) and SSHO will have the overall responsibility to ensure compliance with the DRP and the minimum requirements listed in this SOP.

3.0 POSTING AND COMPLIANCE WITH THIS SOP

This complete attachment, along with any site-specific DRP, will be posted in a conspicuous location in the area where the operation is being conducted. There will be no deviation or change from this attachment without prior written approval of the SR UXO SS, the SSHO, the

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EODT Director of Operations and the client. Any conditions or circumstances not covered by this attachment will be immediately reported to the Demolition Supervisor (DS) the SR UXO SS or the SSHO. Absence of a written safety requirement does not indicate that safeguards are not required. It is the responsibility of all site personnel to ensure that all general safety regulations and safe work practices outlined in this SOP and the DRP are observed at all times. All supervisory personnel and demo ops personnel are required to read, understand and adhere to the requirements contained in this attachment.

4.0 DEMOLITION RANGE RESPONSIBILITIES

4.1 SENIOR UXO SITE SUPERVISOR

The Senior UXO Site Supervisor (SR UXO SS) will be responsible for assuring that adequate safety measures and housekeeping are taken during all phases of site operation, to include demolition activities, and shall visit site demolition locations as deemed necessary to ensure that demolition operations are carried out in a safe, clean, efficient and economical manner.

4.2 DEMOLITION SUPERVISOR

Prior to initiation of demolition operations, the SR UXO SS shall designate an experienced and trained UXO Supervisor to act as the Demolition Supervisor (DS). The demolition activities shall then be conducted under the direct control of the DS, who will have the responsibility of supervising all demo ops within the area. The DS shall be responsible for training all on-site UXO personnel regarding the nature of the materials handled, the hazards involved and the precautions necessary. The DS will also ensure that the Daily Operational Log, Ordnance Accountability Log, *EODT* Shot Records and inventory records are properly filled and accurately depict the demolition events and demo material consumption for each day's operations. The DS shall be present during all demolition operations or designate a competent, qualified person to be in charge during any absences.

4.3 SITE SAFETY AND HEALTH OFFICER

The Site Safety and Health Officer (SSHO) for the site is responsible for ensuring that all demo ops are being conducted in a safe and healthful manner, and is required to be present during all OEW demolition operations. The only exception to this rule is when the project site has multiple sites conducting various types of UXO investigation and remediation operations being conducted concurrently with periods where there may be continuous demo operations throughout the day. In that event a demo team SSHO will be designated. This individual will report to the SSHO and assume the SSHO's responsibilities at the demo range. In this situation, the SSHO will conduct periodic safety audits of the demo team and assist the demo team SSHO in the performance of his duties.

4.4 QUALITY CONTROL SPECIALIST

The Quality Control Specialist (QCS) is responsible for ensuring the completeness of demo ops and for weekly inspecting the Ordnance Accountability Log, the Daily Operational Log, the *EODT* Shot Record and the inventory of OEW and demo material. The QCS will inspect each demo pit and an area of up to 500 feet in radius after firing each day to ensure there are no kickouts, hazardous UXO/OEW components or other hazardous items. In addition, the pit will be checked with a magnetometer and the large, 4" or greater, metal fragments and any hazardous debris removed on a per use basis. Any UXO/OEW discovered during the QC check will be properly stored for destruction at a later date. Extreme caution must be exercised when handling UXO/OEW which has been exposed to the forces of detonation. The only exception to the above requirement for the QCS to inspect each demo pit is the same as in para 4.3. In that event, a demo team QCS will be assigned. The demo team SSHO and the demo team QCS may be the same individual.

5.0 GENERAL OPERATIONAL AND SAFETY PROVISIONS

During demo ops, general safety provisions shall be followed by all demo personnel at all times. Non-compliance with the general safety provisions listed below may result in positive discipline and termination of employment:

- All safety regulations applicable to demo range activities and demolition and OEW materials involved shall be complied with.
- Chemical weapons/munitions items will not be destroyed at the demolition range unless special variances and/or permits are issued by both the appropriate regulatory agency and the appropriate command group.
- Demolition of any kind is prohibited without the express permission from the client.
- The quantity of OEW to be destroyed will be determined by the range limit, as specified in the DRP.
- In the event of an electrical storm, or heavy snow or dust storms, immediate action will be taken to cease all demo range operations and evacuate the area.
- In the event of a fire or unplanned explosion, if possible, put out the fire, if unable to do so, notify fire department and evacuate the area. If injuries are involved, remove victims from danger, administer first aid and seek medical attention.
- The DS is responsible for reporting all injuries and accidents which occur to the SSHO.
- Employees will not tamper with any safety devices or protective equipment.
- Any defect or unusual condition noted that is not covered by this attachment will be reported immediately to the DS or SSHO.
- Methods of demolition shall be IAW this procedure and approved changes thereto.
- Adequate fire protection and first aid equipment shall be provided at all times.
- All personnel engaged in the destruction of OEW shall wear natural fiber, close-weave clothes, such as cotton. Synthetic material such as nylon is not authorized unless treated with anti-static material.

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- Care will be taken to minimize exposure to the smallest number of personnel, for the shortest time, to the least amount of hazard, consistent with safe and efficient operations.
- Work locations will be maintained in a neat and orderly condition.
- All hand tools shall be maintained in a good state of repair.
- Each heavy equipment and/or vehicle operator will have in his possession a valid operator's permit, i.e., state driver's license.
- Equipment and other lifting devices designed and used for lifting will have the load rating and date of next inspection marked on them. The load rating will not be exceeded and the equipment will not be used without a current inspection date.
- Safety shoes will be worn by all personnel except the individual conducting the QC magnetometer checks of the pits.
- Leather or leather-palmed gloves will be worn when handling wooden boxes, munitions or OEW.
- Lifting and carrying require care. Improper methods cause unnecessary strains. Observe the following preliminaries before attempting to lift or carry:
  - When lifting, keep your arms and back as straight as possible, bend your knees and lift with your leg muscles; and
  - Be sure you have good footing and hold, and lift with a smooth, even motion.
- The demolition range shall be provided with telephone and/or radio communication.
- Motor vehicles and material handling equipment (MHE) used for transporting OEW or demo materials must meet the following requirements:
  - Exhaust systems shall be kept in good mechanical repair at all times.
  - Lighting systems shall be electric.
  - One Class ABC rated, portable fire extinguisher shall, if possible, be mounted on the vehicle outside of the cab, on the driver's side, and one Class ABC fire extinguisher shall be mounted inside the cab.
  - Wheels of carriers must be chocked and brakes set during loading and unloading.
  - No demo material or OEW shall be loaded into or unloaded from, motor vehicles while their motors are running.
- Motor vehicles and MHE used to transport demo material and OEW shall be inspected prior to use to determine that:
  - Fire extinguishers are filled and in good working order.
  - Electrical wiring is in good condition and properly attached.
  - Fuel tank and piping are secure and not leaking.
  - Brakes, steering and safety equipment are in good condition.
  - The exhaust system is not exposed to accumulations of grease, oil, gasoline, or other fuels, and has ample clearance from fuel lines and other combustible materials.
- Employees are required to wear leather or rubber gloves when handling demolition materials. The type of glove worn is dependent on the type of demo material.
- A red warning flag will be displayed at the entrance to the demolition range and, if applicable, the entrance gate shall be locked when demolition work is in process.
- Unless otherwise directed, all demo shots will be tamped with a minimum of two feet of clean earth/dirt.

- An observer will be stationed at a location where there is a good view of the air and surface approaches to the demolition range before material is detonated. It shall be the responsibility of the observer to order the DS to suspend firing if any aircraft, vehicles or personnel are sighted approaching the general demolition area.
- Two-way radios shall not be operated on the demolition range while the pit is primed or during the priming process. The charts shown in Appendix A, pgs. A-3 and A-4, have been extrapolated from TM 9-1375-213-12 (Tables 2-3 and 2-4).
- No Demolition operation will be left unattended during the active portion of the operation (i. e., during the burn or once any explosives or UXO/OEW are brought to the range).
- A minimum area of 200 feet in diameter shall be cleared of dry grass, leaves and other extraneous combustible materials around the demolition pit area.
- No demolition activities will be conducted if there is less than a 2,000 foot ceiling or if wind velocity is in excess of 20 mph.
- Demolition shots must be fired during daylight hours (i.e., between 30 minutes after sunrise and 30 minutes before sunset).
- No more than two persons shall ride in a truck transporting demo material or OEW, and no person shall be allowed to ride in the trailer/bed.
- Vehicles shall not be refueled when carrying demo material or OEW, and must be 100 feet from magazines or trailers containing such items before refueling.
- All explosive vehicles will be cleaned of visible explosive and other contamination before releasing the vehicles for other tasks.
- Prior to conducting any other task, personnel shall wash their face and hands after handling demo material or OEW.
- Demo pits shall be spaced at least 50 feet apart, with no more than 10 pits prepared for a series of shots at any one time.

6.0 SPECIAL REQUIREMENTS FOR DEMOLITION ACTIVITIES

The following safety and operational requirements shall be followed during demo range operations. Any deviations from this procedure shall be allowed only after receipt of written approval from the ***EODT*** Director of Operations and the client. Failure to adhere to the requirements and procedures listed in the paragraphs below could result in serious injury or death, therefore complete compliance with these requirements procedure will be strictly enforced.

6.1 GENERAL REQUIREMENTS

The general demolition range requirements listed below shall be followed at all times:

- Appendix A, Explosive Hazards Tables, will be adhered to in all demo ops.
- Material awaiting destruction shall be stored at not less than intraline distance, based on the largest quantity involved, from adjacent explosive materials and from explosives being destroyed. The material shall be protected against accidental ignition or explosion from fragments, grass fires, burning embers or detonating impulses originating in materials being destroyed.

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- OEW or bulk explosives to be destroyed by detonation should be detonated in a pit not less than three feet deep and covered with earth which protrudes not less than two feet above existing ground level. The components should be placed on their sides or in a position to expose the largest area to the influence of the demo material. The demo material should be placed in intimate contact with the item to be detonated and held in place by tape or earth packed over the demolition materials. The total quantity to be destroyed below ground at one time shall not exceed the range limit.
- Detonations will be counted to ensure detonation of all pits. After each series of detonations, a search shall be made of the surrounding area for unexploded UXO and OEW. Items such as lumps of explosives or unfuzed ammunition, may be picked up and prepared for the next shot. Fuzed ammunition or items which may have internally damaged components will be detonated in place, if possible.
- Prevailing weather condition information will be obtained from the U.S. Weather Service and the data logged in the Range Operations Log before each shot or round of shots.
- A minimum of 30 seconds will be maintained between each detonation.
- After each detonation and at the end of each day's operations, surface exposed scrap metal, casings, fragments, and related items shall be recovered from the demo range and disposed of IAW contracted procedures, which must be IAW all applicable environmental regulations. All collected scrap metal will be 100% inspected for absence of explosive materials by demolition range personnel and certified by the SR UXO SS and the QCS.
- When operated in accordance with the conditions of this procedure the demolition range should not present a noise problem to the surrounding community. However, if a noise complaint is received, the name, address and phone number of the complainant should be recorded and reported to the SR UXO SS, who in turn, will report it to the client.
- Whenever possible, during excavation of the demo pits, contour the ground so that runoff water is channeled away from the pits. If demo operations are discontinued for more than two weeks, the pits should be back filled until operations resume.
- Upon completion of the project, all disturbed demo areas will be thoroughly inspected for OEW. Depending upon contract requirements, the site may have to be leveled, seeded and mulched to establish a permanent vegetative cover to inhibit erosion. At a minimum, the holes/pits will be filled in and contoured.
- Prior to and after each shot, the ***EODT*** Shot Record (see Figure B-1) is to be filled out by the DS with all applicable information. This record will be kept with the Ordnance Accountability Log and reflect each shot.

6.2 ELECTRIC DETONATOR USE

The following requirements are necessary when using electric detonators and electric blasting circuits:

- Electric detonators and electric blasting circuits may be energized to dangerous levels from outside sources such as static electricity, induced electric currents and radio communication equipment. Safety precautions will be taken to reduce the possibility of a premature detonation of the electric detonator and explosive charges of which they form a part. Radios will not be operated while the pit is primed or during the priming process.

C.9-16

- The shunt shall not be removed from the leg wires of the detonator until the continuity check of the detonator.
- When uncoiling or straightening the detonator leg wires, keep the explosive end of the detonator pointing away from the body and away from other personnel. When straightening the leg wires, do not hold the detonator itself, rather hold the detonator leg wires approximately one inch from the detonator body. Straighten the leg wires by hand, do not throw or wave the wires through the air to loosen them.
- Prior to use, the detonators shall be tested for continuity. To conduct the test, place the detonators in a pre-bored hole in the ground or place them in a sand bag, and walk facing away from the detonators and stretch the wires to their full length, or to 25 feet, whichever is less, being sure to not pull the detonators from the hole or sand bag. With the leg wires stretched to their full length, test the continuity of the detonators one at a time by unshunting the leg wires and attaching them to the galvinomter and checking for continuity. After the test, re-shunt the wires by twisting the two ends together. Repeat this process for each detonator until all detonators have been tested. This process shall be accomplished at lease 25 feet from any OEW or demolition materials and out of the demo range personnel and vehicle traffic flow pattern. In addition, all personnel on the demo range shall be alerted prior to the test being conducted.

NOTE: When testing the detonator, prior to connecting the detonator to the firing circuit, the leg wires of the detonator must be shunted by twisting the bare ends of the wires together immediately after testing. The wires shall remain short circuited until the time to connect them to the firing line.

- At the power source end of the blasting circuit, the ends of the wires shall be shorted or twisted together (shunted) at all times, except when actually testing the circuit or firing the charge. The connection between the detonator and the circuit firing wires must not be made unless the power end of the firing wires are shorted and grounded or the firing panel is off and locked.
- The firing line will be checked using pre-arranged hand signals or through the use of two-way radios if the demo pit is not visible from the firing point. If radios are used, communication shall be accomplished a minimum of 25 feet from the demo pit and detonators. The firing line will be checked for electrical continuity in both the open and closed positions, and will be closed/shunted prior to connecting the detonator leg wires.
- OEW to be detonated/vented shall be placed in the demo pit and the demolition material placed/attached in such a manner as to ensure the total detonation/venting of the OEW. Once the OEW and demolition material are in place, the detonators will be connected to the firing line. If possible, this process will be conducted while the detonators are still in the test hole or sand bag. The connected detonators will then be carried to the demo pit with the end of the detonator pointed away from the individual. The detonators are then connected to the detonation cord, Non-El, etc., ensuring that the detonator is not covered with tamping material to allow for ease of recovery and investigation in the event of a miss-fire.
- Prior to making connections to the blasting machine, the entire firing circuit shall be tested with a galvanometer for electrical continuity and ohmic resistance to ensure the blasting machine has the capacity to initiate the shot.

C.9-17

- The individual assigned to make the connections at the blasting machine or panel will not complete the circuit at the blasting machine or panel and will not give the signal for detonation until satisfied that all personnel in the vicinity have been evacuated to a safe distance. When in use, the blasting machine or its actuating device shall be in the blaster's possession at all times. When using the panel, the switch must be locked in the open position until ready to fire, and the single key must be in the blaster's possession.
- Prior to initiating a demo shot(s), a warning will be given, the type and duration of such will be determined by the prevailing conditions at the demo range. At a minimum, this should be an audible signal using a siren, air horn or megaphone which is sounded three minutes prior to the shot(s) and again one minute prior to the shot(s).

6.3 DETONATING CORD USE

The following procedures are required when using detonating cord (det cord):

- Det cord should be cut using approved crimpers and only the amount required should be removed from inventory.
- When cutting det cord, the task should be performed outside the magazine.
- For ease of inventory control, only remove det cord in one foot increments.
- Det cord should not be placed in clothing pockets or around the neck, arm or waist, and should be transported to the demo location in either an approved "day box" or a cloth satchel, depending upon the magazine location and proximity to the demo area.
- Det cord should be placed at least ten feet away from detonators and demo materials until ready for use.
- When ready to "tie in" either the det cord to demo materials, or det cord to detonator, the det cord will be connected to the demo material and secured to the UXO/OEW. The cord is then strung out of the hole and secured in place with soil, being sure to leave a one foot tail exposed outside the hole.
- Once the hole is filled, make a loop in the det cord that is large enough to accommodate the det cord detonator, place the detonator in the loop and secured it with tape. The explosive end of the detonator will face down the det cord toward the demo material or parallel to the main line.
- In all cases, ensure there is sufficient det cord extending out of the hole to allow for ease of detonator attachment and detonator inspection/replacement should a misfire occur.
- If the det cord detonator is electric, it will be checked, tied in to the firing line and shunted prior to being taped to the loop. If the det cord detonator is non-electric, the time/safety fuse will be prepared with the igniter in place prior to taping the detonator to the det cord loop. If the det cord detonator is Non-El, simply tape the detonator into the loop as described above.
- In the event that a time/safety fuse is used, and an igniter is not available and a field expedient initiation system is used (i.e., matches), do not split the safety fuse until the detonator is taped into the det cord loop.

6.4 TIME/SAFETY FUSE USE

The following procedures are required when using a time/safety fuse:

- Prior to each daily use, the burn rate for the time/safety fuse must be tested to ensure the accurate determination of the length of time/safety fuse needed to achieve the minimum burn time of five minutes needed to conduct demo ops.
- To ensure both ends of the time/safety fuse are moisture free, use approved crimpers to cut six inches off the end of the time/safety fuse roll and place the six inch piece in the time/safety fuse container.
- If quantity allows, accurately measure and cut off a five foot long piece of the time/safety fuse from the roll.

Note: In the event of an emergency situation when the quantity time/safety fuse is limited, a minimum of two feet of fuse can be used to conduct the burn rate test.

- Take the five foot section out of the magazine and attach a fuse igniter.
- In a safe location, removed from demo materials and UXO/OEW, ignite the time/safety fuse, measure the burn time from the point of initiation to the "spit" at the end, and record the burn time in the DS's Log
- To measure the burn time, use a watch with a second hand or chronograph.
- To calculate the burn rate in seconds per foot, divide the total burn time (in seconds) by the length (in feet) of the test fuse.
- Whenever using time/safety fuse for demo ops, the minimum amount of fuse to be used for each shot will be the amount needed to permit a minimum burn time of five minutes.

6.5 PERFORATOR USE

The following procedures are required when using perforators:

- Only remove from inventory the number of perforators required to perform the task.
- Transport perforators in an approved "day box", cloth satchel or plastic container, depending upon magazine location and proximity to the demo ops.
- Keep perforators stored at the demo site at least ten feet away from detonators and demo materials until ready for use.
- When ready to use, place the det cord in the slot on the perforator, ensuring the cord fits securely and has good continuity with the perforator.
- Once the det cord is secure, place the perforator in the desired location and secure it in place.
- Proceed from this point as described in para 6.3.

6.6 USE OF TWO-COMPONENT EXPLOSIVES

The following procedures are required when using two-component as demo material:

- Only remove from inventory the amount of two-component required to perform the task.

- When transporting the solid and liquid, they need only be placed apart in the bed of a truck.
- Do not mix the solid and liquid components until certain that it will be used, since the resulting mixture is classified as a Class 1.1 explosive by DOT.
- When mixing the solid and liquids components, follow the manufacturer's instructions, while being sure to wear rubber gloves and goggles. Mix components in an area away from the other demo material, the UXO/OEW, and if possible, sheltered from the wind.
- Once the components have been mixed, it is essential that the lid to the solid bottle is put on securely as soon as possible after mixing to prevent evaporation of the liquid.
- Attach the det cord as recommended by the manufacturer, place the assembled unit in the desired location in the hole and secure the unit.
- Proceed from this point as described in para 6.3.

6.7 DEMOLITION RANGE INSPECTION SCHEDULE

The demolition range inspection schedule outlined in Table B-1 will be followed at all sites where demo ops are being conducted. This inspection shall be conducted by the SSHO and will be documented in the Site Safety Log. If any deficiencies are noted demo ops shall be suspended and the deficiency reported to the SR UXO SS and DS. Once the deficiencies are corrected, demo ops may be resumed.

Table B-1: Demolition Range Inspection Schedule

Check List Item	Inspection Schedule
Site Vehicle	Weekly or Prior to Use
Explosive Carrier Vehicle	Weekly or Prior to Use
Range Access/Egress Route	Weekly or Prior to Use
Entrance Gate/Lock	Daily, Prior to Use and After Use
Storage Trailer/Magazine	Daily, Prior to Use and After Use
Fire Extinguishers	Monthly and Prior to Use
Personal Protective Equipment	Prior to Use
Circuit Testing Device	Prior to Use
Demolition Site	Prior to Use
Operating Equipment	Prior to Use
Hospital Route	Prior to Use

7.0 METEOROLOGICAL CONDITIONS

In order to control the effects of demo ops and to ensure the safety of site personnel, the following meteorological condition limitations and requirements shall apply to demo ops:

- Demo ops will not be conducted during electrical storms or thunderstorms.
- Demo ops shall be restricted to periods when surface wind speed is less than 20 miles per hour.
- Demo ops will not be conducted during periods of visibility of less than one mile caused by, but not limited to, dense fog, blowing snow, rain, sand or dust storms.
- Demolition shall not be carried out on extremely cloudy days which are defined as: overcast (more than 80% cloud cover) with a ceiling of less than 2,000 feet.
- Demo ops will not be conducted during any atmospheric inversion condition (low or high altitude).
- Demo ops will not be conducted during periods of local air quality advisories/alerts.
- Demo ops will not be initiated until 30 minutes after sunrise, and will be secured at least 30 minutes prior to sunset.

8.0 PRE-DEMOLITION/DISPOSAL PROCEDURES

8.1 PRE-DEMO/DISPOSAL OPERATIONAL BRIEFING

It is the belief of ***EODT*** that the success of any operation is dependent upon a thorough brief, covering all phases of the task, which is presented to all affected personnel. The DS will brief all personnel involved in range operations in the following areas:

- Type of OEW being destroyed.
- Type, placement and quantity of demolition material being used.
- Method of initiation (electric, non-electric or Non-El).
- Means of transporting and packaging OEW.
- Route to the disposal site.
- Equipment being used (i.e., galvanometer, blasting machine, firing wire, etc.).
- Misfire procedures.
- Post shot clean up of range.

8.2 PRE-DEMO/DISPOSAL SAFETY BRIEFING

The ***EODT*** SSHO will conduct a safety brief for all personnel involved in range operations in the following areas:

- Care and handling of explosive materials.
- Personal hygiene.
- Two man rule and approved exceptions.
- Potential trip/fall hazards.
- Horse play on the range, and other prohibited activities.

- Staying alert for any explosive hazards on the range.
- Location of emergency shelter (if available).
- Parking area for vehicles (vehicles must be positioned for immediate departure, with the keys in the ignition).
- Location of range emergency vehicle (keep engine running).
- Wind direction (to assess potential toxic fumes).
- Location of first aid kit and fire extinguisher.
- Route to nearest hospital or emergency aid station.
- Type of communications in event of an emergency.
- Storage location of demolition materials and OEW awaiting disposal.

8.3 TASK ASSIGNMENTS

Individuals assigned tasks will report the completion of the task to the DS. The types of tasks which may be required are:

- Contact local Police, Fire personnel, USCG and FAA as required.
- Contact hospital/emergency response personnel if applicable.
- Secure all access roads to the range area.
- Visually check range for any unauthorized personnel.
- Check firing wire for continuity and shunt.
- Prepare designated pits as required.
- Check continuity of detonators.
- Check time/safety fuse and its burn rate.
- Designate a technician to maintain custody of blasting machine, fuse igniters or Non-El initiator.
- Secure detonators in a safe location.
- Place UXO/OEW in pit and place charge in desired location.

8.4 PREPARING EXPLOSIVE CHARGE FOR INITIATION

- Insure firing wire is shunted.
- Connect detonator to the firing wire.
- Isolate or insulate all connections.
- Prime the demolition charge.
- Place demolition charge on OEW.
- Depart to firing point (if using non electric firing system, obtain head count, pull igniters and depart to designated safe area).
- Obtain a head count.
- Give warning, using a bullhorn or siren, at three minutes from detonation, and again at one minute from the detonation.
- Yell **"fire in the hole"** three times (or an equivalent warning).
- Take cover.
- If using electric firing system connect firing wires to blasting machine and initiate charge.

- Remove firing wires from blasting machine and shunt.
- Remain in designated safe area until DS announces **"All Clear"**. This will occur after the DS has gone and inspected the pit(s).

9.0 POST DEMOLITION/DISPOSAL PROCEDURES

Do not approach a smoking hole or allow personnel out of the designated safe area until cleared to do so, and follow the below listed procedures:

- After the **"All Clear"** signal, check pit for low orders or kick outs.
- Mag pit and remove any large fragmentation.
- Back fill hole as necessary.
- Police up all equipment.
- Notify police, fire, etc. that the operation is complete.

10.0 MISFIRE PROCEDURES

A thorough check of all equipment, firing wire and detonators will prevent most misfires. However, if a misfire does occur, the procedures outlined below shall be followed.

10.1 ELECTRIC MISFIRES

To prevent electric misfires, one technician will be responsible for all electrical wiring in the circuit. If a misfire does occur, it must be cleared with extreme caution, and the responsible technician will investigate and correct the situation, using the steps outlined below:

- Check firing line connections to the blasting machine and make a second attempt to initiate charge.
- If unsuccessful, disconnect and connect to another blasting machine (if available) and attempt to initiate charge.
- If unsuccessful, commence a 5 minute wait period.
- After the wait period has expired the designated technician will proceed down range to inspect the firing system; a safety observer must watch from a protected area.
- Disconnect and shunt the detonator wires, connect a new detonator to the firing circuit and prime the charge without disturbing the original detonator (replacement detonator must have been checked for continuity as outlined in para 6.2, after disconnecting the defective detonator).
- Follow normal procedures for effecting initiation of the charge.

10.2 NON-ELECTRIC MISFIRES

Working on a non electric misfire is the most hazardous of all operations. Occasionally, despite all painstaking efforts, a misfire will occur. Investigation and corrective action should be undertaken only by the technician that placed the charge, using the following procedure:

- If charge fails to detonate at the determined time, initiate a 30 minute wait period plus the time of the safety fuse, i.e., 5 minute safety fuse plus thirty (30) minutes for a total of 35 minute wait period.
- After the wait period has expired, a designated technician will proceed down range to inspect the firing system. A safety observer must watch from a protected area.
- Prime the shot with a new non electric firing system and install a new fuse igniter.
- Follow normal procedures for initiation of the charge.

10.3 NON-EL MISFIRE

The use of a shock tube for blast initiation can present misfires which require the following actions:

- If charge fails to detonate, it could be the result of the shock tube not firing. Visually inspect the shock tube, if it is not discolored (i.e., slightly black), it has not fired.
- If it has not fired, cut a one foot piece off the end of the tube, re-insert the tube in the firing device and attempt to fire again.
- If the device still does not fire, wait five minutes and replace the shock tube per instructions outlined below.
- If the tube is slightly black, then a "Black Tube" misfire has occurred, and the shock tube will have to be replaced. When replacing the shock tube, be sure to remove the tube with the detonator in place. Without removing the detonator from the end of the tube, repackage the defective tube and return it to the supplier for credit.

11.0 RECORD KEEPING REQUIREMENT

To document the demo ops procedures and the completeness of the demolition of OEW, the following record keeping requirements shall be met:

- The client or ***EODT*** (as directed) will obtain and maintain all required permits.
- The DS will ensure the accurate completion of the logs, and the SR UXO SS and QCS will monitor the entries in the log for completeness, accuracy and compliance with meteorological conditions.
- The DS shall enter the appropriate data on the Ordnance Accountability Log to reflect the OEW destroyed, and shall complete the appropriate information on the Explosives Accountability Log (a.k.a. the Magazine Data Card) which indicates the demo materials used to destroy the OEW.
- The quantities of OEW recovered must also be the quantities of OEW destroyed or disposed of as scrap.
- ***EODT*** will retain a permanent file of all Demolition Records, including permits, Magazine Data Cards, training records, inspector reports, waste manifests if applicable, and operating logs.
- Copies of ATF License and any state or local permits must be on hand.

EODT SHOT RECORD

Site / Location:		Date:
Demo Range Supervisor:	Signature:	License #
Type of OEW Shot:	Firing Method:	Time of Shot:
Type of Demolition Materials: (i.e. perforator/det cord/time fuse/elect/non-elect/2 Comp.)		Amount/Wt. of Each Item Used:
Distance & Direction to Nearest Building, Road, Utility Line, etc.	Temp: ________ Ceiling: ________	Wind Dir./Speed: ________ Clouds/% Sun: ________
Type/Amount of Stemming/Tamp:		Mat or Other Protection Used (list):
Seismographic/Sound Level Meter Used: Yes ☐ No ☐	Readings:	

Site / Location:		Date:
Demo Range Supervisor:	Signature:	License #
Type of OEW Shot:	Firing Method:	Time of Shot:
Type of Demolition Materials: (i.e. perforator/det cord/time fuse/elect/non-elect/2 Comp.)		Amount/Wt. of Each Item Used:
Distance & Direction to Nearest Building, Road, Utility Line, etc.	Temp: ________ Ceiling: ________	Wind Dir./Speed: ________ Clouds/% Sun: ________
Type/Amount of Stemming/Tamp:		Mat or Other Protection Used (list):
Seismographic/Sound Level Meter Used: Yes ☐ No ☐	Readings:	

Site / Location:		Date:
Demo Range Supervisor:	Signature:	License #
Type of OEW Shot:	Firing Method:	Time of Shot:
Type of Demolition Materials: (i.e. perforator/det cord/time fuse/elect/non-elect/2 Comp.)		Amount/Wt. of Each Item Used:
Distance & Direction to Nearest Building, Road, Utility Line, etc.	Temp: ________ Ceiling: ________	Wind Dir./Speed: ________ Clouds/% Sun: ________
Type/Amount of Stemming/Tamp:		Mat or Other Protection Used (list):
Seismographic/Sound Level Meter Used: Yes ☐ No ☐	Readings:	

Figure B-1

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APPENDIX A

EXPLOSIVE HAZARDS TABLES

The following tables are to be used during demo ops and will be used to calculate minimum safe distances as they relate to fragmentation range, mobile RF, television and FM broadcasting transmitters. Table A-1 is to be utilized when computing fragmentation ranges. It is essential when computing the explosive weight, that you include the explosive weight of the demolition/counter charge, propellant, etc. If you have a fraction of any kind, i.e. 1 pound -12 ounces, you go to the next highest weight to compute frag range.

The frag ranges are for open, unbarricaded shots. If there is a protective shelter with overhead protection, you may be closer to the shot. However, every effort will be made to adhere to the appropriate frag range regardless of shelter or depth the shot is buried

If you are using multiple pits you must insure that all pits are within the appropriate frag range. If this is not possible, you may consider detonating smaller quantities in the outer pits to be in compliance. At no time will you violate the frag range without the written approval of the client.

Tables A-2 and A-3 are for determining the minimum safe distances between different types of radio and television transmitters when electric detonators are in use.

TABLE A-1

NOTE: For the purpose of computing frag range, consider all explosives, including those used to counter charge, propellant, etc, when determining the total explosive weight.

Explosive Weight [1]	Frag Range [2]	Explosive Weight	Frag Range	Explosive Weight	Frag Range	Explosive Weight	Frag Range
1	330	16	832	31	1037	46	1182
2	416	17	849	32	1048	47	1191
3	476	18	865	33	1058	48	1199
4	524	19	881	34	1069	49	1208
5	564	20	896	35	1079	50	1214
6	598	21	910	36	1090	75	1392
7	631	22	925	37	1100	100	1532
8	660	23	938	38	1110	150	1752
9	686	24	952	39	1119	200	1931
10	710	25	965	40	1129	250	2079
11	734	26	978	41	1138	300	2208
12	756	27	990	42	1147	350	2327
13	776	28	1002	43	1156	400	2432
14	795	29	1024	44	1165	450	2528
15	814	30	1025	45	1174	500	2620

1 - Weight in pounds

2 - Distance in feet

Formula: 100 X Cube Root of Explosive Weight = Frag Range in Meters.

NOTE: To convert feet to meters, use: Feet X 0.3 = Meters.
To convert meters to feet, use: Meters X 3.28 = Feet

TABLE A-2

MINIMUM SAFE DISTANCE BETWEEN MOBILE RF TRANSMITTERS AND ELECTRIC BLASTING OPERATIONS

MINIMUM SAFE DISTANCE (FEET)					
Transmitter Power (Watts)	**MF 1.6 to 3.4 MHz Industrial**	**HF 28 to 29.7 MHz Amateur**	**VHF 35 to 36 MHz Pub. Use 42 to 44 MHz Pub. Use 50 to 64 MHz Amateur**	**VHF 144 to 148 MHz Amateur 150.8 to 161.6 MHz Public Use**	**UHF 450 to 460 MHz Public Use**
5 [1]					
10	40	100	40	15	10
50	90	220	90	35	20
100	125	310	130	50	30
180 [2]				65	40
250	200	490	205	75	45
500 [3]			290		
600 [4]	300	760	315	115	70
1,000 [5]	400	980	410	150	90
10,000 [6]	1,250		1,300		

1 Citizens band radio (Walkie-Talkie) (26.96 to 27.23 MHz) - Minimum safe distance - five feet.)

2 Maximum power for 2-way mobile units in VHF (150.8 to 161.6 MHz range) and for 2-way mobile and fixed station units in UHF (450 to 460 MHz range).

3 Maximum power for major VHF 2-way mobile and fixed station units in 35 to 44 MHz range.

4 Maximum power for 2-way fixed station units in VHF (150.8 to 161.6 MHz range).

5 Maximum power for amateur radio mobile units.

6 Maximum power for some base stations in 42 to 44 MHz band and 1.6 to 1.8 MHz band.

NOTE: To convert feet to meters on this chart - feet X 0.3 = meters.

C.9-29

TABLE A-3

MINIMUM SAFE DISTANCE BETWEEN TV AND FM BROADCASTING TRANSMITTERS AND ELECTRIC BLASTING OPERATIONS

Effective radiative power (watts)	Minimum safe distances (feet)		
	Channels 2 to 6 and FM	Channels 7 to 13	UHF
up to 1,000	1,000	750	600
10,000	1,800	1,300	600
100,000 [1]	3,200	2,300	1,100
316,000 [2]	4,300	3,000	1,450
1,000,000	5,800	4,000	2,000
5,000,000 [3]	9,000	6,200	3,000
10,000,000	10,200	7,400	3,500
100,000,000			6,000

1 Present maximum power, Channels 2 and 6 and FM.

2 Present maximum power, Channels 7 and 13.

3 Present maximum power, Channels 14 to 83.

C.9-30

Attachment C

Twin Cities Army Ammunition Plant: Site F
Substantive Permit Requirements

- Minimum property distance required is 670 feet at 0-100 pounds per Minn. Rules pt. 7045.0542, subp. 9.
- Properly trained personnel performing the open detonation.
- Prior notification by Federal Cartridge Company to all potential local emergency responders (police, fire, hospitals) and Lee Holden (292-7896) at Ramsey County.
- Minimize noise propagation (e.g., sand bags, optimum weather conditions).
- Document this action in detail in TCAAP Operating Record.
- Conduct pre and post inspection of detonation site and document results.
- Analyze soils for any residual contamination after detonations are complete e.g., metals and organics. Verify the site is clean.
- Document the detonations in the Site F Closure Report, to include:
    - Standard Operating Procedures used
    - Weather conditions
    - Times, dates, waste types/description and quantities open detonated
    - Analysis of soils
    - Personnel involved
    - Security measures taken
    - Inspection (pre and post) results
    - Any problems encountered and corrective actions taken
    - Disposition of all wastes managed off-site, both hazardous and solid

Minnesota Pollution Control Agency

July 31, 1995

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

RE: Addendum Number Six (6) - TCAAP Site F Closure Plan
On-site Detonation of High Explosive Items

Dear Mr. Fix:

We have reviewed your letter of July 24, 1995, which requests approval to open detonate high explosive items that were excavated from Site F and temporarily stored in Building 530. We understand that the Army has determined that shipment to the Alliant Techsystems Proving Ground, as initially proposed, is no longer a feasible option due to transportation safety hazards. Consequently, the Army's standard operating procedure is to detonate these high explosive item's on-site.

Based on the information submitted in your July 24, 1994, request, approval is hereby given to detonated the high explosive items specified in Attachment A of your letter. EOD Technologies shall follow all operational and safety procedures specified in Attachment B of your letter. Lastly, please follow all procedures, including evaluation and cleanup of soil contamination, outlined in Attachment C of your letter including documentation of this activity in the Site F Closure Report forthcoming.

In addition to notification to local emergency responders (police, fire, and hospitals; we request that calculations be made in advance to estimate the expected blast pressure, and expected noise propagation distance for all four (4) 25 pound Net Explosive Weight detonations. Based on these calculations, we ask that the following additional local officials be notified of the expected day of the detonation, expected intensity, and distance of noise propagation:

1. Dan Card of my unit.

2. Ramsey County. Note: Lee Holden's telephone number has changed to 773-4457.

C.9-32

3. City managers for the cities of New Brighton, Arden Hills, Mounds View, Shoreview, and possibly North Oaks and Blaine.

4. Tenant operators at TCAAP such as Alliant Techsystems, Inc. and the National Guard.

5. Potential air space users such as military flight commanders

6. County Board Representatives for Ramsey County and possibly Anoka County

When notifying the above officials, the Army shall provide a telephone "hotline" number for assistance regarding citizen inquires.

Please contact Dan Card of my staff if you have any questions concerning this approval of Addendum No. 6 to the Site F Closure Plan at 612/297-8379.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:ts

cc: Lee Holden, Ramsey County

C.9-33

C.10 Substance Treatment by Soil Washing/Soil Leaching

Minnesota Pollution Control Agency

August 16, 1994

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

RE: TCAAP Site F
"Substance" Treatment by Soil Washing

Dear Mr. Fix:

The Minnesota Pollution Control Agency (MPCA) staff has reviewed your request of July 25, 1994, to treat certain Site F disposal area "substances". These substances and contaminated soils were characterized during the 1993 treatment season with analytical data submitted to MPCA staff February 15, 1994. The following comments are provided to your request:

GENERAL COMMENTS

1. MPCA staff believes that it is not appropriate to treat substances in the soil washing plant (such as potassium chloride) which can readily be removed from the soil and managed off-site. The soil washing system was designed to treat contaminated soil; not solid waste.

2. Any soils contaminated with substances for which clean-up goals have not been set, must be adequately characterized and appropriate treatment goals established if they are to be treated by soil washing.

SPECIFIC COMMENTS

1. The silica sand found in Disposal Area 1 can be treated by the TerraMet system. If contaminants are present in the sand which do not have established clean-up goals, goals must be established prior to treatment. The analytical data submitted for the silica sand did not show any contamination and would not require treatment.

2. The reddish soil from Disposal Areas 4 and 5 can be treated by the TerraMet system. However, clean-up goals must be established for contaminants which are above background concentrations prior to treatment (possibly barium, sodium, tin and potassium).

C.10-2

3. The black stained soil from Disposal Areas 7, 9, and 10 can also be treated by the TerraMet. Because of the relatively low concentrations, small quantities of soil and probable noncarcinogenic nature of the volatiles present in the soil, treatment of this soil in the TerraMet system does not appear to pose a significant risk to human health or the environment. Appropriate background levels for metals (possibly barium, tin and sodium) will have to be established for clean-up goals. Clean-up goals for organics would be nondetect.

You or your consultant may contact Dan Card at 612/297-8379 or Beth Gawrys at 612/297-8376 of my staff if you wish to discuss our response.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:rg

cc: Keith Benker, Wenck Associates, Inc.

C.11 Site F Disposal Area Soil Sampling and Characterization

Minnesota Pollution Control Agency

November 4, 1993

Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

Dear Mr. Fix:

RE: Twin Cities Army Ammunition Plant (TCAAP)
Site F Disposal Areas
Soil Sampling and Characterization

We have reviewed your draft October 29, 1993, letter which describes the proposed sampling plan for characterization of the Site F disposal areas for soil washing treatability. Comments were provided by Minnesota Pollution Control Agency staff to your consultant which were already incorporated into the October 29, 1993, proposed sampling plan.

Soils at the Site F disposal areas will be sampled and analyzed as specified for mercury, cyanide, antimony, cadmium, chromium, copper, lead, nickel, and silver to determine the extent of treatability using the soil washing/acid leaching system operating at Site D. The purpose of the proposed soil sampling plan is to evaluate treatability of disposal area soils. This proposed plan is supplemental to verification/confirmatory sampling described in the approved closure plan to determine the extent of excavation at Site F.

Once these Site F disposal areas are characterized, soils will either be processed through the soil washing/acid leaching system or appropriate alternative disposal options will be used.

Please submit a final letter to be appended to the approved Closure Plan. It is understood that these disposal areas will be characterized before winter so that soil washing may resume in the spring of 1994. You may contact me at 612/296-8379 or Jon Pollock at 612/297-838477.

Sincerely,

Dan R. Card, Engineer
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

DRC:mh

C.12 Treated Soil Sampling Plan

Minnesota Pollution Control Agency

December 6, 1993

Mr. Michael Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

Dear Mr. Fix:

RE: Soil Sampling Plan for Washed Soils
Twin Cities Army Ammunition Plant (TCAAP) - Site F

The Regulatory Compliance Section/Permit and Review Unit of the Minnesota Pollution Control Agency (MPCA) understands that the soil washing process separates the soil into three (3) fractions: a fine fraction (silt and clays) that is less than 0.25 inches, a coarse fraction (sands) that is less than 0.25 inches, and an oversized fraction (gravel) that is greater than 0.25 inches. The fine and coarse fractions are both washed and acid-leached, and recombined after processing. The oversized fraction is processed by a high-pressure water rinse and is not subjected to the acid-leaching. To date, the approved Site F closure plan specified collecting one sample from each 60 ton (50 cubic yard as calculated by Wenck) batch of the recombined fine and coarse treated soil, and one sample of the high-pressure rinsed oversized material.

In response to several proposals and discussions with Wenck Associates, Incorporated (Wenck) concerning sampling frequency and an adjustment of both target and goal levels of cadmium in the soil, the MPCA sent a letter to the Department of the Army dated November 8, 1993. The letter outlined the MPCA staff's approval of a higher target (from 0.4 to 2.0 ug/g) and a higher enforceable goal (from 1.2 to 4.0 ug/g) concentration of cadmium in the washed soil, and also approved mixing of treated batches that do not meet the target and/or goal for cadmium, with treated batches that have met the target and/or goal. Further, the letter approved usage of the TCLP for oversized material verification analysis.

Wenck had indicated that they would submit a plan for determining the number of samples to be collected from mixed batches of soil. The MPCA has reviewed the material submitted to date including the facsimile from Wenck dated November 10, 1993, concerning probability sampling. The MPCA has decided to adopt a sampling frequency plan similar to that proposed by Wenck in that the number of soil samples to be collected from a mixture of batches will be determined by the number of batches in the mixture.

C. 12-2

When soil washing operations resume in the spring of 1994, the MPCA recommends that two random soil samples be collected from each batch of the treated soil. If either of the two samples exceeds the goal, the batch shall be rewashed (then resembled), disposed of at an appropriate facility, or mixed with batches that have passed. If mixing is chosen, then two samples for each batch mixed together (two samples for each 60 tons of soil) shall be randomly collected and all sample results shall be below the specified enforceable goal prior to returning the soil to Site F.

The weekly progress reports should indicate soil sampling results that are available since the last weekly report. In addition, the MPCA should be notified of:

1. when a treated batch has failed the specified enforceable goal,
2. the location of the failed batch (drawn on map), and
3. the decision as to how the failed treated batch will be dealt with.

If treated batches will be mixed, please disclose which batches will be mixed, and when the mixing will occur.

If you have any questions or comments please call me at 612/297-8477.

Sincerely,

Jon Pollock
Hydrogeologist
Permit and Review Unit
Regulatory Compliance Section

JP:mh

cc: Keith Bencker, Wenck
Charles Slaustus, EPA Region 5

C.12 - 3

C.13 Oversize Sample Frequency Approval

Minnesota Pollution Control Agency

January 5, 1994

Mr. Michael Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

RE: Reduction in sampling/Analysis of Oversized Material at Site F.

Dear Mr. Fix:

The Regulatory Compliance Section/Permit and Review Unit of the Minnesota Pollution Control Agency (MPCA) has reviewed your letter dated December 13, 1993. In the December 13, 1993, letter you proposed to reduce the sampling and analysis of the washed oversized material to one (1) sample (analysis) per three (3) weeks of operation. This reduction was based on a review of the results from 11 previous sampling results indicating that the toxic characteristic leaching procedure (TCLP) analyses were well below maximum allowable concentrations specified in Minn. Rules pt. 7045.0131, subp. 8.

Considering the nature of the analysis (TCLP analysis being conducted on uncrushed pressure washed material with a diameter greater then 0.25 inches) and the previous analytical results enclosed with your letter, the MPCA will allow a reduction in sampling/analysis of the oversized material to one (1) sample per 240 tons of oversized material. Through discussions with Mr. Keith Bencker of Wenck and Associates, Incorporated, it was determined that 240 tons of oversized material was roughly equivalent to three (3) weeks accumulation of oversized material.

If you have any questions or comments please contact Jon Pollock at 612/297-8477.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:rg

cc: Keith Bencker, Wenck and Associates, Incorporated, Maple Plain
Charles Slaustus, U.S. EPA, Region 5, Chicago

C 13-2

C.14 Addendum No. 7 and Approval Letters

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
4700 HWY 10 SUITE A
ARDEN HILLS, MINNESOTA 55112-[redacted]-3928

REPLY TO
ATTENTION OF

February 29, 1996

SIOTC-EV (200-1b)

SUBJECT: Addendum No. 7 and Draft Deed Notice, TCAAP Site F Closure Plan

HAND DELIVERED

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
Permit Review Unit
520 Lafayette Road North
St. Paul, MN 55155

Dear Sir:

References:

a. Letter, MPCA, October 24, 1995, subject: Addendum 7 to Site F Closure Plan.
b. Letter, MPCA, November 28, 1995, subject: Explosive Testing at Site F.
c. Letter, MPCA, December 5, 1995, subject: Outstanding Items for Site F.
d. Teleconference, MPCA and Wenck Associates, February 15, 1996, subject: Addendum 7 to Site F Closure Plan.

Please find enclosed a revised **DRAFT** Addendum No. 7 to the TCAAP Site F Closure Plan, July 1993, for your review. The revised addendum incorporates the following items:

1. Revisions to the previous draft based on MPCA comments presented in their letter of October 24, 1995 to the Army, and based on the February 15, 1996 telephone conference between the MPCA and Wenck Associates.

2. While ordnance quantification was included in the previous draft addendum, the details of the quantification plan had been provided in a separate letter from the Army to the MPCA dated June 14, 1995. This revised addendum incorporates the ordnance quantification details presented in the letter and also includes modifications based on a telephone conference of September 28, 1995 between the MPCA and Wenck Associates.

3. A plan for explosives testing of Site F soils was presented in a letter from the Army to the MPCA dated October 31, 1995. The details of this plan were added as a new section in this draft of Addendum No. 7. The details of the explosives testing plan were revised based on comments presented in the MPCA's letter of November 28, 1995 to the Army.

C 141-2

Upon written concurrence by your office, a copy of the final Addendum will be provided to the individuals who have received the subject Closure Plan.

With respect to a deed notice, Attachment Z presents draft wording to eventually be incorporated into an affidavit as a Site F deed notice. After your review, we can discuss this matter further.

The POC is Mr. Martin R. McCleery, SIOTC-EV, or Mr. Michael R. Fix, SIOTC-CO, 612/633-2301, ext. 1651 or 1661.

Sincerely,

Michael R. Fix
Commander's Representative

Enclosure

Copies Furnished:

Global Environmental Solutions, Inc., ATTN: Mr. James R. Persoon (w/encl)
Wenck Associates, Inc., ATTN: Mr. Keith Benker (wo/encl)

ADDENDUM NO. 7
TCAAP SITE F CLOSURE PLAN
February 19, 1996

I. INTRODUCTION

During the course of project work, issues have developed which were different from or not included in the Site F Closure Plan which was approved by the Minnesota Pollution Control Agency (MPCA) in July 1993. Some of these issues were addressed in previous addenda to the closure plan. This addendum presents issues not previously addressed or incompletely addressed in the closure plan or previous addenda.

II. RISK-BASED CLEANUP LEVELS

With the completion of soil processing, 6,855 tons of soil failed either the antimony, copper, or mercury Site F cleanup goals, but were processed to non-hazardous levels as determined by Toxicity Characteristic Leaching Procedure (TCLP) results. These soils are currently stored on the 503 soil storage pads. Since the antimony, copper, and mercury cleanup goals were background-type numbers, it is clear that consistent treatment to background-type goals for these three metals is not feasible. The Army proposes the following, risk-based cleanup levels for antimony, copper, and mercury (see Attachment A for derivation of these levels):

Antimony	6 μg/g
Copper	840 μg/g
Mercury	6 μg/g

Use of risk-based cleanup levels will still be protective of human health and the environment, allow unrestricted future use of the property, and minimize landfilling of soils. These proposed numbers may need to be evaluated again upon completion of explosives testing (Section VIII), since some explosive compounds have toxic endpoints which are similar to those of the proposed metals.

III. NON-HAZARDOUS SOILS

Non-hazardous soils are staged on the 503 soil storage pads and total 6,855 tons. Soils are managed in accordance with procedures detailed in Site F Closure Plan Addendum No. 4. Based on the higher cleanup levels established in the previous section, all but eleven batches of non-hazardous soils will meet the cleanup levels required for backfilling of soils at Site F. The eleven batches consist of six batches failing for antimony (batches 665, 634, 635, 560, 664, and 675) and five batches failing for copper (batches 135, 328, 424, 567, and 286).

The remaining eleven batches will be addressed by mixing. The soils will be mixed, tested, and the results interpreted as described in Site F Closure Plan Addendum No. 4. In this manner, it is believed that the antimony and copper concentrations can be lowered below the risk-based cleanup levels to allow backfilling at Site F.

Non-hazardous soils which are unable to be successfully mixed will be disposed of in an industrial landfill. If any soils are landfilled, the name of the disposal facility will be provided to the MPCA prior to disposal and will be documented in the closure certification report.

As a space conserving measure, some of the non-hazardous batches of soil were combined into larger piles on the 503 soil storage pad during the 1994 and 1995 treatment season. Batches of similar soil quality were combined to maintain flexibility for future mixing or reprocessing

(i.e., some of the batches which only failed for copper were combined, etc.). In the course of combining batches, one batch was inadvertently mixed into a larger pile of soil. Batch 276 which had failed for mercury and lead was mixed into a pile of soil containing 23 other batches of soil which had only failed for mercury. All batches were 30 ton batches resulting in a 720 ton pile of soil. Since the proposed higher cleanup level for mercury would allow all batches in this pile except for Batch 276 (because of lead) to be backfilled at Site F, a sampling program similar to the cadmium sampling described in Site F Closure Plan Addendum No. 4 is proposed for this pile of soil. The pile will be divided into 12 subpiles approximately equal in size with two samples collected from each subpile (approximately 1 per 30 tons). Soil sampling methods and locations (random x, y, z coordinates) will be similar to the cadmium sampling. Samples will be analyzed for lead only. If any sample within the subpile fails the cleanup goal for lead, the subpile will not be backfilled and will be remixed, or landfilled. Subpiles having sampling results which meet the cleanup goal for lead will be backfilled at Site F.

IV. HAZARDOUS SOILS

Some soils excavated from Site F have been temporarily staged in stockpiles at Site F due to difficulty in achieving successful treatment by the soil washing/soil leaching process or due to the presence of contaminants without cleanup goals. Testing has shown some of these soils to be TCLP hazardous. The soils are grouped into three categories with estimated quantities as follows:

Soil Category		Estimated Quantity (tons)
1.	Soils COGNIS elected not to treat. (Stockpiles 2/9/6/10, high antimony surface soils, and V)	985
2.	Soils remaining hazardous after some treatment. (Stockpile C)	240
3.	Soils having contaminants without cleanup goals. (Stockpiles 5, 9/10A, J, 7B, 7E, 17A, 17B, 17D, 18A, 18B, 18D, 19, 20B, and 20C)	3,330
	TOTAL	4,555

The Army has considered sending as much of the hazardous soils as possible to the Doe Run Company smelting facility in Boss, Missouri. While this alternative is attractive from the standpoint of trying to minimize landfilling of soils, it is a higher cost than landfilling and also has a slow implementation schedule (see later discussions). Thus, the Army may choose this option or, upon further evaluation, may propose a different alternative (i.e., off-site landfilling or off-site hazardous waste incineration) or possibly a combination of these alternatives. If soils will be landfilled or incinerated, the name of the disposal facility will be provided to the MPCA prior to disposal and will be documented in the closure certification report. Transportation to an off-site facility will be in accordance with DOT and DOD regulations.

If soils are processed at the Doe Run Company, the soils would be shipped and managed as a feedstock, rather than hazardous waste, since the smelting facility will use the material as a silica substitute (fluxing agent). The Doe Run Company has committed to accepting stockpiles 2/9/6/10, 5, 9/10A, and J, stating that they can manage the contaminants within their operating permit. The Doe Run Company has tentatively agreed to accept stockpiles C, 7B, 7E, and the high antimony surface soils. Discussions are ongoing with respect to stockpiles 17A, B, D; 18A, B, D; 19; and 20B, C, and V. Ramsey County has approved the designation of stockpiles 2/6/9/10, 5, 9/10A, and J as feedstock for transport to the Doe Run Company.

Approvals need to be secured from Ramsey County for any additional soils which may go to the Doe Run Company. Transportation will be in accordance with Department of Transportation (DOT) and Department of Defense (DOD) regulations. Also, if the Army chooses to send some of these soils to a smelting facility, the Army may propose to utilize other smelting companies (if any are identified and deemed cost effective) in order to speed the disposition of hazardous soils. If additional company(ies) are identified, the MPCA and Ramsey County will be notified prior to soil transport.

As an alternative option, soils which are not sent off-site for disposal could be staged in the TCAAP Corrective Action Management Unit (CAMU) for future on-site treatment. Soils would only be staged in the CAMU with the intent to treat the soils using technologies approved in the CAMU design. The MPCA will be notified prior to staging any Site F soils in the CAMU. MPCA approval regarding the adequacy of the CAMU treatment system design(s) will be obtained prior to transporting any Site F soils into the CAMU. A written notification will be provided to the MPCA upon successfully completing treatment of any Site F soils in the CAMU in order to provide documentation of ultimate disposition of the soils.

If soils are sent to the Doe Run Company (or other smelting facilities), interim staging of the hazardous soils will be required. The Doe Run Company can only accept approximately 200 tons per month. Even if another smelting facility could be utilized, the processing rate would likely be comparable. The Army does not want to delay backfilling and revegetation of Site F as would occur if the hazardous soils continued to be staged at Site F. Therefore, if the smelting option is utilized, the hazardous soils will be transported from Site F to within the Site D exclusion zone and staged on a portion of the concrete pad. The soils will be covered with a heavy-duty cover (20 to 30 mil polyethylene cover), prefabricated in two pieces to sizes which will cover both sections of the pad where soils are being staged. Two areas of the pad will be used (and thus two covers) as shown on Figure 1. Piles will be shaped to avoid ponding of water on the cover. With 4,555 tons of soil, estimated heights of the two piles are approximately

six feet. The outermost portions of the cover will be extended over the perimeter walls to prevent rain which falls on the cover from reaching the soil storage pad (some water may collect on top of the cover but will not reach the soils and become leachate). This cover arrangement is illustrated in cross-section on Figure 2. Staging in this manner will avoid generation of any rainfall on the soil storage pad which would require testing and disposal. The integrity of the berm for preventing run-on/runoff from the pad will be investigated and improved, as necessary, prior to staging any soils on the pad. The two covers will either be seamed together where they meet or will otherwise be addressed such that water can not get between the covers and onto the pad. Decontamination and verification wipe sampling of the pad area beneath the hazardous soils will be delayed until after the soils are transported off the Site D pad. An exclusion zone fence and appropriate warning signs will be maintained around the hazardous soils staging area. Weekly inspections of the staging area will be conducted to ensure integrity of the cover and walls.

Alternatively, if soils were sent off-site to be landfilled or incinerated, interim staging of soils might not be required, assuming the off-site transportation arrangements were scheduled to occur in Spring 1996.

Following transport of the soils to Site D (or directly to off-site disposal), testing of soils below the stockpiled soils area at Site F will be conducted as agreed to in separate correspondence with the MPCA (testing will be at the same frequency as for Site F excavation, i.e., one sample per 25 foot grid square). Testing will be documented in the closure certification report.

V. HAZARDOUS WASTE STORAGE

In Site F Closure Plan Addendum No. 4, it was stated that the Army would pursue permitting of a Resource Conservation and Recovery Act (RCRA) containment building for hazardous waste storage. Subsequent to that addendum, use of a CAMU for cleanup of the other on-post Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites was identified for soil staging, characterization, and treatment. The Army proposes not to pursue the RCRA containment building and instead utilize the CAMU for staging of any untreatable soils from Site F which are shown to be treatable in the CAMU. Any soils which are proposed for treatment in the CAMU will be subject to MPCA approval. Additional soil characterization or treatability analyses will be conducted, if necessary, to verify CAMU treatment capability. As described in the previous section, the Army is striving to avoid putting any soils in the CAMU, but wishes to reserve the right to do so if other options are not feasible.

VI. WOOD DEBRIS

Wood debris mainly consists of tree roots and scrap wood encountered during excavation. Wood debris was power-washed inside the exclusion zone next to the decontamination pad to remove any soil adhered to the wood. Following power-washing, sampling results indicated that the wood failed TCLP criteria for lead. Following MPCA notification, the wood debris was disposed of by off-site incineration at Chemical Waste Management's Trade Waste Incinerator in Sauget, Illinois. Disposal information will be documented in the closure certification report, including method and location of disposal, certificate of destruction, and hazardous waste manifest.

VII. ORDNANCE QUANTIFICATION

During the course of excavation and treatment, nearly all ordnance and ordnance-related items have been removed from Site F; however, it is likely that some scattered items remain. The Army and the MPCA have agreed that a representative portion of Site F should be surveyed to determine the typical quantity of ordnance and ordnance-related items remaining. This information will be documented in the closure certification report. Furthermore, it has been agreed that a deed notice (not a restriction) will be prepared alerting future land users to the possibility of ordnance and referring them to the appropriate Army and/or Department of Defense agencies who have responsibility for ordnance issues related to property use. The wording of the deed notice will be submitted for MPCA review and approval.

Quantitative estimates of ordnance will include the excavated area, the treated soil stockpiles located at Site F, and the 503 storage pads. Ordnance quantification methods and results will be documented in the closure certification report. Ordnance quantification will be accomplished by selecting a representative number of ordnance "sampling areas". The number of ordnance items located within each area (as determined with metal detection equipment) will be used to develop an "average" ordnance concentration (number of items per square foot) which would be considered representative of the site.

Specifically, ordnance quantification will be accomplished as follows:

1. The number of sampling areas will be 31 (15 for the excavated area and 16 for the treated soil stockpiles as shown on Figures 3 and 4), as derived below:

   For the purposes of the quantification, it was assumed that the sampling area size will be 25 feet by 25 feet, which is equal to one grid square on the existing grid system (see Figure 3). There are 192 grid squares or sampling areas for the

excavated area and 240 grid squares for the treated soil stockpiles (these are the "population sizes" or N values). For the purposes of this quantification, a probability for exceeding a specified margin of error was chosen to be 5 percent and an acceptable margin of error was chosen to be one-half the standard deviation. Then, the number of sampling areas ("grid squares") required to estimate the mean ordnance concentration within each of the two entire populations can be determined using the following equation (equation for a pre-specified margin of error):

$$n \equiv \frac{4\sigma^2}{d^2} \div \left(1 + \frac{4\sigma^2}{d^2 N}\right)$$

where:	n	=	number of samples
	σ	=	standard deviation
	d	=	margin of error (0.5σ)
	N	=	population size (192 for the excavated area and 240 for the treated soil)

(Source: Statistical Methods for Environmental Pollution Monitoring, Richard O. Gilbert, 1987, Equation 4.10 (where $Z_{1-\alpha/2} = 1.96$, from Table A1), pages 31-32)

The above equation was derived under the following assumptions:

1) The data are normally or log-normally distributed (to be determined later).

2) The data are uncorrelated over time and space (i.e., distance between samples is sufficiently large).

The first assumption will be verified by reviewing the sampling results to ensure the data is normally or log-normally distributed. The requirements of the second assumption were met by selecting sampling locations that had approximately equal spacing throughout the sampling areas.

Calculation of the required number of samples for the excavated area is as follows:

Given N = 192 and specified margin of error (d) = 0.5σ:

$$n \cong \frac{4\sigma^2}{d^2} \div \left(1 + \frac{4\sigma^2}{d^2 N}\right)$$

$$n \cong \frac{4\sigma^2}{(0.5\sigma)^2} \div \left(1 + \frac{4\sigma^2}{(0.5\sigma)^2 (192)}\right)$$

$$n \cong \frac{4}{0.25} \div \left(1 + \frac{4}{0.25\,(192)}\right)$$

$n \cong 14.8$ (rounding up, 15 samples are required)

Similarly, using N = 240 and d = 0.5σ, the required number of samples for the treated soil is calculated to be 15. However, based on discussions with the MPCA, one additional sample location was added for the treated soil resulting in 16 locations (added a sample location in the subpiles related to cadmium mixing).

The estimated mean concentrations for both the excavated area and the treated soil stockpiles will have a 95 percent probability of being within one-half of the standard deviation. The locations of the 31 sampling areas shown on Figures 3 and 4 were determined by randomly selecting the first location (a random number generator was used to select sampling areas #1 and #22) and then selecting the other locations by equally spacing them from the first location.

2. To quantify the ordnance items in these sampling areas, each area (in its entirety) will be surveyed with ferrous and non-ferrous metal detecting equipment (the reasonably best technology available). Generally, this equipment is capable of detecting small caliber ordnance items to a depth of 2 feet below the current ground surface. All anomalies detected will be dug for identification, regardless of the depth (e.g., the object causing the anomaly may be found at six inches or three feet). For each area, the ordnance encountered will be documented as to number of each ordnance type (casing only, projectile only, intact round, or miscellaneous) and depths below existing grade. Ordnance dug out will be removed from the site and will be disposed of by methods used for other recovered ordnance. For ordnance sampling areas which are partially or fully within a disposal area, the ordnance detection will be done on disposal area floors, as required, to cover the entire grid square area.

3. The total number of ordnance items encountered in each sampling area will be arithmetically averaged to determine an "average" ordnance concentration, expressed as a number of ordnance items per square foot (separate averages will be calculated for the excavated area and for the treated soil stockpiles). Standard deviations and coefficients of variance will also be calculated for the two data sets to aide in data review and evaluation.

4. The above procedures and results will be documented in the closure certification report.

VIII. EXPLOSIVES TESTING OF SOILS

Testing for explosives in Site F soils will be conducted as requested by the MPCA. This data will be used, in part, to finalize health risk numbers for antimony, copper, and mercury (Section II).

A. Sample Locations

1. Both unexcavated soil from within the previous exclusion zone boundary and treated soil will be tested.

2. The number of samples will be 31 (16 from treated soils and 15 from soils within the previous exclusion zone boundary). Derivation of the required number of samples is identical to that presented for ordnance quantification (Section VII).

3. As discussed in Section VII, 25 by 25 foot square areas have been selected for ordnance quantification (Refer to Figures 3 and 4). The center of each of these areas will be used for collection of a sample for explosives. If the center of a sampling area falls within a disposal area, the sample will be taken at the base of the disposal area.

4. Within the previous boundary of the exclusion zone, discrete soil samples will be taken from the ground surface.

5. Discrete soil samples from treated soil will be collected from the mid-depth zone of each individual location (mid-depth of the treated soil depth).

6. If any of the "hazardous/untreatable" soils stored on the north end of Site F are not sent off-site, as planned, and are instead treated in an on-site CAMU, they will be characterized as necessary to facilitate treatment. It should be noted that explosive characterization of some of the soils has already occurred (Refer to Attachment B for results). No additional sampling will be conducted unless required by the disposal company.

B. Sample Analysis

1. All samples collected will be analyzed, on-site, with both an EnSys TNT and RDX field test kit (or comparable). If any sample indicates the presence of explosives, that sample will be split for laboratory analysis by EPA Method 8330. Attachments C and D of this letter contain detailed field test kit information.

2. Laboratory analysis by EPA Method 8330 will include the list specified on Table 1.

3. Sample analysis will not include the compound DEGN. DEGN was used only in M8-29 and M8-30, 120 MM tank ammunition, and none of that type of ammunition was found at Site F.

4. The RDX field test kit will be used in part to qualitatively screen for nitroglycerin (NG) (8.9 ppm detection limit). Furthermore, if a sample indicates explosives in the field test, and the 8330 analysis does appear to account for the detection, the Army will consider (on a sample-by-sample basis) running a separate 8015 GC run to quantify for NG.

5. The TCLP method 8270 will be utilized for Nitrobenzene and 2,4-DNT if these compounds are detected in total concentrations above the theoretical TCLP threshold value (Nitrobenzene greater than or equal to 40 mg/kg, or 2,4-DNT greater than or equal to 2.6 mg/kg).

C. Quality Control

1. Ten percent, (rounding up) of all non-detect field samples will be split and run for laboratory verification analysis. This is in addition to lab verification analysis on all samples with a field detection, meaning a minimum of 10 percent of all field samples will be split for lab analysis.

2. Laboratories will be instructed to report all estimated concentrations below the "reportable quantity" and report "tentatively identified compounds" and their estimated concentrations.

3. An evaluation regarding correlation of field test kit data to laboratory data will be made after all data is collected.

IX. ADDITIONAL ISSUES

A. Plant Modifications for the 1995 Treatment Season

A log washer system was added to the Bescorp (soil washing) portion of the plant. This equipment improved attrition of plastic clays and also the high-lead, cement-like granules contained in some disposal area soils. Minor modifications to the soil feeder were also made to improve performance.

For the COGNIS (soil leaching) portion of the plant, the fines leaching circuit was improved by adding another clarifier and another pre-acidification vessel. The soil leaching surge tank was replaced with a 2500-gallon plastic tank which was located on the pad rather than on a trailer. Also, COGNIS began mixing flocculent on-site using two plastic tanks and dry flocculent. Liquid flocculent received in 55-gallon drums had previously been utilized.

B. 503 Soil Storage Pad

The original 503 soil storage pad was constructed in May 1994 for storage of non-hazardous soils in accordance with the design criteria outlined in Site F Closure Plan Addendum No. 4. The soil storage pad is managed in accordance with the operating procedures outlined in Addendum No. 4. A second soil storage pad was constructed adjacent to the original pad in August 1994 to provide additional non-hazardous soil storage capacity. The second pad was also constructed and managed in accordance with criteria specified in Addendum No. 4. Plans and specifications for both pads were submitted to the MPCA for review and documentation. Rainwater collects separately on each of the two pads and is sampled and discharged in accordance with the Metropolitan Council Wastewater Services (MCWS) special discharge approval (MCWS was formerly the Metropolitan Waste Control Commission).

C. MCWS Special Discharge Approval

The MCWS special discharge approval expired in December 1994. This approval authorizes discharge of rainwater (from the Site D pads and the 503 soil storage pads), decontamination water, and process water generated from Site F closure work. Extension of this approval was received from MCWS in their letter of March 10, 1995. The discharge limits and other conditions of the special discharge approval were identical to 1994. Water discharges in 1995 were in accordance with the special discharge approval. An extension of this approval for 1996 was requested and will be obtained prior to Spring 1996 when discharges from the 503 pad are anticipated to be needed.

ATTACHMENT Z

DRAFT WORDING TO BE INCORPORATED INTO AN AFFIDAVIT AS A SITE F DEED NOTICE

February 28, 1996

1. The U.S. Army is the owner of certain real property called the Twin Cities Army Ammunition Plant (TCAAP) located in Ramsey County, State of Minnesota.

2. The TCAAP manufactured small caliber ammunition.

3. An area within the TCAAP was used as a burning ground and burial ground for the disposal of ordnance-related materials. This area was known as the 326 Burning Ground or Site F, and lies within the following legal description ("Site F"):

   [Legal description of Site F "box" to be inserted after agreement between the Army and the MPCA on the area, and then a survey by a Registered Land Surveyor. See proposed "box" in Exhibit A.]

4. Site F was closed and under went cleanup in compliance with the TCAAP Federal Facilities Agreement and the TCAAP RCRA permit. All work was performed under the review of the Minnesota Pollution Control Agency (MPCA).

5. For more information on cleanup activities, interested parties should refer to the Administrative Record, in particular, the Site F Closure Certification Report.

6. Closure cleanup activities also included the removal of ordnance-related items. For more details on cleanup activities and the amount of ordnance-related items potentially remaining, interested parties should refer to the Administrative Record.

7. The MPCA approved the closure on _[date]_, but deferred authority on ordnance-related safety to the Department of Defense Explosives Safety Board (DDESB).

8. This Affidavit is being filed to notify any potential property transferee of the past and current condition of Site F in accordance with Minnesota Statute 115B.16, Subd. 2.

Tables

Table 1
Explosive Compound Analysis

Site F Closure
Twin Cities Army Ammunition Plant

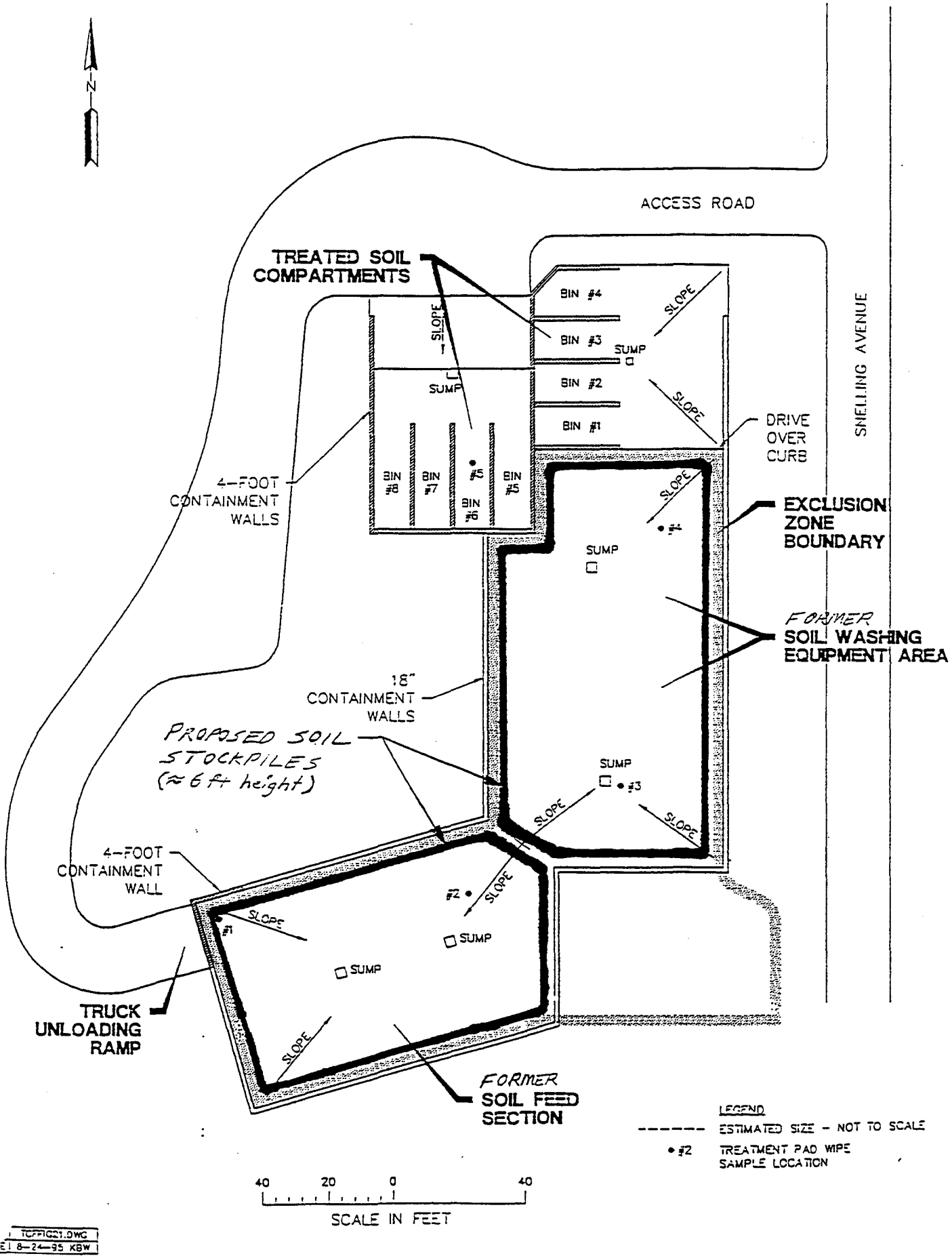
Compound	EPA Lab Method (Detection Limit)	TCLP Method (Detection Limit)	Field Test Kit Analysis(1) (Detection Limit)
HMX	8330 (0.25 ppm)		RDX (2.4 ppm)
RDX	8330 (1.0 ppm)		RDX (0.8 ppm)
1,3,5-TNB	8330 (0.25 ppm)		TNT (0.5 ppm)
1,3-DNB	8330 (0.25 ppm)		TNT (<0.5 ppm)
Tetryl	8330 (0.65 ppm)		TNT (0.9 ppm)
Nitro Benzene	8330 (0.26 ppm)	8270 (2.0=Regulatory Limit)(2)	
TNT	8330 (0.25 ppm)		TNT (0.7 ppm)
2AM46DNT/4AM46DNT	8330 (0.11 ppm)		
2,4-DNT	8330* (0.25 ppm)	8270 (.13=Regulatory Limit)(2)	TNT (0.5 ppm)
2,6-DNT	8330* (0.26 ppm)		TNT (2.1 ppm)
2-Nitrotoluene	8330 (0.12 ppm)		
3-Nitrotoluene	8330 (0.16 ppm)		
4-Nitrotoluene	8330 (0.32 ppm)		
PETN	8330** (2.0 ppm)		RDX (1 ppm)
Nitroglycerine (NG)	8015 (generic GC method)*** (10 ppm)		RDX (8.9 ppm)

* - 8330 Results combine 2,4 and 2,6-DNT to yeild a total
** - Can be added to 8330 list
*** - Analysis will be considered on a sample-by-sample basis

(1)- Information provided is from two kits (TNT and RDX) available from one vendor (EnSys). Detection limits and specificity of compounds in these two kits are similiar to other available kits. Field Test Kit Prices: TNT- ~$42/Sample, RDX- ~$50/Sample. Sold in 20 sample packages.
(2) - Information provided by Minnesota Pollution Control Agency

C. 14-22

Figures



TCFIG21.DWG
DATE 8-24-95 KBW

TWIN CITIES ARMY AMMUNITION PLANT

Soil Washing/Soil Leading Treatment Pad

Wenck Associates, Inc.
Environmental Engineers

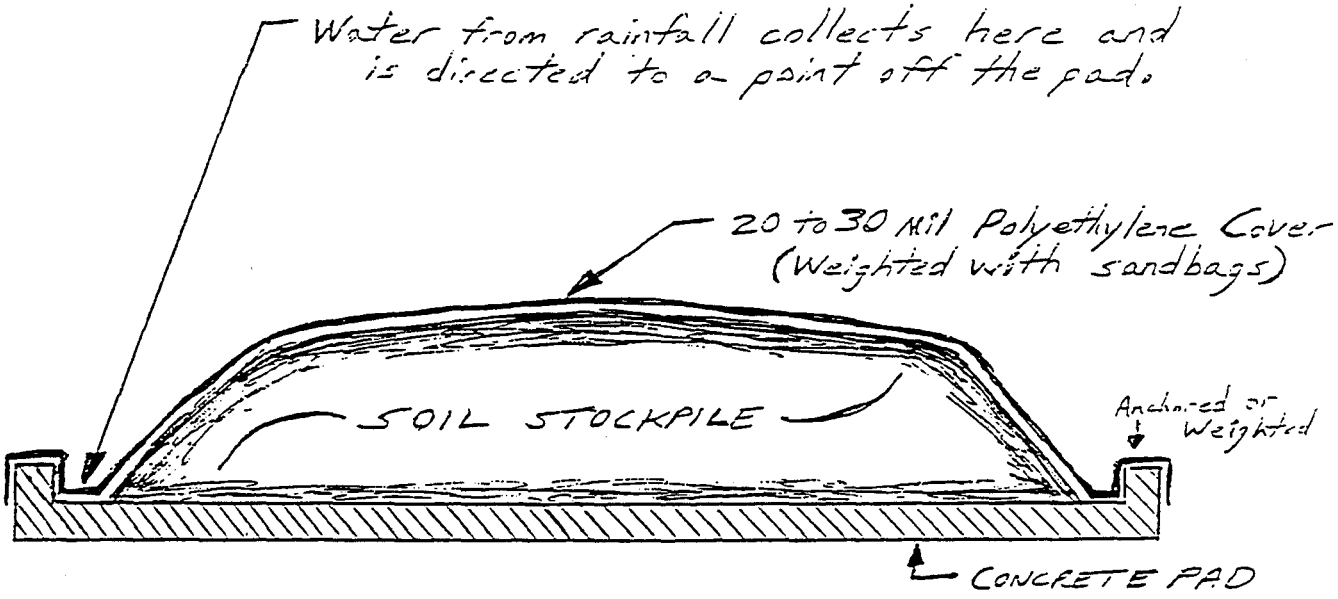
Wenck

1800 Pioneer Creek Center P.O. Box 428
Maple Plain, MN 55359-0428

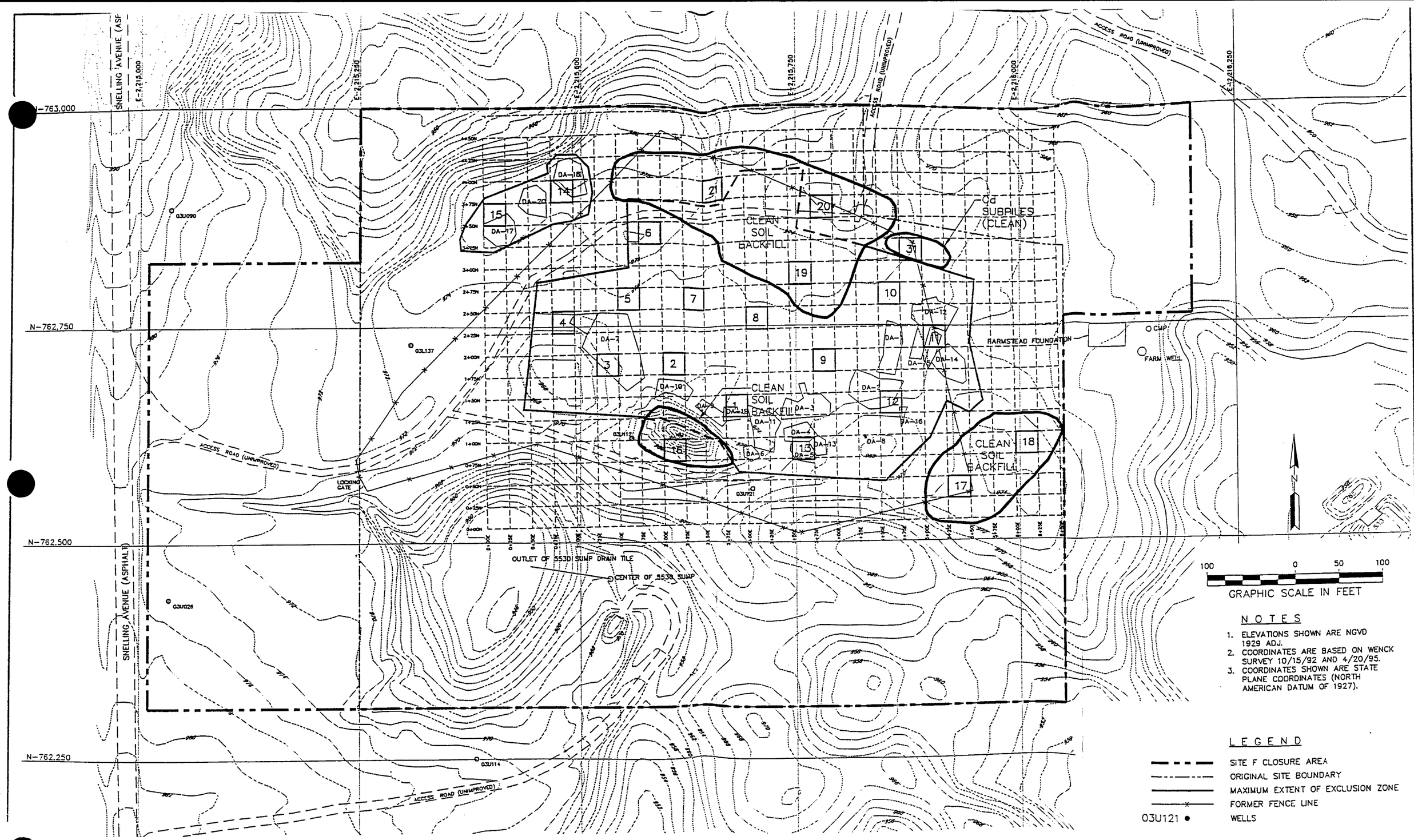
FEB. 1996

Figure 1

C. 14-24



TWIN CITIES ARMY AMMUNITION PLANT	COPYRIGHT Wenck Associates, Inc. 1800 Pioneer Creek Ctr. Environmental Engineers Maple Plain, MN 55359	FEB 1996
Proposed Soil Stockpile Covering Method		Figure 2



NOTES

1. ELEVATIONS SHOWN ARE NGVD 1929 ADJ.
2. COORDINATES ARE BASED ON WENCK SURVEY 10/15/92 AND 4/20/95.
3. COORDINATES SHOWN ARE STATE PLANE COORDINATES (NORTH AMERICAN DATUM OF 1927).

LEGEND

- SITE F CLOSURE AREA
- ORIGINAL SITE BOUNDARY
- MAXIMUM EXTENT OF EXCLUSION ZONE
- FORMER FENCE LINE
- 03U121 ● WELLS

I TCFF0195.DWG
12-16-96 M:DLM

TWIN CITIES ARMY AMMUNITION PLANT

Site F Closure Area

Wenck
Wenck Associates, Inc. Environmental Engineers
1800 Pioneer Creek Center P.O. BOX 428
Maple Plain, MN 55359-0428 (612)479-4200

FEB. 1996

Figure 3

C. 14-26

ATTACHMENT A

Derivation of Health Risk Based
Cleanup Levels for Closure of Site F,
Twin Cities Army Ammunition Plant
August 17, 1995

A. INTRODUCTION

The purpose of this attachment is to present the calculations used to determine health risk based cleanup levels for antimony, copper, and mercury at Site F. As agreed at a meeting between the USEPA Region V, MPCA, and Wenck Associates on September 20, 1994, the procedures used to derive the risk-based levels are consistent with the procedures approved by USEPA Region V and MPCA for areas of TCAAP outside Site F. These procedures were approved at a meeting between the Army, USEPA Region V, and MPCA on August 8, 1995. Therefore, most of the information in this attachment was excerpted from the technical memorandum "Determination of Health-Risk Based Preliminary Remediation Goals (PRGs), Twin Cities Army Ammunition Plant, Operable Unit 2 Feasibility Study" (Montgomery Watson, 1995).

B. CALCULATION METHODOLOGY

Equations used to calculate the risk-based levels are presented in Table 1. The risk-based levels were determined assuming dermal contact and incidental ingestion for a residential exposure scenario. Under the residential scenario, the most health protective means of estimating noncarcinogenic risk is exposure to children, so input parameters describing this age group were used to calculate noncarcinogenic risk-based levels. For carcinogenic constituents under the residential scenario, an age-adjusted exposure group (6 years as child, 24 years as adult) was used. Input parameters used for these calculations, listed in Table 2 of this document, are those presented on page 4-2 of the MPCA general comments to Section 4 of the Draft FS and subsequent discussions between Montgomery Watson and MPCA staff (personal communication, H. Goeden, 5/31/95). USEPA Region V concurs with these input parameters.

Slope factors and reference doses utilized in the calculations were obtained from several sources. The primary source for oral toxicity values was the Oak Ridge National Laboratory document (1995) summarizing toxicity data from the Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Table (HEAST). The USEPA Region IX PRG Table (Smucker 1995) was referred to for additional toxicity information when necessary. Finally, some toxicity data was obtained from the Human Health Risk Assessment for OU-2 (PRC 1991) and from PRC's letter to USEPA dated September 14, 1993. The toxicity data used and references for the toxicity values are provided in Table 3. Dermal reference doses were calculated simply by multiplying the oral reference dose by the absorption efficiency, as referenced in Appendix A of the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part A (USEPA 1989b).

The risk-based levels were adjusted to account for exposure to multiple compounds affecting the same target endpoint. Noncarcinogenic levels were adjusted for multiple exposures to constituents that affect the same target organ. Likewise, carcinogenic levels were adjusted for multiple exposures to carcinogenic

constituents. The adjustment factors are based on the number of constituents with similar endpoints which are primarily responsible (≥ 95 percent) for the risk at Site F. The percent contribution of each constituent to either the noncarcinogenic hazard or carcinogenic risk at a site was determined using equations similar to those described in the USEPA Region IX PRG Table (Smucker 1995). These equations are provided in Table 4. Constituents contributing the greatest percentage of risk were selected in decreasing order until they totaled ≥ 95 percent of risk, either noncarcinogenic or carcinogenic. Only the compounds contributing the greatest risk were then adjusted for multiple endpoints (additivity).

C. RESULTS

The risk-based cleanup levels for the residential scenario are presented in Table 5. This table includes constituent toxicity information such as slope factors and reference doses, the maximum concentration of each constituent at the site, the calculated unadjusted levels, the percent contribution of each constituent to the noncarcinogenic hazard and carcinogenic risk, the adjustment factors used, and the adjusted cleanup levels.

D. REFERENCES

Montgomery Watson. 1995. Determination of Health-Risk Based Preliminary Remediation Goals, Twin Cities Army Ammunition Plant, OU-2 Feasibility Study. Technical Memorandum. Minnesota.

Oak Ridge National Laboratory. 1995. Toxicity Values from the U.S. Environmental Protection Agency Integrated Risk Information System and Health Effects Assessment Summary Table. Chemical Hazard Evaluation Group, Biomedical and Environmental Information Analysis Section.

PRC. 1991. Final Report Human Health Risk Assessment New Brighton/Arden Hills Superfund Site Including Twin Cities Army Ammunition Plant, Ramsey County, Minnesota.

Smucker, S.J. 1995. USEPA Region IX Preliminary Remediation Goals (PRGs) First Half 1995. USEPA, San Francisco, CA.

USEPA. 1989b. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation (Part A). Office of Emergency and Remedial Response. Washington, D.C.

USEPA. 1991. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation (Part B). Office of Emergency and Remedial Response. Washington, D.C.

TABLE 1

EQUATIONS FOR DETERMINING PRELIMINARY REMEDIATION GOALS

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Average Soil Intake via Ingestion

$$Io = [IR \times EF \times YE \times CF] / [BW \times AT]$$

where: Io = Average soil intake via ingestion, kg soil/kg body weight-day
IR = Soil ingestion rate, mg/day
EF = Exposure frequency, days/year
YE = Years of exposure, years
CF = Conversion factor, 1E-06 kg/mg
BW = Body weight, kg
AT = Averaging time, days

Average Soil Adherence via Dermal Contact

$$Ad = [SA \times CF1 \times AdF \times CF2 \times EF \times YE] / [BW \times AT]$$

where: Ad = Average soil adherence, kg/kg-day
SA = Body surface area exposed to soil, square meters/day
CF1 = Conversion factor, 1E+04 square centimeters/square meter
AdF = Soil to skin adherence factor, 0.9 mg/cm^2 (PRC 1991)
CF2 = Conversion factor, 1E-06 kg/mg
EF = Exposure frequency, days/year
YE = Years of exposure, years
BW = Body weight, kg
AT = Averaging time, days

Total Lifetime Average Soil Intake

$$Io_t = Io_1 + Io_2 + \_ + Io_n \qquad \text{or} \qquad Io_t = Io(adj)$$

where: Io_n = Average soil intake via ingestion per age group (e.g., child, adult), kg soil/kg body weight-day
Io(adj) = Age-adjusted (6 yrs as child, 24 yrs as nonchild) average soil intake via ingestion, kg soil/kg body weight-day
Io_t = Total lifetime average soil intake, kg soil/kg body weight-day

Total Lifetime Soil Adherence via Dermal Contact

$$Ad_t = Ad_1 + Ad_2 + \_ + Ad_n \qquad \text{or} \qquad Ad_t = Ad(adj)$$

where: Ad_n = Average soil adherence per age group (e.g., child, adult), kg/kg-day
Ad(adj) = Age-adjusted (6 yrs as child, 24 yrs as nonchild) average soil adherence, kg/kg-day
Ad_t = Total lifetime soil adherence via dermal contact, kg/kg-day

Noncarcinogenic PRG (mg/kg)

$$PRG_n = \frac{TR_n}{[(Io*(1/RfDo)) + (Ad*AbF*(1/RfDd))]}$$

where: PRG_n = Noncarcinogenic PRG, mg/kg
TR_n = Total acceptable noncarcinogenic risk (HI), 1 (unitless) (EPA, 1991)
Io = Age group-specific average soil ingestion, kg/kg-day
Ad = Age group-specific average soil adherence, kg/kg-day
AbF = Chemical-specific dermal absorption factor, unitless
RfDo = Chemical-specific oral reference dose, mg/kg-day
RfDd = Chemical-specific dermal reference dose, mg/kg-day

Carcinogenic PRG (mg/kg)

$$PRG_c = \frac{TR_c}{[(Io_t*SFo) + (Ad_t*AbF*SFd)]}$$

where: PRG_c = Carcinogenic PRG, mg/kg
TR_c = Excess acceptable carcinogenic risk, 1e-06 (unitless) (EPA 1991)
Io_t = Total lifetime average soil intake via ingestion, kg/kg-day
SFo = Chemical-specific oral carcinogenic slope factor, (mg/kg-day)$^{-1}$
Ad_t = Total lifetime average soil adherence via dermal contact, kg/kg-day
AbF = Chemical-specific dermal absorption factor, unitless
SFd = Chemical Specific dermal carcinogenic slope factor, (mg/kg-day)$^{-1}$

Source: Montgomery Watson, 1995.

TABLE 2

INPUT PARAMETERS FOR DETERMINING PRELIMINARY REMEDIATION GOALS

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Age Group-Specific Values Used in Estimating Chemical-Specific Soil PRGs for Residential Exposure Scenario

Residential Exposure Scenario

	Age Group (years)	IR (mg/kg)	EF (days/yr)	ED (years)	BW (kg)	Noncarcinogenic AT (days)	Carcinogenic AT (days)	SA (cm^2)
1	0 to 6	200	350	6	15	2190	25550	0.2
2	7 to 30	100	350	24	57	8760	25550	0.41
adj	Age Adjusted	120	350	30	50	10950	25550	0.368

Calculation of Values for Residential Exposure Scenario

Noncarcinogenic

Io_1 = 1.28E-05
Io_2 = 1.68E-06

Ad_1 = 1.15E-04
Ad_2 = 6.71E-05

Carcinogenic

Io_1 = 1.10E-06
Io_2 = 5.77E-07

Io(adj) = 9.36E-07

Ad_1 = 9.86E-06
Ad_2 = 2.13E-05

Ad(adj) = 2.72E-05

Io_1 = Io(adj) = 9.86E-07
Ad_1 = Ad(adj) = 2.72E-05

Source: Montgomery Watson, 1995.

C-14-30

TABLE 3

TOXICITY VALUES USED IN PRG CALCULATIONS

TWIN CITIES ARMY AMMUNITION PLANT
SITE F

Constituent	Sfo (mg/kg/day)[2]	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (Unitless)	Sfd (mg/kg/day)[2]	RfDo (mg/kg/day)	RfDd (mg/kg/day)	RfDo and/or Sfo Data Source
Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	√ [1]
Cadmium	NA	0.06	0.01	NA	1.00E-03	6.00E-05	√ [1]
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	√ [1]
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	HEAST [3]
Lead	NA	NA	NA	NA	NA	NA	No toxicity values.
Mercury	NA	0.1	0.01	NA	3.00E-04	3.00E-05	√ [1]
Nickel	NA	0.1	0.01	NA	2.00E-02	2.00E-03	√ [1]
Silver	NA	0.1	0.01	NA	5.00E-03	5.00E-04	√ [1]

DEFINITIONS:

Sfo	Oral carcinogenic slope factor
Sfd	Dermal carcinogenic slope factor
RfDo	Oral reference dose
RfDd	Dermal reference dose
IRIS	Integrated Risk Information System Database
HEAST	Health Effects Assessment Summary Tables
Region IX	US EPA Region IX Preliminary Remediation Goals (PRGs) First Half 1995 (February 1995)
PRC 9/14/95 Memo	PRC Environmental Management, Inc. Memo to Tom Baroumis, US EPA Region 5, September 14, 1995, detailing calculation of PRGs for OU-2 Sites at TCAAP.
NA	Not Available

NOTES:

[1] Oak Ridge National Laboratory, "Toxicity Values from the U.S. Environmental Protection Agency Integrated Risk Information System and Health E Assessment Summary Table" (May 1995)

[2] US EPA Region IX PRG Table, with HEAST, IRIS, or ECAO as sources in list.

[3] According to Oak Ridge document, HEAST concluded the toxicity data were inadequate for calculation of oral RfDs and substituted current drinking water standard (MCLG) of 1.3 mg/l [x (2 l/day) / 70 kg] = 0.037 mg/kg-d.

Source: Montgomery Watson, 1995.

TABLE 4

EQUATIONS FOR DETERMINING CONSTITUENT CONTRIBUTION TO TOTAL RISK AT A SITE[1]

TWIN CITIES ARMY AMMUNITION PLANT
OPERABLE UNIT 2 FEASIBILITY STUDY

Noncarcinogenic Hazard Estimates

$$HI = CONC / PRG$$

where: HI = Noncarcinogenic hazard index (≤ 1 generally considered safe)
CONC = maximum concentration or 95% UCL of compound, mg/kg
PRG = preliminary remediation goal calculated for compound, mg/kg

Percent Contribution to Noncarcinogenic Hazard

$$\% = [HI_c / \Sigma (HI)] \times 100$$

where: % = percent contribution of constituent to total noncarcinogenic hazard at site
HI_c = Constituent noncarcinogenic hazard
$\Sigma (HI)$ = Total noncarcinogenic hazard of all constituents at site

Carcinogenic Hazard Estimates

$$RISK = [CONC / PRG] \times 1E\text{-}06$$

where: RISK = Carcinogenic risk (≤ 1E-06 generally considered acceptable)
CONC = maximum concentration or 95% UCL of compound, mg/kg
PRG = preliminary remediation goal calculated for compound, mg/kg

Percent Contribution to Carcinogenic Risk

$$\% = [RISK_c / \Sigma (RISK)] \times 100$$

where: % = percent contribution of constituent to total carcinogenic risk at site
$RISK_c$ = Constituent carcinogenic risk
$\Sigma (RISK)$ = Total carcinogenic risk of all constituents at site

[1] Equations from US EPA Region IX PRG Table (First Half 1995).

Source: Montgomery Watson, 1995.

TABLE 5

RISK-BASED REMEDIATION LEVELS FOR ANTIMONY, CADMIUM, COPPER, AND MERCURY
SITE F
TWIN CITIES ARMY AMMUNITION PLANT

Constituent	Sfo (mg/kg/day)$^{-1}$	Oral Absorption Efficiency (unitless)	Dermal Absorption Factor (unitless)	Sfd (mg/kg/day)$^{-1}$	RfDo (mg/kg/day)	RfDd (mg/kg/day)	PRGn[a] (mg/kg)	PRGc[a] (mg/kg)	Max Concen (mg/kg)	Hazard Indices Concen/PRGn	Percent of Risk(n)	Cancer Risk Concen/PRGc	Percent of Risk(c)	Constituents Which in Decreasing Order Comprise >95% of the Risk	Target Endpoints for Constituents Comprising >95% of Risk				Adjustment Factor		Adjusted PRGn[b] (mg/kg)	Adjusted PRGc[c] (mg/kg)
															CNS	Liver	Kidney	Reproduction	Noncarcinogens[g]	Carcinogens		
Antimony	NA	0.05	0.01	NA	4.00E-04	2.00E-05	1.12E+01	NA	9.62(d)	0.859	47.5%	NA	NA	1		X			1.86E+00	–	6.02E+00	NA
Cadmium	NA	0.06	0.01	NA	1.00E-03	6.00E-05	3.13E+01	NA	3.64(e)	0.116	6.4%	NA	NA	4		X	X		7.82E+00	–	4.00E+00	NA
Chromium	NA	0.01	0.01	NA	1.00E+00	1.00E-02	7.82E+03	NA	47.7(e)	0.006	0.3%	NA	NA						NA	–	NA	NA
Copper	NA	0.6	0.01	NA	3.70E-02	2.22E-02	2.52E+03	NA	1520(d)	0.603	33.3%	NA	NA	2	X	X			3.00E+00	–	8.40E+02	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	300(e)	NA	NA	NA	NA						NA	–	NA	NA
Mercury	NA	0.1	0.01	NA	3.00E-04	3.00E-05	1.23E+01	NA	2.01(d)	0.163	9.0%	NA	NA	3	X		X		2.00E+00	–	6.15E+00	NA
Nickel	NA	0.1	0.01	NA	2.00E-02	2.00E-03	7.21E+02	NA	34.3(f)	0.048	2.7%	NA	NA						NA	–	NA	NA
Silver	NA	0.1	0.01	NA	5.00E-03	5.00E-04	2.06E+02	NA	3.17(d)	0.015	0.8%	NA	NA						NA	–	NA	NA
									TOTAL	1.810	100.0%			96.2%								

Notes: Toxicity data are from Oak Ridge National Laboratory (May 1995), which summarizes data from both the Integrated Risk Information System Database (IRIS) and the Health Effects Assessment Summary Tables (HEAST). If toxicity data were not found in HEAST or IRIS, values in the USEPA Region IX PRGs Table (First Half 1995) from ECAO and/or in the PRC Memo (September 1993) detailing PRG calculations were utilized.

a: Equations from "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part B, Development of Risk-Based Remediation Goal" (EPA 1991).

b: Noncarcinogenic PRGs were adjusted to consider multiple exposures to constituents which contribute 95% of the risk at the site and affect the same target organ (constituents in bold).

c: Carcinogenic PRGs were adjusted to consider multiple exposures to carcinogenic constituents which contribute 95% of the carcinogenic risk at the site (constituents in bold).

d: Soil on the 503 pad.

e: Treated soil returned to Site F.

f: Post-excavation verification boring.

g: Adjustment factors for each constituent represent the Unadjusted PRGn divided by the Adjusted PRGn. The cadmium adjusted PRGn was taken to be 4 $\mu g/g$ as previously agreed for Site F.

For each target organ, the sum of the ratios $\frac{Adjusted\ PRGn}{Unadjusted\ PRGn}$ should be less than or equal to 1 as follows:

Liver:	$\frac{Antimony\ 6.02}{11.2}$	+	$\frac{Cadmium\ 4}{31.3}$	+	$\frac{Copper\ 840}{2520}$	= 0.997
Kidney:	$\frac{Cadmium\ 4}{31.3}$	+	$\frac{Mercury\ 6.15}{12.3}$			= 0.628
CNS:	$\frac{Copper\ 840}{2520}$	+	$\frac{Mercury\ 6.15}{12.3}$			= 0.833

NA: Not Available.

Attachment B

Hazardous Soil Stockpile
Explosive Characterization Data

TABLE II

HAZARDOUS SOIL STOCKPILE CHARACTERIZATION DATA

Site F Closure

Twin Cities Army Ammunition Plant

Stockpile Identification	Estimated Quantity (tons)	Date Sampled	Chloride (mg/Kg)	Sulfate (mg/Kg)	Antimony (mg/Kg)	Arsenic (mg/Kg)	Barium (mg/Kg)	Cadmium (mg/Kg)	Chromium (mg/Kg)	Copper (mg/Kg)	Lead (mg/Kg)	Mercury (mg/Kg)	Nickel (mg/Kg)	Selenium (mg/Kg)	Silver (mg/Kg)
Stockpile J	250	12-Jul-94	NA	NA	<1.2	NA	NA	1.68	9.5	17.5	733	3.54	11.1	NA	<0.06
		10-May-95	NA	NA	NA	<1.2	1200	NA	NA	NA	NA	NA	NA	<1.3	NA
Stockpile 5	500	20-Jul-94	NA	NA	370	NA	NA	<0.08	12.0	5520	12000	0.42	5.7	NA	6.00
		20-Jul-94	NA	NA	28	NA	NA	0.60	7.0	2570	920	0.59	8.0	NA	0.20
		10-May-95	NA	NA	NA	<1.2	1600	NA	NA	NA	NA	NA	NA	<1.3	NA
Stockpile 2/6/9/10	550	24-Aug-94	NA	NA	53	NA	NA	<0.08	10.2	1990	12700	0.28	6.1	NA	0.32
		24-Aug-94	NA	NA	104	NA	NA	<0.08	8.8	5760	29600	0.38	5.6	NA	1.06
		24-Aug-94	NA	NA	194	NA	NA	<0.08	7.6	18900	42700	0.85	8.8	NA	1.43
		24-Aug-94	NA	NA	383	NA	NA	<0.08	11.1	11500	49300	0.72	6.6	NA	1.74
		10-May-95	NA	NA	NA	<1.2	410	NA	NA	NA	NA	NA	NA	<1.3	NA
Stockpile 9/10A	400	10-May-95	NA	NA	5.57	<1.2	3100	1.73	9.27	1540	10000	0.26	5.95	<1.3	0.38
Surface Soil	400	24-Jun-95	810	100	8.5	<1.4	1400	1.7	10	280	980	0.19	8.6	<1.5	1.6
Stockpile C	240	24-Jun-95	2000	56	94	3	600	1.8	10	610	3300	0.68	8.9	<1.5	1.6
Stockpile 7B	150	24-Jun-95	1700	96	5.2	<1.3	200	2.1	30	380	760	0.68	9.7	<1.4	1.6
Stockpile 7E	75	24-Jun-95	350	72	6.4	<1.4	1400	1.9	11	90	150	0.08	8.8	<1.5	1.4
Stockpile 17A	135	20-Jul-95	5.9	58	6.3	<1.3	160	1.3	7.0	31	110	1.0	6.9	<1.5	1.3
Stockpile 17B	90	20-Jul-95	19	59	56	<1.3	290	1.2	5.6	48	440	11	5.9	<1.4	2.0

C 14-35

TABLE 11
HAZARDOUS SOIL STOCKPILE C' 'CTERIZATION DATA

Site F Closure
Twin Cities Army Ammunition Plant

Stockpile Identification	Estimated Quantity (tons)	Date Sampled	Chloride (mg/Kg)	Sulfate (mg/Kg)	Antimony (mg/Kg)	Arsenic (mg/Kg)	Barium (mg/Kg)	Cadmium (mg/Kg)	Chromium (mg/Kg)	Copper (mg/Kg)	Lead (mg/Kg)	Mercury (mg/Kg)	Nickel (mg/Kg)	Selenium (mg/Kg)	Silver (mg/Kg)
SP-17D	390	28-Aug-95	22	24	<5	<13	40	<0.9	9	22	43	0.31	<0.6	<14	<4
SP-18A	200	28-Aug-95	43	52	<5	<13	96	<0.9	12	36	86	0.69	<0.6	<14	<4
SP-18B	240	28-Aug-95	29	75	<5	<13	180	<0.9	12	55	150	1.7	<0.6	<14	<4
SP-18D	570	28-Aug-95	18	8.3	<5	<13	28	1	10	23	<9	0.09	<0.6	<14	<4
SP-19	100	28-Aug-95	11	9.9	<6	<13	600	1	9	96	67	0.04	12	<15	<4
SP-20B	190	28-Aug-95	20	78	<6	<13	280	<0.9	12	66	490	4.2	<0.7	<15	<4
SP-20C	40	28-Aug-95	260	46	<5	<13	140	<0.9	13	35	220	0.83	<0.6	<14	<4
SP-V	35	28-Aug-95	220	40	<5	<13	2400	<0.9	10	1300	7200	1.6	0.7	<14	44
Total Est. Tons	4555														

Notes:
1) NA = Not Analyzed
2) ND = Not Detected
3) For VOCs and SVOCs, only those compounds detected are presented in this table (compounds in the EPA 8260 or 8270 analyte list not presented in this table were not detected).
4) * = Additional characterization data is provided in Table 10 and/or Table 13.

TABLE II
SOIL STOCKPILE CHARACTERIZATION DATA

Site F Closure
Twin Cities Army Ammunition Plant

Stockpile Identification	Estimated Quantity (tons)	Date Sampled	VOCs Detected (EPA 8260) (mg/Kg)	SVOCs Detected (EPA 8270) (mg/Kg)	Explosives Detected (EPA 8330) (mg/Kg)	SiO2 (% by Wt)	Al2O3 (% by Wt)	MgO (% by Wt)
Stockpile J	250	12-Jul-94	NA	NA	NA	NA	NA	NA
		10-May-95	NA	NA	NA	116	7.8	0.95
Stockpile 5	500	20-Jul-94	NA	NA	NA	NA	NA	NA
		20-Jul-94	NA	NA	NA	NA	NA	NA
		10-May-95	NA	NA	NA	78	7.3	1.5
Stockpile 2/6/9/10	550	24-Aug-94	NA	NA	NA	NA	NA	NA
		24-Aug-94	NA	NA	NA	NA	NA	NA
		24-Aug-94	NA	NA	NA	NA	NA	NA
		24-Aug-94	NA	NA	NA	NA	NA	NA
		10-May-95	NA	NA	NA	78	6.8	0.88
Stockpile 9/10A	400	10-May-95	NA	NA	NA	79	7.3	1.7
Surface Soil	400	24-Jun-95	NA	NA	NA	63.4	8.21	0.91
Stockpile C	240	24-Jun-95	NA	NA	NA	59.6	7.88	0.92
Stockpile 7B	150	24-Jun-95	No VOCs Detected	2,4-Dinitrotoluene 0.46 Di-n-butyl phthalate 9.3 Bis(2-ethylhexyl)phthalate 0.75 Diphenylamine 3.0	NA	61.9	7.41	0.79
Stockpile 7E	75	24-Jun-95	No VOCs Detected	2,4-Dinitrotoluene 3.3 Di-n-butyl phthalate 0.10 Diphenylamine 0.87	NA	63.7	8.59	0.89
Stockpile 17A	135	20-Jul-95	No VOCs Detected	Di-n-butylphthalate=20 Diphenylamine=11	NA	77.2	7.68	0.99
Stockpile 17B	90	20-Jul-95	cis-1,2-Dichloroethene=9.4 Trichloroethene=260 Benzene=0.22 Toluene=21 Ethylbenzene=55 m/p-Xylene=170 o-Xylene=35 1,3,5-Trimethylbenzene=0.089 1,2,4-Trimethylbenzene=0.38 p-Isopropyltoluene=0.68 n-Butylbenzene=0.09	Di-n-butylphthalate=210	24DNT/26DNT =4.2 (28-Aug-95)	70.4	9.95	1.5

TABLE II
SOIL STOCKPI ARACTERIZATION DATA

Site F Closure
Twin Cities Army Ammunition Plant

Stockpile Identification	Estimated Quantity (tons)	Date Sampled	VOCs Detected (EPA 8260) (mg/Kg)	SVOCs Detected (EPA 8270) (mg/Kg)	Explosives Detected (EPA 8330) (mg/Kg)	SiO2 (% by Wt)	Al2O3 (% by Wt)	MgO (% by Wt)
SP-17D	390	28-Aug-95	No VOCs Detected	Di-n-butylphthalate=2.8 Bis(2-ethylhexyl)phthalate=0.56 Diphenylamine=2.4	NA	66.1	9.73	1.46
SP-18A	200	28-Aug-95	No VOCs Detected	2,4-Dinitrotoluene=1.0 Di-n-butylphthalate=4.3 Butylbenzyl phthalate=0.13 Bis(2-ethylhexyl)phthalate=0.36 Diphenylamine=5.7	NA	74.5	8.13	0.91
SP-18B	240	28-Aug-95	Trichloroethene=0.74 Toluene=0.42 m/p-Xylene=0.31 0-Xylene=0.12	2,4-Dinitrotoluene=2.9 Di-n-butylphthalate=29 Diphenylamine=40	24DNT/26DNT =5.5	65.8	8.54	1.07
SP-18D	570	28-Aug-95	No VOCs Detected	Di-n-butylphthalate=1.7 Bis(2-ethylhexyl)phthalate=0.095 Diphenylamine=0.50	NA	70.1	7.78	0.98
SP-19	100	28-Aug-95	NA	NA	NA	67.2	8.6	2
SP-20B	190	28-Aug-95	cis-1,2-Dichloroethene=0.55 Trichloroethene=1.6 Toluene=0.73 Ethylbenzene=0.25 m/p-Xylene=0.89 0-Xylene=0.38 p-Isopropyltoluene=0.65	2,4-Dinitrotoluene=10 Di-n-butylphthalate=26 Bis(2-ethylhexyl)phthalate=2.9 Diphenylamine=23	24DNT/26DNT =16	60.3	7.54	1.04
SP-20C	40	28-Aug-95	m/p-Xylene=0.26	Phenanthrene=0.18 Di-n-butylphthalate=8.5 Diphenylamine=11	NA	70.3	7.64	1.18
SP-V	35	28-Aug-95	NA	NA	NA	70.3	10	2.16
Total Est. Tons	4555							

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Attachment C

EnSys Field Kit Information

C. 14-39

The TNT Soil Test is a wet chemistry, non-immunoassay, field-compatible test that provides quantitative results. The method was originally developed by Dr. Thomas F. Jenkins with the Army Corps of Engineers Cold Regions Research and Engineering Laboratory and funded by the Army Environmental Center.

The TNT Soil Test gives an accurate concentration value from 1 to 30 ppm. Higher sample concentrations can be quantified by dilution of the sample extract. A calibrator control is provided in each Test Kit.

The TNT Soil Test also effectively detects dinitrotoluene (DNT) at approximately the same concentrations:

Minimum Detection Levels	2,4,6-trinitrotoluene	0.7 ppm
	2,4-dinitrotoluene	0.5 ppm
	2,6-dinitrotoluene	2.1 ppm
	1,3,5-trinitrobenzene	0.5 ppm
	tetryl	0.9 ppm
	1,3-dinitrobenzene	<0.5 ppm

Format	20 Test Kit
Analysis Time[†]	10 minutes per sample
Sample Throughput	10 samples per 40 minutes
Operational Temperature Range	40°F to 100°F
Storage Temperature	Room temperature
Shelf Life*	24 months at 80°F
Regulatory Status	EPA SW-846 Draft Method 8515
Confirmatory Laboratory Method	EPA Method 8330

[†] *Does not include drying time. Recovery of the nitroaromatics from soil samples is most consistent when the samples are air dried prior to extraction.*

*Guaranteed 2 months upon delivery. Call the Order Department for current kit shelf life.

APPLICATIONS

Industries:

- Army Ammunition Manufacturing Facilities
- Depots and Explosives Ordinances
- Disposal Sites

- Delineation of soil contamination
- Monitoring remediation and treatment

For more information call 919-941-5509
Monday - Friday, 8 a.m. to 5 p.m. EST

C. 14 - 40

The Test Kit includes most of the consumables needed for testing twenty samples. The Test Kits require the use of an accessory kit, which contains the instruments needed to run the analyses. The accessory kit can be rented from EnSys. (Please call the Order Department for purchasing information.) The user must supply 50 mL of acetone (hardware store or laboratory grade) per sample.

20 Test Kit	Part Number	Purchase Price ($)	Rental Price ($)
	70020	410	N/A

Accessory Kit	Part Number	Purchase* Price ($)	Rental Price ($)
	69997	see note below	430/week 160/day

*Call the Order Department for purchasing information.

Includes:
Hach DR/2000 Photometer*
150 gram Balance

Materials not included:
50mL of acetone per sample (hardware or laboratory grade)

*The Hach DR/2000 Photometer is a variable wavelength lamp spectrophotometer with a 3 cm pathlength; this test requires a 540 nm wavelength.

The RDX (hexahydro-1,3,5,-trinitro-1,3,5-triazine) Soil Test System is a wet chemistry, non-immunoassay, field-compatible test that provides quantitative results. The method was originally developed by Dr. Thomas F. Jenkins at the Army Corps of Engineers Cold Regions Research and Engineering Laboratory with funding by the Army Environmental Center.

The RDX Soil Test gives an accurate concentration value from 1 to 30 ppm. Higher sample concentrations can be quantified by dilution of the sample extract. A calibration control is provided in each Test Kit.

The RDX Soil Test also effectively detects HMX (octchydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine).

Minimum Detection Levels	**RDX**	**0.8 ppm**
	HMX	**2.4 ppm**
	PETN	**1 ppm**
	Nitroglycerine	**8.9 ppm**
	Nitroguanadine	**10.1 ppm**
	Nitrocellulose	**42.2 ppm**
Format	20 Test Kit	
Analysis Time	30 minutes per sample	
Sample Throughput	6 samples per hour	
Operational Temperature Range	40°F to 100°F	
Storage Temperature	Room temperature	
Shelf Life*	13 months at 80°F	
Confirmatory Laboratory Method	EPA Method 8330	

*Guaranteed 2 months upon delivery. Call the Order Department for current kit shelf life.

APPLICATIONS

Industries:

- ✓ Army Ammunition Manufacturing Facilities
- Depots and Explosives Ordinances
- Disposal Sites

- Delineation of soil contamination
- Monitoring remediation and treatment

For more information call 919-941-5509
Monday - Friday, 8 a.m. to 5 p.m. EST

C. 14-42

The Test Kit includes most of the consumables needed for testing twenty samples. The Test Kits require the use of an accessory kit, which contains the instruments needed to run the analyses. The accessory kit can be rented from EnSys. Please call the Order Department for purchasing information.. The user must supply 50 mL of acetone (hardware store or laboratory grade) per sample.

20 Test Kit	Part Number	Purchase Price ($)	Rental Price ($)
with extraction jars	70850	500	N/A
without extraction jars*	70851	450	N/A

*To be used in conjunction with the EnSys TNT Soil Test

Accessory Kit	Part Number	Purchase[1] Price ($)	Rental Price ($)
	69997	see note below	430/week 160/day

[1] *Call the Order Department for purchasing information.*

Includes:
Hach DR/2000 Photometer*
150 gram Balance

Materials not included:
50mL of acetone per sample (hardware or laboratory grade)

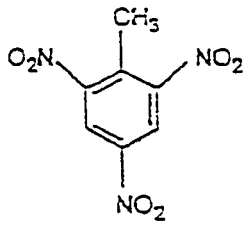
*The Hach DR/2000 Photometer is a variable wavelength lamp spectrophotometer with a 3 cm pathlength; this test requires a 510 nm wavelength.

TNT Soil Test
Technical Guide

Contamination of soil with trinitrotoluene (TNT), the major component of many munitions formulations, is a serious problem at Army ammunition manufacturing facilities, depots, and explosive ordnance disposal sites. TNT readily enters groundwater supplies from soil at contaminated sites. It is thought to be relatively toxic and has been the focus of intensive clean-up efforts at several federal facilities.

Trinitrotoluene

TNT is a single ring aromatic compound that is relatively soluble in water. It has been listed as a hazardous compound by the EPA. Many military sites where extensive munitions handling has occurred historically are highly contaminated with TNT and other explosive ordnance compounds.



trinitrotoluene

Existing Laboratory Methods

The laboratory method employed for TNT analysis, EPA method 8330 (HPLC), is relatively expensive, typically $200-500, and suffers from the same laboratory turnaround time requirements (2-4 weeks) as other lab methods.

Test Characteristics

The TNT Soil Test serves as a field-based alternative to sending all soil samples for analysis by laboratory-based methods. The EnSys test exhibits broad recognition of nitroaromatic compounds (Table 1). Various members of this group of compounds are found associated with ordnance manufacture and storage. The test responds approximately equally to all of the common nitroaromatics found at significant concentrations in these situations. However, the TNT Test does not measure either RDX or HMX.

Recovery of the nitroaromatics from soil samples is most consistent when the soil samples are air dried prior to extraction and testing. This can be accomplished by spreading out about 50 g of soil on aluminum foil and allowing it to dry for a period of time without application of heat. Alternatively, soil samples can be dried quickly in a small oven (such as a toaster oven) set at 170° F.

Regulatory Status

The TNT Soil Test conforms to EPA SW-846 draft Method 8515 for quantitative field analysis of TNT. Extensive validation has shown that the EnSys test equals or exceeds the method specifications for Method 8515.

Correlation with Laboratory Methods

As with other EnSys tests, the TNT soil test can provide a high degree of accuracy when used to analyze soils contaminated with TNT. Soil samples spiked with TNT and tested using the field test show excellent recovery of TNT from soils at low concentrations (Table 2). Product validation studies indicate that the test can correctly determine the TNT concentration of contaminated soils, as well. Extensive data have been obtained with the EnSys TNT Soil Test using soil samples collected from military sites. These analyses have shown very good correlation of the field test results to results derived from the laboratory method. A correlation plot is shown in Figure 1.

Field Application

The TNT Soil Test has been configured to provide easy operation in the field. With the use of a field spectrophotometer (the Hach DR/2000 is recommended), several samples can be tested per hour. The operational temperature range for use in the field with full performance as described above is 40°F to 100°F. The shelf life of the TNT Soil Test is 24 months. Although TNT Soil Tests will always be shipped with at least two months of shelf life remaining, users will typically receive test kits with several months of shelf life.

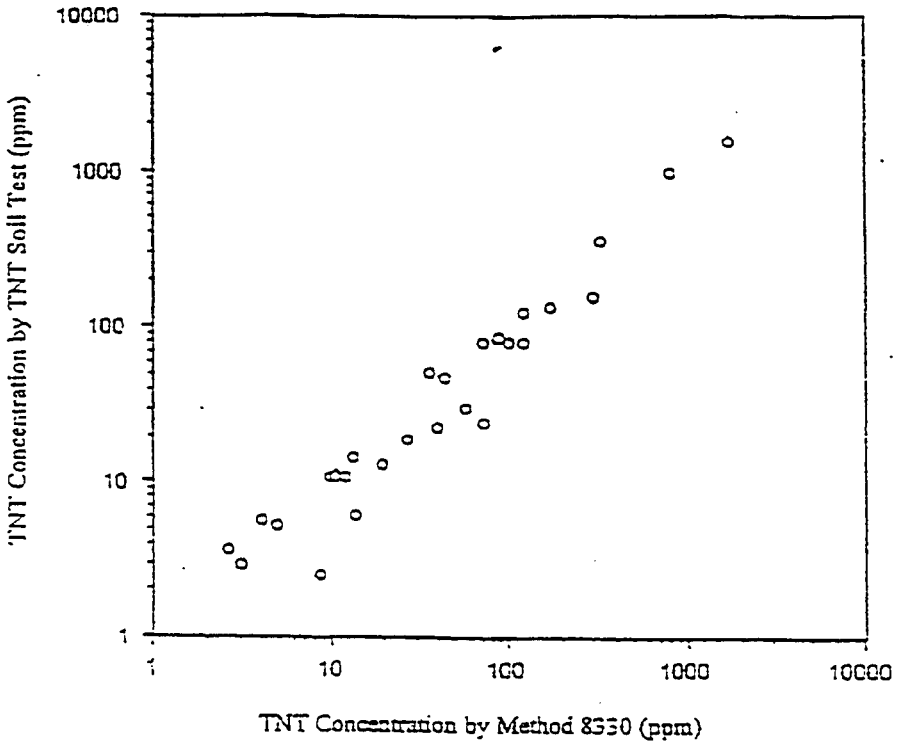
Rather than sending every sample to the laboratory for analysis, samples collected can be analyzed in the field to provide real-time information about TNT levels to guide further sampling or excavation. The appropriate use of field testing can result in relatively substantial savings in project cost due to more efficient use of project resources. All results from field analysis of soil samples using the TNT test should be accompanied by supporting QA data. At the least, method and soil blanks and a control sample should be tested daily. In addition, one duplicate sample should be tested for every twenty samples analyzed. Confirmation of a portion of the field results should also be obtained by either Method 8330.

The TNT test can be used to screen soil samples for the presence of TNT and chemically related compounds. Because the TNT measures several of the related nitroaromatic compounds, it should be viewed as an indicator or screening test for TNT. In order to ensure that a user is likely to obtain good correspondence with confirming laboratory data, it is advisable to review any analytical data that has been obtained for presence of high levels of other nitroaromatic compounds prior to doing extensive field screening for TNT.

Clean-up levels at ammunition storage or manufacturing sites are typically set at 1 ppm. The TNT Soil Test has the required sensitivity to use down to that level with confidence.

Figure 1

Correlation of TNT Soil Test with Laboratory Method



C. 14-47

Table 1

TNT Soil Test Sensitivity to Explosive Compounds

Compound	Minimum sensitivity (ppm)*
2,4,6-trinitrotoluene	0.7
2,4-dinitrotoluene	0.5
2,6-dinitrotoluene	2.1
2-nitrotoluene	>100
3-nitrotoluene	>100
4-nitrotoluene	>100
4-amino-2,6-dinitrotoluene	>100
1,3,5-trinitrobenzene	0.5
nitrobenzene	>100
tetryl	0.9
1,3-dinitrobenzene	<0.5

* The lowest concentration at which the analyte is distinguishable from a matrix blank by two standard deviations.

Table 2
TNT Spike Recoveries

Spike Treatment	Spike Level (ppm)	TNT Soil Test Results (ppm±SD)
blank soil	-	0.0 ± 0.2
TNT	5	5.1 ± 0.4
TNT	10	10.1 ± 0.5
TNT	20	20.1 ± 0.8

DRAFT

METHOD 8515

SOIL SCREENING FOR TRINITROTOLUENE

1.0 SCOPE AND APPLICATION

1.1 Method 8515 is a procedure for screening and quantitating soils for trinitrotoluene (TNT) when TNT is present at concentrations above 1 ppm.

1.2 Results obtained using this method should be used to locate samples with TNT levels between 1 to 30 ppm. Extracts of samples reading > 30 ppm should be diluted and re-evaluated in the test.

1.3 Using the test kit from which this method was developed, 95% of samples containing 0.7 ppm or less TNT will produce a negative result.

1.4 The TNT test can be used to screen soil samples for the presence of TNT and other chemically related nitroaromatic compounds (eg. dinitrotoluene and trinitrobenzene). It should be used as an indicator or screening test for TNT.

2.0 SUMMARY OF METHOD

2.1 Test kits are commercially available for this method. The manufacturer's directions should be followed. In general, the method is performed using an extract of a soil sample. The sample is treated with color-change reagents. The sample is read in a portable spectrophotometer. The concentration of TNT in an unknown sample is determined by evaluating how much color is developed.

3.0 INTERFERENCES

3.1 Chemically similar compounds and compounds which might be expected to be found in conjunction with TNT contamination were tested to determine the concentration required to produce an equivalent TNT result. These data are shown in Table 1.

3.2 The TNT test does not measure RDX or HMX.

4.0 APPARATUS AND MATERIALS

4.1 TNT Soil Test System (EnSys, Inc.), or equivalent. Each commercially available test kit will supply or specify the apparatus and materials necessary for successful completion of the test.

5.0 REAGENTS

5.1 Each commercially available test kit will supply or specify the reagents necessary for successful completion of the test.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 See section 6.0 in SW-846 Method 8330.

6.2 Soil samples may be contaminated, and should therefore be considered hazardous and handled accordingly.

7.0 PROCEDURE

7.1 Follow the manufacturer's instructions for the test kit being used. Those test kits used must meet or exceed the performance indicated in Tables 2-3.

8.0 QUALITY CONTROL

8.1 Follow the manufacturer's instructions for the test kit being used for quality control procedures specific to the test kit used. Additionally, guidance provided in Chapter One should be followed.

8.2 Use of replicate analyses, particularly when results indicate concentrations near the action level, is recommended to refine information gathered with the kit.

8.3 Do not use test kits past their expiration date.

8.4 Use the test kits within their specified storage temperature and operating temperature limits.

8.5 Method 8515 is intended for field or laboratory use. The appropriate level of quality assurance should accompany the application of this method to document data quality.

9.0 METHOD PERFORMANCE

9.1 This method has been applied to a series of soil samples whose TNT concentration had been established by analytical Method 8330. These results are provided in Table 4. A high degree of correlation was observed between the standard method and the field method.

DRAFT

10.0 REFERENCES

1. T. F. Jenkins, "Development of a Simplified Field Method for the Determination of TNT in Soil", Special Report 90-38 (November, 1990) USA Cold Regions Research and Engineering Laboratory.

2. TNT Soil Test System Instructions for Use, EnSys, Inc.

Table 1 TNT Sensitivity to Explosive Compounds	
Compound	Minimum Sensitivity (ppm)
2,4,6-trinitrotoluene	1
2,4-dinitrotoluene	1.1
2,6-dinitrotoluene	0.6
2-nitrotoluene	>100
3-nitrotoluene	>100
4-nitrotoluene	>100
4-amino-2,6-dinitrotoluene	>100
1,3,5-trinitrobenzene	1
nitrobenzene	>100

Table 2 Interassay Precision of the TNT Soil Test		
TNT Spike Concentration (ppm)	Average TNT Result ppm ± SD	TNT %RSD
0	0.0 ± 0.2	-
5	5.1 ± 0.4	7.8%
10	10.1 ± 0.5	4.5%
20	20.1 ± 0.8	4.2%

Table 3 Intraassay Precision in the TNT Soil Test		
TNT Spike Concentration (ppm)	Average TNT Result ppm ± SD	TNT %RSD
0	0.0 ± 0.2	-
10	10.2 ± 0.2	1.9%

Table 4 Comparison of TNT Soil Test System with the HPLC Method 8330			
Sample ID	Screening Test Result, ppm	GC Results ppm	Does screening test agree with GC determination?
012	18.9	21.5	yes
028	26.2	29.0	yes
022	34	25.2	no
021	34.6	23.8	no
023	37.7	28.1	yes
024	56.5	58.5	yes
027	192	191	yes
025	120	110	yes
026	120	131	yes
016	49	49	yes
013	174	175	yes
015	150	135	yes
020	295	287	yes
019	712	719	yes

Attachment D

Field Kit General Study

C. 14-55

MEASUREMENT OF TRINITROTOLUENE (TNT) AND HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX) IN SOIL BY ENZYME IMMUNOASSAYS AND HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (EPA METHOD 8330)

Report prepared by Robert A. Haas and Barton P. Simmons, California Environmental Protection Agency, Department of Toxic Substances Control, Office of Scientific Affairs, Hazardous Materials Laboratory, 2151 Berkeley Way, Berkeley, CA 94704

C 14-56

MEASUREMENT OF TRINITROTOLUENE (TNT) AND HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX) IN SOIL BY ENZYME IMMUNOASSAYS AND HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (EPA METHOD 8330)

Site: The Sierra Army Depot (SIAD) is at Herlong in northeastern California, near the Nevada border. It is located in the Honey Lake valley, on the western edge of the Great Basin.

Site Background: SIAD has an area historically known as the TNT Leaching Beds (TLB) which were the receptor site for runoff from a used ordnance washout facility (Figure 1). Remedial investigation/feasibility study (RI/FS) activities were begun at the TLB in 1989 and completed in May, 1993. This site has been previously characterized as to explosives contamination including TNT, RDX, HMX, and 1,3,5-TNB. Remediation of this site is planned for 1995.

Data Needs and Uses: Products using emerging environmental technologies often need to be validated by independent, non-biased evaluators using real world samples in a scenario identical or similar to that for which the product is intended. Chemical measurement technologies are of the kind that are in particular need of this validation. Manufacturers often have the need for contaminated soil or water samples that are not artificially produced by spiking clean matrices. In order to demonstrate the efficacy of such products, a comparison must be made between their measurements and those made by an acknowledged reference technology. It is to this end that this study was designed.

Constraints: The soil type found at SIAD TLBs is sandy only; thus no comparison of varying soil types could be made. Soil moisture was low at the time of year when sampling occurred (July); therefore no study of the effects of soil moisture was attempted.

Project Design and Scope: Field screening methods have been developed and commercialized for the analysis of TNT and RDX in contaminated soil. The accepted method of analysis of these compounds is EPA Method 8330 (HPLC with UV detection) (1). The field screening methods allow for a greater number of samples to be assessed at less cost, thereby yielding more detailed information about the extent of contamination at a site. The efficacy of these methods was compared to Method 8330 by measuring TNT and RDX in the same soil samples. The Strategic Diagnostics, Inc. (SDI) field assays for TNT and RDX were done in a field trailer; the other assays were performed in the California EPA Hazardous Materials Laboratory.

Data Quality Objectives: U.S. EPA has established a data quality objective (DQO) process for environmental projects (2). The DQO process is a seven-step process for establishing project-specific requirements. The DQOs for a remedial investigation are typically based on risk-based concentrations. One application of the TNT and RDX immunoassays is the analysis of potentially contaminated soil to determine if further investigation and remediation is needed. EPA Region IX has established Preliminary Remediation Goals (PRGs), which are soil concentrations based on reasonable maximum exposure factors which are generally agreed to be safe for humans (3). If levels exist above the PRGs, there may be enough concern to warrant additional investigation.

The PRGs only consider direct human exposures and do not include impact to groundwater or ecological receptors. If groundwater exposure or ecological receptors are important, PRGs should be refined as part of a site-specific risk assessment. The PRGs for enzyme immunoassay (EIA) target compounds are listed in Table 1. The PRGs with a "ca" designation are based on 10^{-6} cancer risk. The "nc" PRGs are based on a "safe" reference dose. No regulatory levels have been set for this site.

Table 1. EPA Region IX Preliminary Remediation Goals (PRGs) First Half 1995

Compound	Residential Soil (mg/kg)	Industrial Soil (mg/kg)
2,4,6-Trinitrotoluene	48 ca*	64 ca
1,3,5-Trinitrobenzene	3.3 nc**	34 nc
2,4-Dinitrotoluene	130 nc	1400 nc
2,6-Dinitrotoluene	65 ca	680 ca
m-nitrotoluene	650 nc	6800 nc
p-nitrotoluene	650 nc	6800 nc
nitrobenzene	33 ca	340 nc
RDX(cyclonite)	4 ca	17 ca

* ca = cancer PRG
** nc = Non cancer PRG

Quality Assurance: Each kit was handled in the manner prescribed by the manufacturer with regard to storage temperature. Materials that required 4° C storage were transported to the field in a polystyrene foam cooler and stored in a refrigerator at the on-site trailer. Samples were collected in certified clean vials and capped immediately. After subsampling for the field analysis, samples were stored at 4 ° until transport to the laboratory. Field duplicates were collected to assess assay precision. Field blanks were processed daily and 8% of the samples were analyzed in duplicate for TNT. Each product has its own unique quality assurance criteria for accepting the results of calibration and blanks; these were followed in all cases.

For the Method 8330 analysis, accuracy and precision were assessed with surrogate spikes plus matrix spikes and matrix spike duplicates. All the analytical batch runs (n=7) used for the determination of TNT, TNB, RDX, and other nitrated aromatics had spike recoveries ranging from 63-106%, matrix spike recoveries from 61-93%, and relative percent differences between matrix replicates of 0.3-8.6%. Surrogate standard (1,3-dinitrobenzene) recoveries were from 77-

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128% (mean=92.5%) (S.D.=9.2%). quality control results were within the acceptance criteria. The limit of detection (LOD) was 0.15 mg/kg for TNT; the quantitation limit (QL) was 1.0 mg/kg

Soil sampling strategy: Systematic surface soil sampling based on the known pattern of contamination of the TLBs was used to provide a range of expected values from non-detectable through the lower limits of quantitation (about 0.5 mg/kg) up to a high range of contamination (>10000 mg/kg). The choice of soil sampling locations was based on the 1992 surface soil sampling for explosive compounds in the TNT Leaching Beds Area (TLB) and surrounding area (Figure 1). Surface soil samples were collected in the first six inches (6") of the surface using disposable wooden tongue depressors. Approximately forty field samples were collected in the southeast quadrant of TNT Leaching Bed #2 (labeled "F" in Figure 1), forty additional samples were collected outside and northeast of the leaching bed in the areas defined as TNT-31-SS, TNT-10-SS, TNT-19-SS, and TNT-20-SS and twenty samples were collected outside and southeast of the TLB in TNT-12-SS, TNT-22-SS, and TNT-23-SS. All samples were placed into clean 16 oz. jars, stirred to homogenize, and capped immediately. Sample size was about 200 g. After collection all soil samples were brought to the field trailer on site for subsampling and execution of the field-specific analysis. For analysis, subsamples were withdrawn from the sample containers using disposable wooden tongue depressors and weighed or measured volumetrically according to the assay manufacturer's directions.

Ninety nine (99) soil samples were collected, ten of these samples were field duplicates. Our data analysis is based on the eighty nine (89) unique samples (one of each field duplicate was randomly discarded from data analysis). HPLC results of the 89 samples indicate that forty-three (43) contained no detectable concentration of TNT [TNT]; eight (8) samples had detectable amounts of TNT but were below the QL; twenty-seven samples had [TNT]=1-48 mg/kg; and eleven samples had [TNT]>48 mg/kg.

[D TECH TEST KITS]

All participating manufacturers (Strategic Diagnostics, Inc.[SDI], Idetek, Inc., Millipore Corp. and Ohmicron Corp.) provided materials necessary to use their respective kits according to their directions and HML personnel carried out the analyses. SDI's field analysis was performed in a trailer on the site. Both the Idetek and Millipore products are laboratory microtiter plate assays and were completed in our laboratory within twelve days of soil collection. Subsequently, Millipore developed a field portable tube assay and this was evaluated with the same soil samples in the laboratory. Ohmicron's magnetic particle-based tube assay was evaluated in January, 1995, using the soil samples which had been stored at 4°. All the products have provisions for analyzing heavily contaminated specimens by diluting the soil extract with the extraction solvent. All data were collected as described in the kit's instructions and only dilutions made according to these directions were attempted. The goal was to use each kit within the parameters of usage specified by the product and to compare the kit with the Method 8330 values.

Specific data objectives for each kit are described below.

SDI: The DTech™ TNT and RDX kits have quantitation ranges of 0.5-5.0 mg/kg and 0.5-6.0 mg/kg, respectively, using undiluted extracts. The undiluted extract was analyzed and the TNT results grouped as <0.5 mg/kg, 0.5-1.5, 1.5-3.0, 3.0-4.0, 4.0-5.0, and >5.0 mg/kg. RDX results were grouped similarly as <0.5 mg/kg, 0.5-1.5, 1.5-2.5, 2.5-4.5, 4.6-6.0, and >6.0 mg/kg. After completing this preliminary analysis, extracts from the high concentration group were diluted and reanalyzed. The above categories were multiplied by the dilution factor so that samples in higher concentration ranges could be determined.

Millipore: The Envirogard™ TNT Plate Kit is a quantitative laboratory test for the detection of TNT residues in water or soil. Two grams of soil are extracted with 8 ml of methanol and this extract is further diluted (1:100) with deionized water. This diluted (500X) methanol soil extract is incubated in parallel with a negative control and three calibrators (0.5, 5.0 and 50 ppb) to measure soil concentrations of about 0.5-25 mg/kg. The TNT Tube Kit is designed for qualitative or semi-quantitative analysis yielding data as <0.2 mg/kg, values between 0.2-2.0 mg/kg, 2-15 mg/kg and >15 mg/kg using an acetone extract of the soil sample. Both of these analyses were done on subsamples taken from the original sample vial upon completion of the field phase of the study. To obtain values or ranges greater than those described above, dilutions of the original extracts were made using methanol for the plate kit and acetone for the tube kit.

Idetek: The Idetek™ TNT Laboratory Immunoassay Kit is designed for the quantitative analysis of TNT in soil. It yields values for samples containing 0.25 mg/kg to 10,000 mg/kg TNT. Soil is measured volumetrically (~4.2 g) in a soil collector and extracted with 21 ml of acetone (1:5 dilution). This extract is diluted 1:1000 and used for the immunoassay to yield values between 0.25-500 mg/kg. A subsequent aqueous dilution (1:100) is made to quantitate high level samples with a quantitation range of 50-10,000 mg/kg. This analysis was done on a subsample taken from the original sample vial upon completion of the field phase of the study. Higher dilution of the original acetone extract was performed to quantitate samples containing >10,000 mg/kg.

Ohmicron: The Ohmicron RaPID Assay® is designed for the quantitative analysis of TNT in soil. It yields values for samples containing 0.25 mg/kg to 5 mg/kg TNT. Soil is measured volumetrically (=12 g) or gravimetrically (10 g) in a soil collector and extracted with 20 ml of a proprietary methanolic extraction solution. This extract is filtered and diluted 1:500 (50 µl into 25 ml) and used for the immunoassay to yield values between 0.25-5 mg/kg. Additional serial 1:10 dilutions are made to quantitate high level samples up to 50,000 mg/kg. This analysis was done on a subsample taken from the original sample vial upon completion of the field phase of the study.

Results: Table 2 reports the overall results of the EIAs as well as the SW-846 Method 8330 results [reporting TNT, 1,3,5-trinitrobenzene (TNB) and RDX only].

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Table 2. Summary of TNT and RDX Results in mg/kg

SAMPLE	SDI [TNT] (DTECH)	MFP [TNT]	MFT [TNT]	IDE [TNT]	OHM [TNT]	8330 [TNT] (LAB)	8330 [TNB] (LAB)	SDI [RDX] (DTECH)	8330 [RDX] (LAB)
1	<0.5	<0.25		<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
2	<0.5	<0.25		<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
3	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
4	0.5-1.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
5	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	0.5-1.5	<0.17
6	0.5-1.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
7	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
8	<0.5	0.34	<0.2	<0.25	<0.25	<0.15	<0.10	0.5-1.5	<0.17
9	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
10	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
11	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	0.5-1.5	<0.17
12	<0.5	0.41	<0.2	<0.25	<0.25	<0.15	<0.10	0.5-1.5	<0.17
14	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
15	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
16	0.5-1.5	0.38	0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
17	<0.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
19	0.5-1.5	<0.25	<0.2	<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
20	<0.5	0.39	<0.2	<0.25	0.44	<0.15	<0.10	<0.5	<0.17
21	<0.5	0.50		<0.25	<0.25	<0.15	<0.10	<0.5	<0.17
22	<0.5	0.49		1.07	0.47	<0.15	<0.10	<0.5	<0.17
23	<0.5	0.49		0.46	<0.25	<0.15	<0.10	<0.5	<0.17
24	0.5-1.5	1.51		2.19	1.09	<0.15	<0.10	0.5-1.5	<0.17
25	<0.5	2.51		1.91	0.55	<0.15	<0.10	<0.5	<0.17
26	<0.5	1.24		2.48	1.85	<0.15	<0.10	<0.5	<0.17
28	0.5-1.5	1.62		2.90	2.31	<0.15	<0.10	<0.5	<0.17
29	<0.5	0.61	0.2-2.0	1.51	1.32	<0.15	<0.10	<0.5	<0.17
30	0.5-1.5	3.24		4.43	2.30	0.15-0.99	<0.10	1.5-3.0	0.17-0.99
31	<0.5	0.75		<0.25	1.31	<0.15	<0.10	<0.5	<0.17
32	0.5-1.5	1.62		1.62	3.79	<0.15	<0.10	0.5-1.5	<0.17
33	0.5-1.5	1.63		1.49	1.95	<0.15	<0.10	<0.5	<0.17
34	0.5-1.5	5.26		3.23	5.4	0.15-0.99	<0.10	<0.5	0.17-0.99
36	<0.5	2.91		1.19	4.55	<0.15	<0.10	<0.5	<0.17
37	3.0-4.0	23.1		12.58	31.3	0.15-0.99	0.1-0.99	1.5-3.0	1.2

Table 2. Summary of TNT and RDX Results in mg/kg

	DTECH					LAB	LAB	DTECH	LAB
SAMPLE	SDI [TNT]	MPP [TNT]	MPT [TNT]	IDE [TNT]	OHM [TNT]	8330 [TNT]	8330 [TNB]	SDI [RDX]	8330 [RDX]
38	<0.5	0.60		3.62	3.0	<0.15	<0.10	<0.5	<0.17
39	<0.5	2.83		<0.25	3.30	<0.15	<0.10	0.5-1.5	<0.17
40	<0.5	0.76		1.05	2.47	<0.15	<0.10	<0.5	<0.17
42	1.5-3.0	7.65		4.95	13.1	0.15-0.99	<0.10	<0.5	3.8
43	<0.5	1.79		1.42	4.55	<0.15	<0.10	<0.5	<0.17
44	0.5-1.5	0.88		0.64	1.33	0.15-0.99	<0.10	<0.5	<0.17
45	0.5-1.5	0.78		1.01	0.72	<0.15	<0.10	<0.5	<0.17
46	0.5-1.5	1.39		2.13	1.11	<0.15	<0.10	1.5-3.0	<0.17
47	0.5-1.5	7.55	2-15	0.99	3.32	1.3	<0.10	<0.5	<0.17
48	<0.5	1.21		<0.25	1.40	<0.15	<0.10	0.5-1.5	<0.17
50	<0.5	1.94		4.50	2.21	<0.15	<0.10	0.5-1.5	<0.17
51	0.5-1.5	3.42		3.40	2.66	<0.15	<0.10	<0.5	<0.17
52	5-15	23.12	2-15	12.47	28.7	1.4	7.9	0.5-1.5	0.17-[illegible]
53	40-50	156	20-150	39.99	52	35	29	50-150	100
54	0.5-1.5	3.99		7.02	4.16	<0.15	<0.10	3.0-4.5	<0.17
55	0.5-1.5	3.83		2.01	2.40	0.15-0.99	<0.10	3.0-4.5	<0.17
56	1.5	5.12		1.52	2.60	0.15-0.99	<0.10	<0.5	<0.17
58	3.0-4.0	7.64		3.68	4.73	0.15-0.99	<0.10	<0.5	<0.17
59	0.5-1.5	4.30		2.13	3.84	<0.15	<0.10	<0.5	<0.17
60	15-30	55.4	15	9.37	24.2	22	2.1	1.5-3.0	1.1
61	0.5-1.5	6.29		3.11	3.84	<0.15	<0.15	0.5-1.5	<0.17
62	4-40	27.03		114	83	2.1	130	150-300	290
63	5-15	22.87	2-15	13.01	1.83	2.0	4.8	15-30	46
64	400-500	713	200-2000	348	338	360	21	1.5-3.0	4.8
65	4000-5000	8620		6900	3170	6300	120	1.5-3.0	0.17-0.99
66	15000	8560		4090	2060	4000	120	3.0-4.5	12
68	5-15	16.52	2-15	11.67	8.0	2.8	2.5	0.5-1.5	2.6
69	400-500	759	200-1500	1390	313	460	74	50-150	140
70	15-30	23.39		23.23	12.1	4.2	11	0.5-1.5	7.8
71	5-15	7.52	2-15	7.21	4.4	1.0	2.5	1.5-3.0	3.2
72	40	31.72	15	139	101	5.1	150	150-300	340
74	5	14.19	2-15	16.84	7.9	1.6	4.9	>60	
75	4-30	18.86	2-15	7.14	11.2	2.2	9.4	30-45	63

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SAMPLE	DTECH SDI [TNT]	MPP [TNT]	MPT [TNT]	IDE [TNT]	OHM [TNT]	LAB 8330 [TNT]	LAB 8330 [TNB]	DTECH SDI [RDX]	LAB 8330 [RDX]
76	5-15	10.44	2-15	8.82	10.0	1.7	1.5	1.5-3.0	2.4
77	5-15	6.92	2-15	15.38	10.2	2.2	7.6	4.5-6.0	6.4
78	300-400	144	150	264	209	180	53	>60*	73
79	5-15	11.41	2-15	17.12	20.6	3.1	6.6	15-30	14
80	5-15	7.99	2-15	11.29	23.9	2.8	2.1	0.5-1.5	2.1
81	5-15	14.70		22.74	24.9	2.5	12	3.0-4.5	2.4
82	15-30	19.39	2-15	26.9	20.8	3.2	5.7	1.5-3.0	2
83	40-50	18.15		60.5	90	<0.15	100	>60*	94
84	15-30	28.5	2-15	136	61	3.8	64	>6**	23
86	15-30	26.8		96.4	23.3	3.6	22	30-45	34
87	5-15	12.66	2-15	55.7	39.3	2.6	72	50-150	150
88	5-15	5.53		13.6	9.3	3.2	2.8	0.5-1.5	1.2
89	150-300	110	20-150	253	166	78	18	<0.5	0.17-0.99
90	4-5	26567		28900	34800	18000	260	<0.5	<15
92	40-50	42.30		113	91	36	28	<0.5	<2.0
93	15000-30000	11700		6380	23200	11000	230	<0.5	<15
94	500-1500	88.6	20-150	165	162	88	84	<0.5	<5.0
95	3	>25		610	69	9.6	2.5	<0.5	<0.17
96	40000-50000	17900		320	32000	15000	220	<0.5	<15
97	4000-5000	2710		4550	3460	2200	95	<0.5	<5.0
98	15-30	7.15		22.8	31.3	3.5	1.7	<0.5	<0.17
99	15-30	5.32	2-15	14.0	26.0	6.4	1.7	<0.5	<0.17
100	50-150	49.6	2-20	112	106	26	12	<0.5	<0.17

SDI = Strategic Diagnostics, Inc. DTech™ test
MPP = Millipore plate assay
MPT = Millipore tube assay
IDE = Idetek, Inc. Plate assay
OHM = Ohmicron Environmental Diagnostics, Inc. plate test

* Result was >60 mg/kg using a 1:10 dilution of the original extract and <50 mg/kg using a 1:100 dilution of the original extract.

** Result was >6 mg/kg using the original extract and <5 mg/kg using a 1:10 dilution of the original extract.

Using the preliminary remediation goals (PRGs) given in Table 1 for residential and industrial soils, the EIA and HPLC data can be compared as shown in Table 3 (for residential and industrial PRGs).

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Table 3. Classification of Soil Samples by HPLC (Method 8330) and EIA for TNT

Residential PRG (48 mg/kg)				Industrial PRG (64 mg/kg)			
HPLC (8330) Result (mg/kg)	>48	1(1%)	10(11%)	HPLC (8330) Result (mg/kg)	>64	1(1%)	10(11%)
	0–48	77(87%)	1(1%)		0–64	76(84%)	3(3%)
		0–48 SDI Result	>48 TNT EIA (mg/kg)			0–64 SDI Result	>64 TNT EIA (mg/kg)
HPLC (8330) Result (mg/kg)	>48	0(0%)	11(12%)	HPLC (8330) Result (mg/kg)	>64	0(0%)	11(12%)
	0–48	68(78%)	8(10%)		0–64	71(80%)	7(8%)
		0–48 IDETEK Result	>48 TNT EIA (mg/kg)			0–64 IDETEK Result	>64 TNT EIA (mg/kg)
HPLC (8330) Result (mg/kg)	>48	0(0%)	11(12%)	HPLC (8330) Result (mg/kg)	>64	0(0%)	11(12%)
	0–48	75(84%)	3(3%)		0–64	77(86%)	1(1%)
		0–48 MP* PLATE Result	>48 TNT EIA (mg/kg)			0–64 MP* PLATE Result	>64 TNT EIA (mg/kg)
HPLC (8330) Result (mg/kg)	>48	0(0%)	5(12%)	HPLC (8330) Result (mg/kg)	>64	0(0%)	5(12%)
	0–48	36(88%)	0(0%)		0–64	36(88%)	0(0%)
		0–48 MP* TUBE Result	>48 TNT EIA (mg/kg)			0–64 MP* TUBE Result	>64 TNT EIA (mg/kg)
HPLC (8330) Result (mg/kg)	>48	0(0%)	11(12%)	HPLC (8330) Result (mg/kg)	>64	0(0%)	11(12%)
	0–48	70(79%)	5(5%)		0–64	72(81%)	6(7%)
		0–48 OHMICRON Result	>48 TNT EIA (mg/kg)			0–64 OHMICRON Result	>64 TNT EIA (mg/kg)

* MP = Millipore

** Three samples gave a result of 20-150 mg/kg. When quantitated using a standard curve, one sample was <48 mg/kg, another was between 48 and 64 mg/kg, and the third was >64 mg/kg.

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Tables 4a casts the data in somewhat different terms; according to "sensitivity" or ability to correctly classify positive-testing samples and "specificity," or ability to correctly identify HPLC negative-testing samples based on the residential PRG (48 mg/kg) cutoff. The overall "accuracy" is defined as the combination of the sensitivity and specificity. Table 4b records the per cent false positive and negative based on the HPLC Method 8330 as a reference method.

Table 4a. Accuracy of Soil Sample Classification using TNT Residential PRG (48 mg/kg)

	Sensitivity	Specificity	Overall Accuracy
SDI	91% (10/11)	99% (77/78)	98% (87/89)
IDETEK	100%	88% (69/78)	90%(80/89)
MP PLATE	100%	96% (75/78)	97% (86/89)
MP TUBE	100% (5/5)	100% (36/36)	100% (41/41)
OHMICRON	100%	90% (70/78)	91% (81/89)

Table 4b. Misclassification of TNT EIAs Using Residential PRG and HPLC as Reference

	Per Cent False Positive	Per Cent False Negative
SDI	1 (1/89)	1 (1/89)
IDETEK	10 (9/89)	0 (0/89)
MP PLATE	3 (3/89)	0 (0/89)
MP TUBE	0 (0/41)	0 (0/89)
OHMICRON	9 (8/89)	0 (0/89)

SDI TNT Field Assay:

The EIA yielded non-detectable results (<0.5 mg/kg) with 28 of the 43 soils measured below 0.15 mg/kg by HPLC. Therefore the EIA correctly predicted negative results 65% of the time on an absolute scale, *ie.* without regard to specified levels or cutoffs.. Of the remaining 15 "clean" soils the EIA yielded a result of 0.5-1.5 mg/kg for 14 samples (93%). In summary, the EIA gave values of ≤1.5 mg/kg for 98% of the soils judged "non-detect" by HPLC.

IDETEK TNT Laboratory Plate Assay:

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The EIA yielded no results of 0-48 mg/kg that had [TNT]>48 mg/kg by HPLC but 9 samples (10%) were classified by EIA as >48 mg/kg that HPLC classified as <48 mg/kg. These 9 samples had [TNT] ranges from below detection to 36 mg/kg (Table 5). The 1,3,5-trinitrobenzene (TNB) concentration was between 2.5-150 for these same samples. The Idetek product literature reports 47% cross-reactivity with TNB and the PRG for TNB in residential soil is 3.3 mg/kg. As a result, the assay reports "false positives" for TNT but is able to classify soils at the remediation level for TNB in all but one of these cases.

Table 5. Misclassified Soil Samples by Idetek and Ohmicron EIA vs. HPLC Method 8330

Sample	HPLC [TNT]	HPLC [TNB]	Idetek [TNT]	Ohm [TNT]
62	2.1	130	114	83
72	5.1	150	139	101
83	<0.15	100	60	90
84	3.8	64	136	61
86	3.6	22	96	23
87	2.6	72	56	39
92	36	28	113	91
95	9.6	2.5	610	69
100	26	12	112	106

MILLIPORE TNT Laboratory Plate Assay:

Using residential PRGs, the Millipore quantitative plate EIA showed agreement with HPLC for 97% (86/89) of the samples. Two of the three misclassifications wherein EIA and HPLC disagreed at the 48 mg/kg level had $[TNT]_{HPLC}$=50 and 55 mg/kg, respectively. Thus the EIA was within 4% and 15% of the cutoff level although it overestimated the HPLC result by about 100%.

MILLIPORE TNT Field Tube Assay:

To conform to the PRG evaluation guidelines, it was necessary to make quantitative estimates for three soil samples (#s 53, 89, and 94). The data indicated a TNT concentration of between 20 and 150 mg/kg so the absorbance values of the standards were used to make a calibration curve and the absorbances of these samples used to determined actual values instead of the range 20-150 mg/kg. This analysis resulted in all three samples agreeing with the HPLC data with regard PRG cutoff levels.

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OHMICRON TNT Tube Assay:

As shown in Table 3, there were eight misclassifications (all false positives) at the residential PRG (48 mg/kg). Similar to the Idetek product seven of these soil samples had high 1,3,5-trinitrobenzene levels)Table 5) to which this assay is very sensitive.

SDI RDX Field Assay: The residential PRG for RDX in soil is 4 mg/kg and for industrial soil is 17 mg/kg. Thus, we categorized the data as above using the residential level and also found very little difference by analyzing the data for industrial PRGs (Table 5).

Table 6a. Classification of HPLC Method 8330 and EIA for RDX Using PRGs

Residential PRG (4 mg/kg)

		0-4 SDI Result	>4 RDX EIA (mg/kg)
HPLC (8330) Result (mg/kg)	>4	[illegible]	13(15%)
	0-4	73(82%)	[illegible]

Industrial PRG (17 mg/kg)

		0-17 SDI Result	>17 RDX EIA (mg/kg)
HPLC (8330) Result (mg/kg)	>17	[illegible]	11(12%)
	0-17	76(85%)	[illegible]

Table 6b. Accuracy of Soil Sample Classification using RDX PRG

	Sensitivity	Specificity	Overall Accuracy
Residential PRG (4 mg/kg)	81% (13/16)	100% (73/73)	97% (86/89)
Industrial PRG (17 mg/kg)	92% (11/12)	99% (76/77)	98% (87/89)

Two samples (#s 66 and 70) were falsely negative by EIA giving values of 3-4.5 and 0.5-1.5, respectively, while the HPLC results were 12 and 7.8 mg/kg, respectively. This yields a false negative rate of 2%.

Precision Determination: Soil sample duplicates were collected in the field by one of the field personnel in a manner blind to the other collector. These samples were used to estimate the precision of the different analyses. The results are summarized in Table 7. The HPLC results are all within acceptance criteria (±35% relative percent difference) except for the #85/#87 pair. This gives an overall acceptance rate of 90%. The SDI field assay demonstrates reasonably close agreement except #67/#69 with values of 1500-3000 and 400-500, respectively, still giving an overall acceptance rate of 90%. The rest of the SDI TNT data is either in the same category or the adjoining category. Millipore plate and tube assays similarly meet the 35% RPD except for one pair, in this case #85/#87 for the plate assay (acceptance rate=90%). The Idetek EIA fails to

C.14-67

meet the 35% RPD criterion with four of the ten duplicate pairs (acceptance rate=40%). The Ohmicron EIA fails to meet the 35% RPD criterion for four of nine duplicate pairs (44%). The tenth pair (which was excluded from this analysis) includes sample 85 which was never accurately determined; giving a high out of range result with a 1:100 dilution and a low out of range result with a 1:1000 dilution.

Finally, the SDI RDX data for both HPLC and EIA both have 100% acceptance based on the 35% RPD requirement.

Table 7. Results from Field Duplicate Soil Samples

LAB DTECH DTECH LAB

Duplicate Pair	HPLC [TNT]	SDI [TNT]	MP PLATE [TNT]	MP TUBE [TNT]	IDETEK [TNT]	OHMICRON [TNT]	SDI [RDX]	HPLC [RDX]
13	<0.15	<0.5	<0.25	<0.2	<0.25	<0.25	<0.5	<0.17
14	<0.15	<0.5	<0.25	<0.2	<0.25	<0.25	<0.5	<0.17
18	<0.15	<0.5	0.28	<0.2	<0.25	<0.25	<0.5	<0.17
19	<0.15	0.5-1.5	<0.25	<0.2	<0.25	<0.25	<0.5	<0.17
27	<0.15	<0.5	0.50	0.2-2	1.78	0.41	0.5-1.5	<0.17
29	<0.15	<0.5	0.61	0.2-2	1.51	1.32	<0.5	<0.17
41	<0.15	0.5-1.5	1.85		2.01	2.98	<0.5	<0.17
43	<0.15	<0.5	1.79		1.42	4.55	<0.5	<0.
49	<0.15	0.5-1.5	5.05		2.89	2.26	<0.5	<0.17
51	<0.15	0.5-1.5	3.42		3.4	2.56	<0.5	<0.17
57	<0.15	0.5-1.5	3.46		4.05	2.4	0.5-1.5	<0.17
59	<0.15	0.5-1.5	4.30		2.13	3.84	<0.5	<0.17
67	530	1500-3000	658	200-1500	416	360	50-150	150
69	460	400-500	759	200-1500	1390	313	50-150	140
73	1.9	5-15	15.33	2-15	18.41	7.3	45-60	55
75	2.2	4-30	18.86	2-15	7.14	11.2	30-45	63
85*	36	15-30	37.2	2-15	119	50-667	50-150	150
87	2.6	5-15	12.66	15	55.7	39.3	50-150	150
91	11000	15000-30000	9490		4590	17900	<0.5	<15
93	11000	15000-30000	11700		6380	23200	<0.5	<15

* Sample 85 has possible tetryl and/or nitrobenzene (this may account for the high values observed).

Quantitative Comparison of EIAs with Method 8330: The SDI and Millipore tube kits are designed for semi-quantitative analysis, but the Millipore and Idetek plate kits and the Ohmicron tube kit are quantitative analysis tools. Therefore, these EIA results were evaluated on this basis. Additionally, for the SDI semi-quantitative kits, concentration ranges were also converted to continuous values for comparison with Method 8330 HPLC data. Results below the HPLC

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quantitation limit were excluded from regression analysis since the detection limits for the different methods were different and including them would bias the regression.. The quantitative analysis of these soils for TNT by both EIA and HPLC covered the range from below detection to 18,000 mg/kg. This large range in results complicates the comparison of the two methods. A simple linear correlation is dominated by the large values. Conversely, a comparison of log-transformed data emphasizes the low values. Figures 2-6 show the individual EIA products results *versus* Method 8330 results plotted on a log-log scale, since this includes more concentration regions of interest.

Categorizing the data by order of magnitude demonstrates that all the EIAs reasonably agree with each other and that HPLC gives many more results below 1 mg/kg. (Table 8).

Table 8. Classification of TNT Results by Frequency within Categories

Method	<1 mg/kg	1-10 mg/kg	10-100 mg/kg	100-1000 mg/kg	1000-10000 mg/kg	>10000 mg/kg	Total
HPLC	51	23	6	3	3	3	89
D TECH → SDI	28	26	24	5	3	3	89
IDETEK	25	29	18	11	5	1	89
MP PLATE	27	29	22	5	3	3	89
OHMICRON	23	31	22	7	3	3	89

Comments:

The field assays generate a significant amount of trash, as well as acetone or methanol solvent waste, which must be stored, transported, and disposed of as ignitable waste.

The operators of the assays in this were experienced chemists, but inexperienced personnel could use the EIAs with training and field experience. Required training should be included as part of the manufacturer's documentation.

Conclusions:

Semi-quantitative screening

All of the EIAs produced less than 5% false negatives at the residential PRGs. The false positives were 0-10% Thus the EIAs all have the potential to accurately screen soil samples for contamination at risk-based levels.

Quantitative Analysis

Several of the assays had significant positive bias compared with HPLC results below 1 ppm. This positive bias may result from intentionally adjusting the calibrators to reduce the number of false negatives or it could arise from cross-reacting compounds in the samples or a combination of

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the above. Measurement near the detection limit is often problematic, and the HPLC results below the quantitation limit of 1 ppm should be considered approximate. If DQOs for a project require accurate measurement below 1 ppm, spiked or reference samples with concentrations near the detection limit should be used as part of quality control.

Above 1 ppm, the correlation between the EIAs and HPLC was generally good.

References:

1. U.S. EPA Office of Solid Waste, *Test Methods for Evaluating Solid Waste, SW-846, Third Edition*, Update II, 1994.

2. U.S. EPA Quality Assurance Management Staff, *Interim Final Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process*, EPA QA/G-4, Washington, DC, 1993.

3. U.S. EPA Region IX, "Region IX Preliminary Remediation Goals (PRGs) First Half 1995," Memo from Stanford J. Smucker, Regional Toxicologist, February 1, 1995.

Acknowlegements:

The authors gratefully aknowledge the assistance and cooperation of the Sierra Army Depot Environmental Office for providing access to the site, Montgomery Watson and Strategic Diagnostics, Inc. for sharing their site characterization data, and Harding Lawson Associates for allowing us to use their on-site trailer. The invaluable assistance of the Analytical Services Section of the Hazardous Materials Laboratory for the Method 8330 analysis is much appreciated.

FIGURE 1. MAP OF THE SIERRA ARMY DEPOT TNT LEACHING BEDS

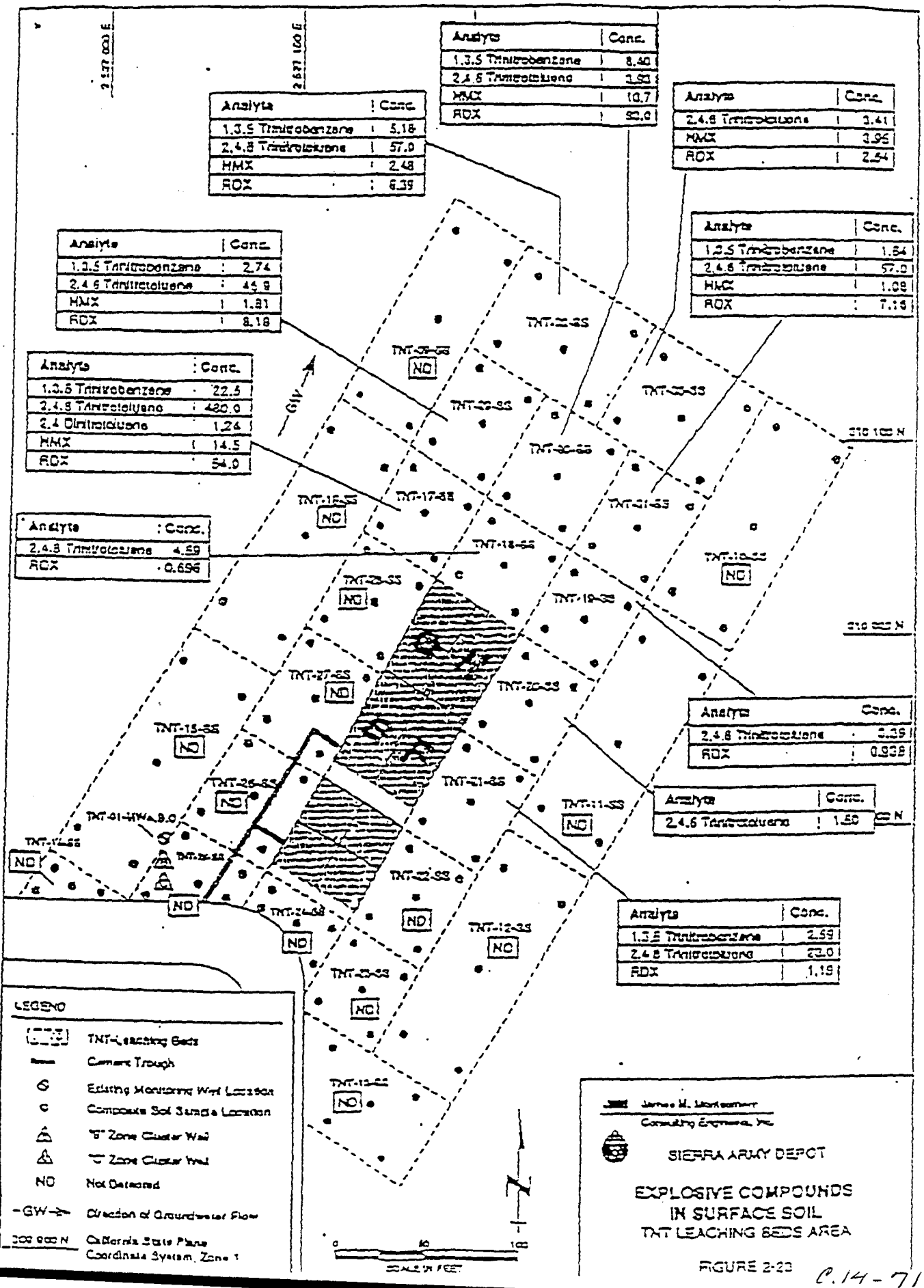
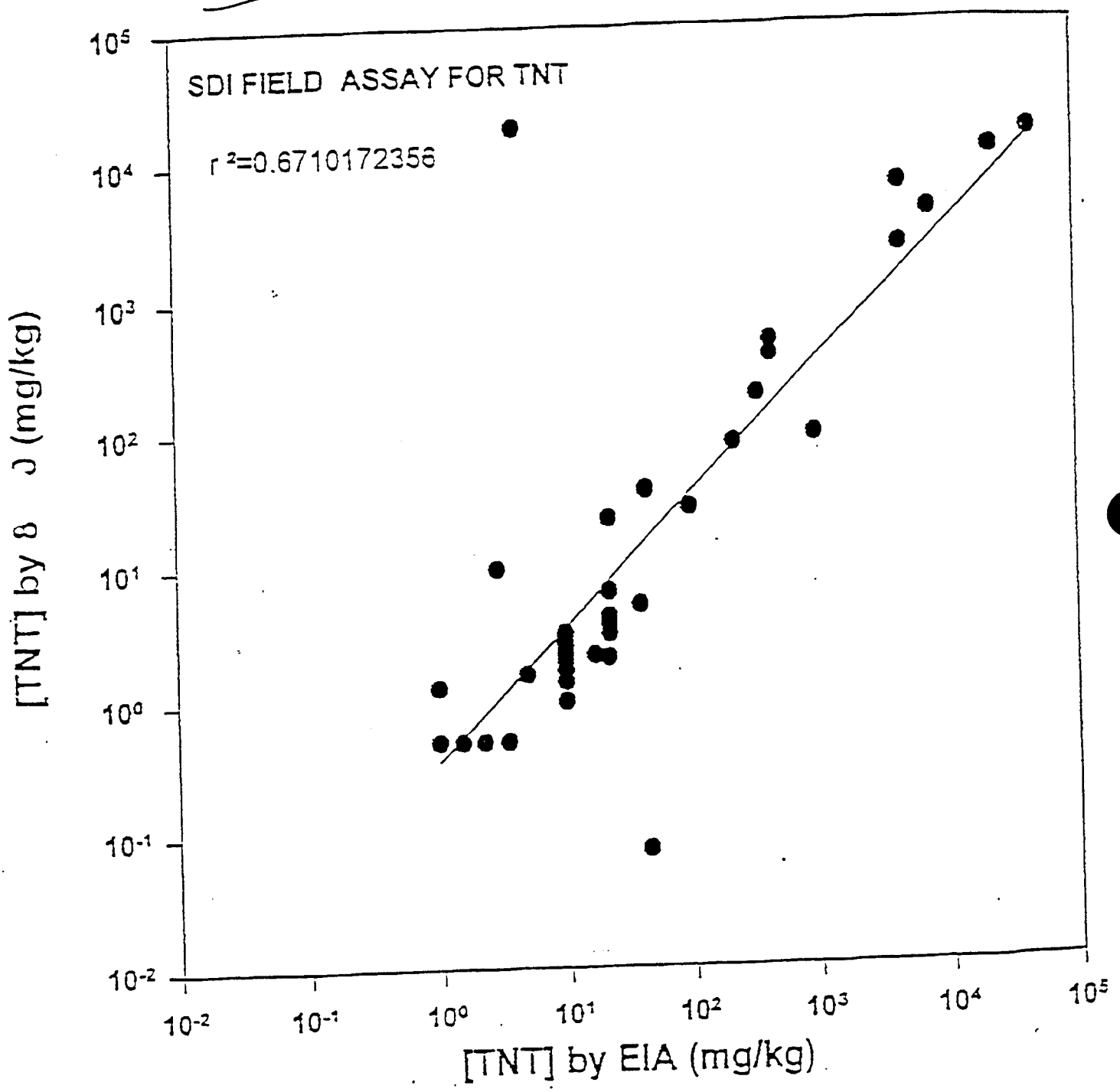


FIGURE 2. REGRESSION ANALYSIS OF EIA vs. METHOD 8330 (HPLC) FOR TNT

DTECH



C 14-72

Minnesota Pollution Control Agency

April 4, 1996

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112-5700

RE: Addendum No. 7 and Draft Property Deed Notice Approval
TCAAP Site F Closure Plan

Dear Mr. Fix:

The Minnesota Pollution Control Agency (MPCA) staff of the Hazardous Waste Regulatory Compliance Section Permit and Review Unit has reviewed your February 29, 1996, revised Addendum No. 7 to the Twin City Army Ammunition Plant (TCAAP) Site F Closure Plan. Thank you for incorporating previous MPCA staff recommendations into this version which includes Ordnance Quantification, Explosive Testing, and a proposed Property Deed Notice. Upon review of this submittal, we approve of Addendum No. 7 with the following understandings and modifications:

II. RISK-BASED CLEANUP LEVELS

page 1. Approval of the proposed human health risk-based cleanup goals for Antimony (6), Copper (840), and Mercury (6) ug/g respectively, will be contingent upon evaluation of gathered residual site concentrations for explosive compounds as outlined in the Addendum. Once Site F explosive data is available, MPCA staff will evaluate the proposed metal cleanup goals considering combined limited multiple direct exposure analysis (i.e., incidental soil/dust ingestion, dermal contact, and inhalation), and additivity of similar target endpoints. Incorporating previously negotiated PRC exposure assumptions for TCAAP, the proposed Site F metal cleanup goals, and site concentrations for explosive compounds;

- individual chemical specific noncarcinogenic Hazard Quotients must not exceed 1.0,
- cummulative noncarcinogenic Hazard Indicies must not exceed 1.0, and
- individual as well as cummulative Excess Cancer Risk must not exceed 1E-06.

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IV. HAZARDOUS SOILS

page 4. Under soil category 1, please clarify what ("...and V") means.

page 5. Based on previous discussions with Global Environmental Solutions representatives, the Corrective Action Management Unit is highly unlikely to be used at TCAAP. If this is true, reference to the possible use of a Corrective Action Management Unit for Site F wastes in Addendum 7 seems inappropriate. If construction of a Corrective Action Management Unit is a real possibility, please inform MPCA staff of this change in waste and soils management.

VIII. EXPLOSIVES TESTING OF SOILS

page 12. Please provide MPCA staff with the name of the laboratory the Army will be using for explosives analysis.

Please provide the laboratory's Quality Assurance Manual and the appropriate Standard Operating Procedures for method 8330 and nitroglycerin by method 8015.

MPCA staff also request that laboratory Quality Control information be submitted with the laboratory data report including surrogate recovery, spike and spike duplicates, standards calibration and narrative information as to acceptability of the data.

page 13. The Army shall coordinate with MPCA staff concerning any data anomalies that might indicated the presence of nitroglycerine and the need to run method 8015 to quantify nitroglycerine (based on field test kit and 8330 analysis). Further, a cleanup goal will have to be established for nitroglycerine if detected at levels of concern.

ATTACHMENT Z - DRAFT WORDING TO BE INCORPORATED INTO AN AFFIDAVIT AS SITE F DEED NOTICE

Lead:

Based on our January 16, 1996, meeting with representatives from Global Environmental Solutions, it was agreed that the Site F property deed notice/affidavit language would specify the lead cleanup goal of 300 ug/g (ppm).

As we have discussed, effective September 1993 (after TCAAP Site F goal was established) the bare soil lead abatement statutory standard (Minn. Stat. § 144.871-144.879, and Minn. R. 4761.0300) was amended to 100 ppm for residential property and playgrounds. While we agree that Site F goal of 300 ppm does not warrant a deed restriction, we do require sites cleaned up to residual lead levels above background, or the current 100 ppm, to have a deed notice regarding past contamination.

Other metals and explosives:

If based on limited multipathway analysis as discussed above, metal and/or explosive levels to be left in place pose a human health risk i.e., Hazard Quotients > 1.0, Hazard Indicies >1.0, or Excess Cancer Risk > 1E-06 (using previously negotiated PRC exposure assumptions), the deed notice must also include residual metal and/or explosive concentrations remaining in place at excess risk levels.

Ordnance:

If quantified ordnance to be left in place poses a safety risk i.e., exceeds recommended Department of Defense Explosives Safety Board standards, the deed notice must also include ordnance quantities remaining in place at excess risk levels.

Legal description of Site F "box"

While the Army's legal description of the Site F "box" will include the entire "Site F Closure Area" shown on Figure 3, the MPCA's closure certification approval will more specifically distinguish between the investigatory areas (all of "Site F Closure Area") and the remediated areas (defined exclusion zones).

FIGURE 3

Just to clarify, we understand that the following samples will be taken within the following disposal areas:

Sample #	DA
3	7
11	15
12	2
13	5
14	18

Samples for ordnance quantification will include the entire 25 x 25 foot sampling area, whereas samples for explosives will be taken from the center of the grid.

You may contact Dan Card at 612/297-8379, or Beth Gawrys at 6132/297-8376, of my staff if you have any questions regarding this approval of Addendum No. 7. Please notify Mr. Card or Ms. Gawrys at least two weeks in advance of beginning field work at Site F.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:mln

C.14-76

Minnesota Pollution Control Agency

January 22, 1997

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway Ten, Suite A
Arden Hills, Minnesota 55112-3928

RE: Approval of Site F Risk-Based Cleanup Levels for
Antimony, Copper, and Mercury, and Explosive Analysis
Twin Cities Army Ammunition Plant
MN7213820908

Dear Mr. Fix:

The Army has proposed in Section II of the February 19, 1996, Twin Cities Army Ammunition Plant (TCAAP) Site F Closure Plan Addendum Number 7, risk-based cleanup levels for post-treated soils as follows:

- Antimony 6 ug/g
- Copper 840 ug/g
- Mercury 6 ug/g

As we have discussed, our approval of these proposed risk-based cleanup levels was contingent on explosive analysis as outlined in Section VIII of Addendum Number 7. Explosive sampling was complete on October 30, 1996, and analysis completed on December 9, 1996, by Interpoll Laboratories, Inc. using EPA SW846 method 8330.

The following information was reviewed by Minnesota Pollution Control Agency (MPCA) staff related to approval of the proposed risk-based levels:

- December 9, 1996, data (received via facsimile) from Wenck Associates, Inc. (supersedes November 19, 1996, explosive analysis).

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- October 31, 1996, Interpoll Laboratories, Inc. Determination of Nitroaromatics and Nitramines by High Performance Liquid Chromatography in Soil, Sediment, and Sludge Samples.

- December 16, 1996, Interpoll Laboratories, Inc. Quality Assurance Quality Control Report, Project Number 8532.

Based upon review of the above data and reports, MPCA staff approve the explosive soil analysis and the proposed risk-based cleanup levels for copper, antimony, and mercury listed above, with the following conditions:

1. The Army shall identify the distribution of mercury within the batch treated non-hazardous soil piles at the Building 503 asphalt pads, and propose a management plan for backfilling at Site F that provides for soils containing higher concentrations of mercury to be placed within the deepest Disposal Areas in an effort to minimize human and environmental exposure.

2. The Army shall state in the Property Deed Affidavit (Notice) that treated soils containing mercury concentration up to ____ug/g were backfilled within Disposal Area #_____.

3. All other non-hazardous stockpiled soils at the Building 503 asphalt storage pads meeting these new risk-based goals, or previous established goals, may be returned anywhere within the Site F exclusion zone for backfilling.

This approval is also based on our understanding that the ordnance quantification effort outlined in Section VII of Addendum Number 7, and performed on October 29-30, 1996, indicates that there was no unexploded ordnance ("live rounds") discovered in the 503 pad soils, nor in any other soils evaluated at Site F. Exploded ordnance (casings, projectiles etc.) which was quantified and will remain at Site F will on average, for any 25 foot by 25 foot area, contain approximately five (5) ordnance related items to a depth of two feet. Quantified ordnance will be fully described in the Site F Closure Certification Report.

Lastly, on January 15, 1997, we received the revised Enclosure Z to Addendum 7 which address the contents of a proposed Notice. Overall, it appears that the revised Enclosure Z describes the contents of the Notice (with the exception of mercury as described in item two (2) above), but is not formatted in accordance with accepted MPCA affidavit protocol. We will be submitting specific comments on the revised Enclosure Z, and attempt to meet your requested response date of January 24, 1997.

C14-78

You may contact Dan Card at 612/297-8379, or Beth Gawrys at 612/297-8376, of my staff, if you have any questions regarding this letter.

Sincerely,

for Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:mln

Enclosure

cc: James Persoon, Alliant/Global Environmental Solutions, TCAAP, Arden Hills

C-14-78

Minnesota Pollution Control Agency

February 3, 1997

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway Ten, Suite A
Arden Hills, Minnesota 55112-3928

RE: Approval of Treated and Untreated Soils
Explosive Testing at Site F
Twin Cities Army Ammunition Plant
MN7213820908

Dear Mr. Fix:

As discussed during our January 30, 1997, conference call, the Department of the Army requested a separate cover letter addressing the Minnesota Pollution Control Agency's (MPCA) approval of treated and untreated soils explosive testing at Site F.

As noted in our January 22, 1997, letter, the following information was reviewed by MPCA staff:

- December 9, 1996, data (received via facsimile) from Wenck Associates, Inc. (supersedes November 19, 1996, explosive analysis).
- October 31, 1996, Interpoll Laboratories, Inc. Determination of Nitroaromatics and Nitramines by High Performance Liquid Chromatography in Soil, Sediment, and Sludge Samples.
- December 16, 1996, Interpoll Laboratories, Inc. Quality Assurance Quality Control Report, Project Number 8532.

Based on the available data, MPCA staff have determined that residual explosive levels in untreated soils and post-treated soils do not pose an unacceptable risk to human health. Therefore, it is not necessary to establish cleanup goals for explosives in these soils at Site F.

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Having completed investigation of residual explosives in soils to be left in place or backfilled at Site F, no further action is warranted at this time. We thank you for your cooperation in evaluating this concern.

You may contact me at 612/297-8379, or Beth Gawrys at 612/297-8376, if you have any further questions or concerns on this issue.

Sincerely,

Dan R. Card, P.E.
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

DRC:mln

C 14-81

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
4700 HWY 10- SUITE A
ARDEN HILLS, MINNESOTA 55112-3928

REPLY TO
ATTENTION OF

March 6, 1997

SIOTC-EV (200-1b)

SUBJECT: Site F Closure - Disposition of the Mercury-Containing Soils Stored on the 503 Pad and Notice of Work Continuance

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

P554 446 436

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
520 Lafayette Road
St. Paul, MN 55155

Dear Mr. Card:

References:

(a) Letter, MPCA, January 22, 1997, SAB.
(b) Army/MPCA meeting, February 20, 1997 and meeting minutes (enclosed).
(c) Letter, MPCA, January 27, 1997, SAB.

The purpose of this letter is to respond to MPCA conditions 1 & 2 expressed in referenced letter (ref a) and to notify MPCA that Army has selected MPCA's option one (1) as noted in referenced meeting minutes (ref b); that is, distribute the soils from the 503 pad with mercury levels that exceed 1 µg/g, along with other non-hazardous soils, on to Site F without specific locations being documented. This approach is the same as agreed to in Addendum No. 7 of the Site F Closure Plan. In addition, the deed affidavit language would include information regarding the concentrations of mercury remaining in the soil that had been placed at Site F and would note that there is no use restriction on the property.

Our response to your letter of January 27, 1997, (ref c) has been delayed as the proposed language for the deed affidavit is undergoing Corps of Engineers Real Estate Property review. We anticipate this activity will be completed by March 27, 1997.

Army is continuing activities to close Site F and plans to initiate movement of the soils not requiring mixing to begin within the next few weeks, weather permitting. This letter is our official notice to you of that action.

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If you have any questions, please contact Mr. Marty McCleery, SIOTC-EV, 612/633-2301, ext. 1651.

Sincerely

Scott F. Lantz
Acting Commander's Representative

Enclosure

Copies Furnished:

GES, ATTN: Mr. Jim Persoon (w/encl)
U.S. Army Corps of Engineers, Omaha District, ATTN: CEMRO-MD-HA, Mr. Jay Hodges (w/encl)
HQ, IOC, ATTN: AMSIO-GCE, Mr. Tom Jackson (w encl)

C14-83

Meeting Re: Site F Closure
Minutes
Thursday February 20, 1997 1:00 PM
Minnesota Pollution Control Agency (MPCA) offices, St. Paul Minnesota.

Attendees: Bruce Brott, Dan Card, Beth Gawrys (MPCA); Martin McCleery, Mike Fix (U.S. Army); and Jim Persoon, Joel Sandstrom, and Jean Brewster Alliant Techsystems / Global Environmental Solutions (Alliant/GES)

Attendee's List is attached.

Marty McCleery opened the meeting by stating that a review of the current status of Addendum 7 would be conducted. Marty indicated that the Army had agreed upon the terms of Addendum 7, had contracted the services required to perform the actions described in Addendum 7, and is prepared to meet the requirement of Addendum 7. Remaining tasks from Addendum 7 include:

- decontamination of the Site D pad,
- decontamination of the concrete pad used as a transfer area during the loading of the previously stockpiled Site F soils into rail cars for off-site disposal,
- agreement upon the language of a property deed affidavit,
- and other tasks related to the final closure of Site F,
- movement of 503 pad soils to Site F, grading and revegetation, and decontamination of the 503 pad,
- scraping of the Site F hazardous waste pile storage area to remove hazardous soils and confirmatory sampling, and
- finalize closure report.

Marty also noted that no additional funds were available at this time to do work beyond the work scope that had been contracted based on Addendum 7.

Dan Card noted that the April 4, 1996, letter (in which MPCA approved Addendum 7) stated that the risk-based cleanup levels could be modified pending explosive analysis and ordnance quantification/analysis. Per the MPCA letter of February 3, 1997, explosives and ordnance quantification are not an issue at Site F and no further action is required for these items. The last issue is to develop the risk-based cleanup goals for antimony, copper and mercury. In the letter of January 22, 1997, MPCA suggested approval of the remediation goals cited in Addendum 7 for antimony, copper and mercury but wanted the placement of the piles with the highest mercury levels in the deepest former disposal areas located at Site F to minimize potential mercury exposure. This was a change from the previously approved Addendum 7, which had a mercury clean up level of 6 ug/g. The recently calculated risk-based level for mercury is 1 ug/g.

C. 14-84

Bruce Brott noted that there was already agreement on Addendum 7 with the exception of the mercury issue, which had been discussed previously in a January 30 telephone call between the MPCA, the Army and Alliant/GES. During the telephone conversation the issue was not resolved. He suggested focusing the meeting on the unresolved issue(s) and asked if there were any other issues about Addendum 7 that needed resolution. All of the parties agreed that there were no issues with other areas of Addendum 7 and agreed to focus on resolution of the mercury issue.

Marty McCleery said that he would like to know how the mercury level of 1 ug/g was developed and what the regulatory driver(s) was for the 1 ug/g value. He was also concerned about mercury related language that would appear in the Deed Affidavit for Site F.

Dan Card noted that in the earlier stages, the existing EPA method was used to develop the mercury level and Wenck had proposed 6 ug/g. This was based on the technical memorandum developed by Montgomery Watson for the OU-2 Draft Feasibility Study (FS) in 1995. At the time, it was agreed that the Site F cleanup would be consistent with the FS. Beth Gawrys noted that the EPA had not included the inhalation pathway in their risk assessment and had agreed to include this pathway for the latest draft of the OU-2 FS. The latest draft of the OU-2 FS, however, focused on the industrial use scenario and so the Preliminary Remediation Goals for residential use were not recalculated. In the meantime, the MPCA developed draft soil reference values (SRVs) for metals including mercury SRVs, which are risk-based values derived from exposure pathways for groundwater and surface water. The value calculated for mercury is 1 ug/g. The SRVs are not final but are out for public notice (since April 1995). They were developed by the MPCA risk assessor from the Superfund Section and the SRVs were developed with multiple pathways. The values can be changed if circumstances are different than the assumptions used to develop the SRVs, such as if the mercury is in a non-volatile form such as mercury sulfide. However, it was noted that mercury was found in air sampling at Site F during the excavation work. Beth Gawrys noted that, if the inhalation pathway is included, the SRV for mercury may be reduced to 0.7 ug/g. This potential SRV has not been published.

Dan Card noted that, under RCRA, the clean closure standard is often stricter than closure standards under CERCLA. If it is not possible to meet the clean closure standard, then other cleanup numbers will be considered (reviewed as possible). If actual cleanup numbers are above the cleanup standards, then a deed affidavit will be required.

It was noted that GES (Joel Sandstrom) had provided MPCA with the information on the mercury concentrations for the soil piles at the 503 pad areas. These concentrations range up to 2.01 ug/g. and 26 batches had mercury concentrations above 1.0 ug/g. Thus, MPCA stated that a deed affidavit will be required since mercury concentrations exceed the current SRV of 1 ug/g.

Marty McCleery asked what was the legal driver for the deed affidavit and how much information needs to go in the deed affidavit. Dan Card stated Minnesota Statute 115 is the legal driver for the deed affidavit requirement. The Army noted that the deed affidavit needs to be worded so that it is very clear that there are no use restrictions on the property. Bruce Brott agreed, but noted that, whenever there is a clean up action where the clean up levels are numbers other than background, other requirements must be met. In this case, it is the deed affidavit. MPCA indicated that the remaining levels of mercury must be noted in the deed affidavit if the soils were hauled to Site F and the location of the soils was not documented. MPCA noted that this does not infer or imply a use restriction on the property.

It was noted by the MPCA that only 20 % of the risk from mercury was assumed to come from the site (80% was assumed to come from other sources). The MPCA notified EPA two years ago that there was substantial evidence for assuming that 80% of the mercury exposure came from off-site sources. When metal concentration rise above background levels, then risk-based numbers are used and these numbers are developed based on current information.

Regarding exposure to explosives, the MPCA risk assessor assumed that 100% of potential exposure to explosives came from the site.

Marty McCleery noted that, if it were possible and it did not add cost to the project, the Army could place the highest mercury-containing soils in the deepest holes at Site F, as suggested in the January 22, 1997, letter from the MPCA to the Army. The MPCA noted that for the soil batches that are less than 1 ug/g, there is no need for discussion and these batches could be backfilled immediately and anywhere on Site F, without other requirements.

Bruce Brott stated that for the piles of soil that have mercury concentrations that are greater than the 1 ug/g, the Army has two options:

1) distribute the soils from the 503 pad with mercury levels that exceed 1 ug/g, along with other non-hazardous soils, onto Site F without specific locations being documented. The deed affidavit language would include information regarding the concentrations of mercury remaining in the soil that had been placed at Site F and would note that there is no use restriction on the property;
2) placing the piles of soil that have mercury concentrations above 1 ug/g in the deeper areas at Site F. There would be no requirement for placing information on mercury concentrations in the deed affidavit. The closure report would, however, reflect that the soils containing the higher mercury concentrations were placed in the deeper areas at Site F.

Mike Fix then asked for a sidebar meeting with the Army and Alliant/GES.

When the meeting was reopened, Marty McCleery stated that the Army would evaluate the two options and would notify the MPCA of the Army decision in a few days.

Marty then noted that, whatever the resolution regarding the mercury-containing soils, there would likely be a delay in the Army review of the deed affidavit language (MPCA had requested a response by February 28, 1997) because Tom Jackson from the IOC legal department wanted the Army Corps of Engineers Real Estate personnel to review the proposed language.

Bruce Brott noted that, in considering the options, it should be noted that long-term liability may be of concern, and that the risk-based numbers change. Even if it is not required, to benefit the potential buyer, and minimize future liability, the option for placing soil in deeper disposal areas should be considered. He also noted that there is a trend to have more deed affidavits and to err on the conservative side in order to alert future generations of property owners.

Dan Card noted that another option would be to send the mercury-containing soil off site for disposal but Marty indicated that this was not being considered.

Other issues were then discussed:

- Beth Gawrys noted that with regard to the need for monitoring collected rainwater at the soil piles at the 503 pads, the Solid Waste Section had indicated that there would be no problem if the water met Health Risk Limits (HRLs). She noted that there were several potential standards and the Solid Waste Section would probably apply the strictest of the standards. She indicated that if the available water sampling results were forwarded to the Hazardous Waste Section, they would coordinate with other sections of MPCA do determine what was allowed.

- Alliant/GES (Jim Persoon) updated MPCA on the status of the Site F area where hazardous soils had been removed off site. Metal testing results had indicated the need for additional scraping of the site and Alliant/GES was planning that activity. When the Work Plan is prepared, MPCA will be provided with a copy for review and approval.

- Dan Card noted that they also expected a plan describing the decontamination for the rail car loading pad used for soils from Site F.

- The potential decontamination of the 503 pads will depend on the results of wipe sampling as described in Addendum 7. The decontamination of Site D pad is also covered in Addendum 7.

Action for the Army includes three items:

1- Providing MPCA with MCES sewered water test results for the 503 pads.
2- Providing the decontamination plan for the rail car loading pad.

3- Providing the MPCA with the Work Plan for additional soil scraping, sampling and disposal at Site F.

Action for the MPCA includes:

1- Coordinating and providing Army with a determination for monitoring stormwater runoff from the 503 pad.

C. 14-88

Site F Meeting
MPCA - Room 31
Thursday, 20 February 1997 - 1:00 P.M.

Name	Organization	Telephone No.
[illegible]	ATK	(612) 633-2301 x16
MICHAEL R. FIX	TCAAP	(612) 633-2301 x1661
[illegible]	MPCA	[illegible]
Dan Card	MPCA	612-297-8379
Marty McCleary	Army TCAAP	612-633-2301 x1651
Jim Peterson	Alliant/GES	612-633-2301 x1631
JEAN BREWSTER	Alliant/GES	612 633 2301 x1635
Brian Gannon	MPCA	612/297-8376

C.14-89

C.15 Site F Hazardous Soil Disposal - Operations Plans and Correspondence

Operations Plan
for
Disposal of Site F Hazardous Soils

Introduction

Alliant Techsystems/Global Environmental Solutions, DYNEX, and BELAIR Excavation conducted a site assessment on 11/11/96. This assessment was to determine the best method to minimize risk in removal and transportion of approximately 4,500 tons of stockpiled contaminated soil from site F at the Twin City Army Ammunitions Plant, Arden Hills, MN. The tasks shall include loading and relocating the hazardous soils from Site F via twenty-five ton capacity trucks to a concrete pad at Building 515. Off-loading onto this pad will be followed by immediate placement into rail cars. Existing roadways will be used where possible, but a portion of the route will be constructed at the Site F area.

Exclusion Area

An evaluation was conducted of means for loading and moving trucks out of the exclusion area without drag-out of contaminated soil. The option selected was to build an asphalt turn-around at the western edge of the exclusion area. Construction of the turn around will be placed on the western part of the exclusion area. (See drawing) The turn-around will be built on the ninety-foot boundary line adjacent to Stockpile 18B.

The design of the asphalt pad allows both the entrance and exit to extend outside the exclusion area. The trucks would never come in contact with exclusion zone base soils. This turn-around, combined with strict dust/soil control practices, would eliminate the need to decontaminate the trucks with water before leaving the exclusion zone. A single front-end loader will remain within the exclusion zone throughout the entire project and will transfer stockpiled soils to trucks. Before the truck leaves this pad, a laborer will sweep exposed truck surfaces and tires and remove any soil that fell onto the pad during the loading process. This process will eliminate contaminated soil drag-out..

Rail Car Loading Area

Building 515 represents the shortest distance to rail access from Site F (see attached figure). Adjacent to the rail is a large and very solid concrete loading pad. The existing construction has the concrete pad and the rail sufficiently close that the rail car's side overlaps the pad. The pad slopes visibly away from the rail. An asphalt pad will be constructed between the rail and concrete pad. This approach will eliminate any ground contamination by allowing easy collection of soils that fall beneath the rail car during the car loading process. The cleanup of soils that fall on asphalt pad, next to rail, will be removed by sweeping and shoveling between each rail car load. Soils will be off-loaded from trucks by dumping onto the pad, and a front-end loader will immediately reload these materials onto the rail cars. Two laborers will sweep exposed truck surfaces and tires and clean the work area after each load. The operation will cease if snow or heavy rain occurs while working. The area will be covered with a plastic tarp at the end of each day. The single front-end loader used for rail car loading will be confined to a defined exclusion zone on the concrete pad until project completion. The only exception to this rule would be if the front end loader was needed for heavy snow removal and decontamination of the front end loader was performed. The front-end loader and all equipment will be decontaminated on this pad. Final decontamination of this area will incorporate heavy brushing of the concrete to remove residual

contaminated soil and confirmation sampling using the EPA Standard Wipe Test Method for lead. This standard wipe test method will be applied for other metals as necessary.

Other Conditions

Soils will not be transported from the Site F exclusion zone under conditions sufficient to cause runoff at the rail car loading pad. Loading onto rail cars is a much faster operation than truck loading, therefore soil ***will not*** *accumulate on this pad at any time during the project. Each night the pad will be cleaned and covered to prevent potential migration of contamination due to high winds or precipitation conditions. Emergency absorbents will be at the loading pad and will be used if the risk of runoff from light rain or snowfall exists. Decontamination of equipment will be done within a curbed plastic containment. Water from the containment will be collected in drums, analyzed, and properly disposed.*

Transport Route

The Site F improved road leads to Snelling Avenue, south along Snelling approximately 500 feet to Utility Road, west approximately three blocks to the rail car loading pad. Snelling Avenue and utility Road are asphalt construction. There are three previously traveled roads to the Site F hazardous soils. The selected route is a well established route that exits off Snelling Avenue and partially leads to the exclusion zone along the north side of the Site F excavated area. Minimal construction is required to complete this route to the hazardous soils without impact to the excavated area. To accomplish this, previously stockpiled clean soil will be moved slightly from its current position but will not be moved into any excavated area. The trucks will travel on the same road coming in and out from the exclusion zone. Equipment will be decontaminated on the asphalt pad. Final decontamination will include removal and proper disposal of the asphalt pad.

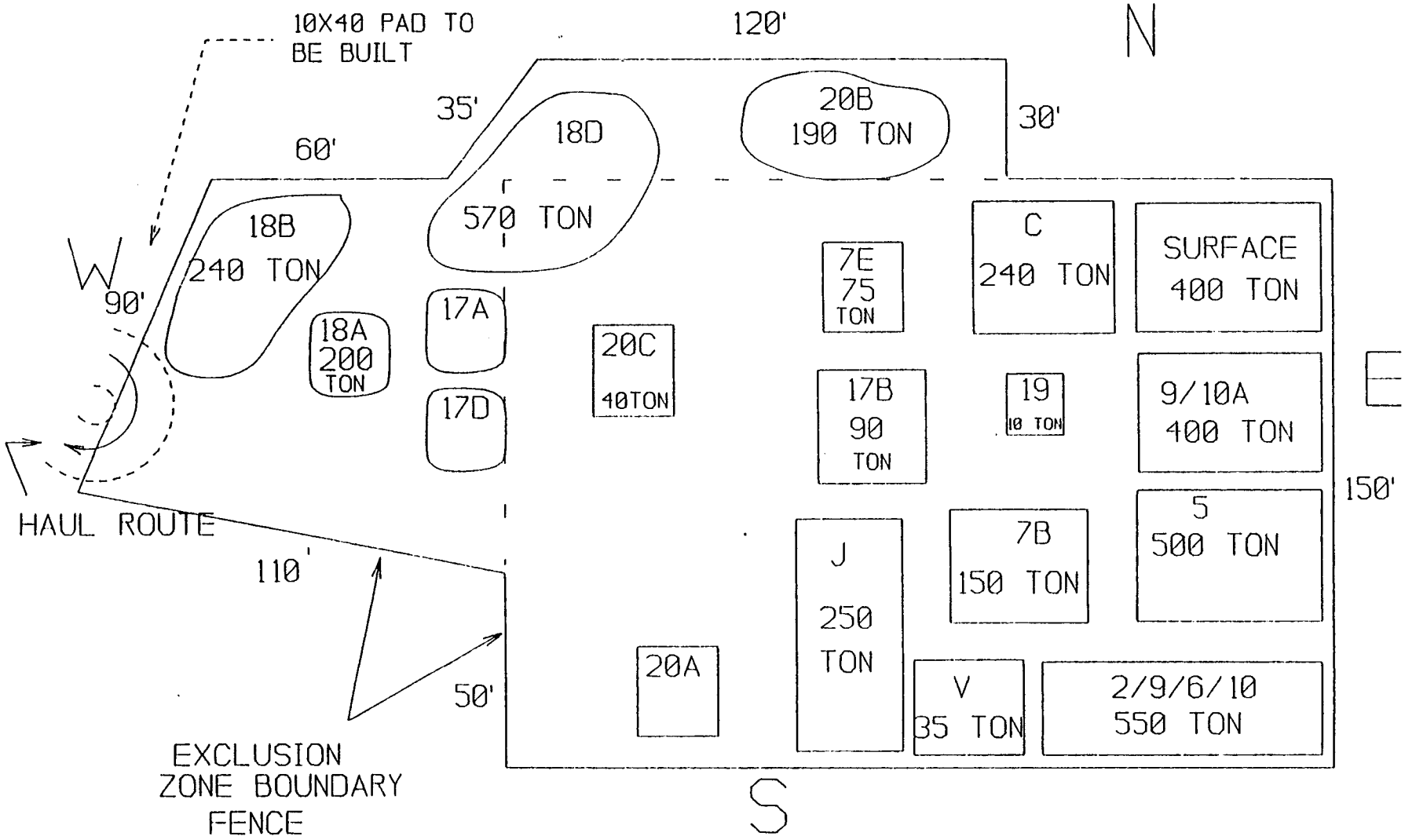
Dust Control

Inspecting of the stockpiles indicate that the soil is damp and will not require dust control. Continued perimeter monitoring will be used throughout the operation. Minimal watering of the soil will be applied should conditions change.

Supporting Attachments

A drawing indicating the stockpiles within the exclusion area have been included. Also provided is a map showing the road from the Exclusion Area to the Load Site.

C 15-3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120'
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570 TON
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7E
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90
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19
10 TON
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400 TON
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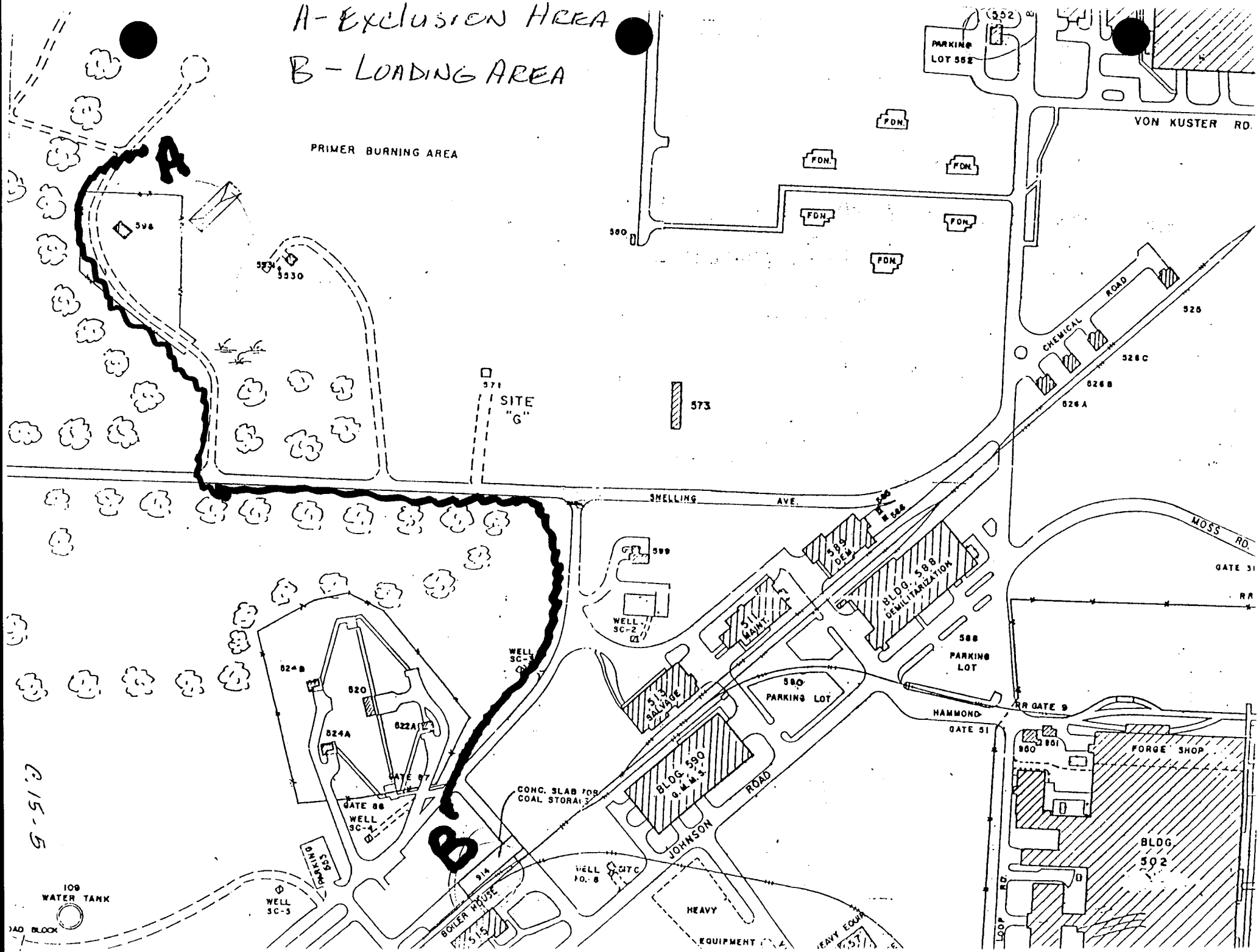
110'
J
250
TON
7B
150 TON
5
500 TON
50'
20A
V
35 TON
2/9/6/10
550 TON
EXCLUSION
ZONE BOUNDARY
FENCE
S

C-15-4


A - EXCLUSION AREA
B - LOADING AREA
PRIMER BURNING AREA
A
B
PARKING LOT 552
552
VON KUSTER RD.
FDN.
FDN.
FDN.
FDN.
FDN.
FDN.
560
596
553
5530
571
SITE "G"
573
CHEMICAL ROAD
525
526C
526B
526A
SNELLING AVE.
599
WELL SC-2
511 MAINT.
589 DEM.
BLDG. 588 DEMILITARIZATION
588 PARKING LOT
MOSS RD.
GATE 31
RR
580 PARKING LOT
513 SALVAGE
HAMMOND GATE 51
RR GATE 9
624B
620
624A
622A
GATE 87
GATE 88
WELL SC-1
WELL SC-2
CONC. SLAB FOR COAL STORAGE
BLDG. 590 O.M.M.S.
JOHNSON ROAD
860
861
FORGE SHOP
BLDG. 592
655 PARKING
914
BOILER HOUSE
515
WELL NO. 8
WELL SC-3
109 WATER TANK
HEAVY EQUIPMENT
LOOP RD.
C-15-5

March 26, 1997 **sent via facsimile**

Jean Brewster
Alliant Techsystems, Inc.
TCAAP Building 105, MN 24
New Brighton, MN 55112

RE: Comments on 3/18/97 Phase II Operations Plan for
Disposal of Site F Hazardous Soils

Dear Ms. Brewster:

General Comment

- The MPCA verbally approved the final 12/5/96 Phase I Operations Plan (received via FAX). We agreed to not approve in writing, but will approve inadvertainly when we approve the Closure Report. We will take this same approach for the Phase II Operations Plan.

- Please submit a final Phase II Operations Plan (facsimile initially, followed by hardcopy) which incorporates the below comments.

Introduction

- Per the 1/3/97 Site F Closure Status Report, confirmation metals sampling of the Site F exclusion zone hazardous soil stockpile area was done on 12/2/96 and 12/3/96. Analytical results were expected by 1/2/97. For reference, the plan notes that only lead (Pb) and antimony (Sb) failed previous goals. The plan should note exactly which hazardous metals were analyzed and what the goals were at the time of confirmation sampling.

- Secondly, MPCA staff have not had the opportunity to review the analytical results for 86 samples taken. Even though it will be documented in the final Closure Report, please submit a summary of the lab analytical at this time.

- Ideally, the plan should reflect the most current approved cleanup goals. While 6 ug/g was the original background derived goal for antimony, through the 1/22/97 MPCA approval of Addendum 7 to the Closure Plan, the MPCA approved a risk-based goal of 6 ug/g for antimony and 840 ug/g for copper. More recently, Alliant Techsystems has verbally requested using the current MPCA residential based Soil Reference Value (SRV) for antimony (14 ug/g) and copper (1300 ug/g). Since copper was not a hazardous metal analyzed for confirmatory sampling related to disposal of hazardous soils, the Phase II Operations Plan is not dependent on MPCA approval of the copper SRV. However, at this time we are coordinating with MPCA Superfund staff and their EPA counterpart on the feasibility of using SRVs for antimony and copper considering previous risk methodology established at TCAAP. We suggest if Alliant Techsystems wants to pursue using the antimony and copper SRV, please request this in writing through an Addendum 8 to the Closure Plan. In the mean time, it is

C 15-6

assumed that the most current approved risk-based antimony goal of 6 ug/g will be used to conduct confirmatory sampling related to disposal of hazardous soils.

Decon Area/Truck Turn-around

- Please submit the attached drawing as stated in text.

- Given that only polyethylene sheeting will be used as a decon base rather than asphalt, it is subject to more tearing by the trucks. What mil thickness will the poly be?

- The plan states that the poly will be replace as necessary during operation. MPCA staff question whether additional confirmation sampling is necessary under the poly decon area if poly has to be replaced often and a large amount of soil spillage occurs. Perhaps we need more discussion on how will laborers will decontaminate the decon area/truck turn-around after all stockpiles are removed.

- It does not appear that a sand barrier will be placed over the poly liner to protect it which would prevent visual observation of a tear. If the poly liner does tear, confirmation sampling should also be done at the loading area.

- MPCA staff assume the loading truck will break up the ice layer by driving over it. Therefore we disagree that the ice will provide a good barrier between the soil and the poly.

Final Loading Pad Decon

- Please submit a tentative schedule/estimate when they will submit the separate Building 515 pad decontamination plan.

Railcar Loading Area

- Please submit the attached drawing as stated in text.

- The plan states that a sand berm underlain with poly will be constructed between the rail and concrete pad. Further, at project completion the sand will be collected by vacuum and loaded onto the last railcar. Perhaps a statement such as, "If excessive soil spillage occurs during loading operations throughout the project, the spilled soil will be collected from the poly liner and placed into the railcar." A visual inspection at the end of each day should be made of the rail spur and concrete interface. This is to eliminate any potential wind erosion or run-off due to excessive soil spillage during operations.

Dust Control/Air Monitoring

Please specify the type of equipment to be used. It is assumed that Dynex will monitor air for particulate Pb, Sb, and dust; not volatile metal air monitoring.

You may contact me at 612/297-8379 or Beth Gawrys at 612/297-8376 if you have any questions regarding our comments.

Sincerely,

Dan R. Card, P.E.
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

C. 158

Minnesota Pollution Control Agency

May 2, 1997

Ms. Jean Brewster
Alliant Techsystems, Inc.
Building 105, MN24
Twin Cities Army Ammunition Plant
New Brighton, Minnesota 55112

RE: Comments on April 28, 1997, Phase II Operations Plan for Disposal of Site F Hazardous Soils

Dear Ms. Brewster:

It appears all Minnesota Pollution Control Agency (MPCA) staff comments of March 26, 1997, have been incorporated into this revised Phase 2 Operations Plan. Based upon our review of the revised plan, we have the following additional comments.

Introduction

- With regard to changing the Nickel and Silver cleanup goals to residential Soil Reference Value (SRV)s to accommodate scraping of surface soils which failed confirmation sampling, MPCA staff do not feel there is sufficient justification to warrant this proposal.

  To date, management of all contaminated soils treated by soil washing soil leaching, and all failed goal piles managed at the 503 pad (now returned to Site F) were governed by the original established cleanup goals for Nickel (45 ug/g) and Silver (5 ug/g). In accordance with the Federal Facility Agreement, Site F is required to "clean close" in accordance with RCRA cleanup protocol. The Army agreed with this as the Site F cleanup goal. Historically, this entails cleanup to background levels for metal contaminated soils. Original cleanup goals for Site F were in fact not truly background, but a modified background level.. Policy allows deviation from clean closure if it can be demonstrated that it is not economically or technically reasonable, practical, or feasible to comply with this RCRA cleanup philosophy.

  Based on the less than desirable performance of the soil washing soil leaching treatment technology for some of the metals present at Site F, MPCA staff have agreed to pursue residential risk-based cleanup goals (SRVs) for Antimony, Copper, and Mercury. We felt that a good faith attempt was taken to achieve background goals, but it was not technically

achievable for these metals. This has been reflected through the numerous Addendum's to the original Site F Closure Plan. However, we feel there is no compelling reason to modify the cleanup goals for Nickel or Silver since a majority of the treated batches were able to achieve the originally established modified background cleanup goals. MPCA staff have been more than accommodating to this point in the project at approving requests for addendum's to the Closure Plan. But, changing the Nickel and Silver goal at this particular time in the project just to reduce the amount of soil (approximately 40-50 tons) that needs to be scrapped and sent off-site is an unacceptable reason. In fact grid SB877 must be scrapped anyway for failure of the lead, antimony, and mercury goals, so the estimated quantity impacted by this decision is even less.

- With regard to scraping/excavation, the plan states that 3 to 6 inches of surface soils will be removed from the grids that failed to meet cleanup goals. Figure 1 indicates that areas to be scraped will center around the sampling point, which is located in the center of each 25 by 25 foot grid. The plan should state that the horizontal extent of scraping/excavation will include the entire 25 by 25 foot grid.

- Figure 1. Please indicate that grid SB 857 failed the lead goal, and grid SB 865 failed the antimony goal.

You may contact me at 612/297-8379 or Beth Gawrys at 612/297-8376 if you have any questions.

Sincerely,

for Dan R. Card, P.E.
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

DRC:mh

C15-10

Global Environmental Solutions
An Alliant Techsystems Operation

Alliant Techsystems Inc.
Global Environmental Solutions
4700 Highway 10, Suite F Tel.: 612-633-2301
Arden Hills, MN 55112 Fax 612-633-7166

May 22, 1997

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card and Ms. Beth Gawrys
Hazardous Waste Division
Regulatory Compliance Section
520 Lafayette Road
St. Paul, MN 55155

Dear Mr. Card and Ms. Gawrys:

Enclosed for your files is a copy of the final Operations Plan for Phase II Disposal of Site F Hazardous Soils.

This final version addresses the minor MPCA comments made in your letter of May 2, 1997, as follows:

1. The text now states that the grid areas that failed to meet cleanup goals for nickel and silver will be scraped/excavated along with other grid areas that failed to meet cleanup levels designated in Addendum 8.

2. The text now clearly states that the entire 25 x 25 foot area of a failed grid area will be excavated.

3. Figure 1 now shows that Grid 857 failed for lead and Grid 865 failed for antimony.

We will notify you when the selected contractor provides a schedule for performing additional scraping/excavation.

Sincerely,

James R. Persoon

Enclosure

cc: M. McCleery, SIOTC-EV (w/encl)
M. Fix, SIOTC-CO (w/encl)
GES Files (w/encl)

C:\smc\data2\sallv\phaseiiplan ltr

C 15-11

Operations Plan
for
Phase II
Disposal of Site F Hazardous Soils

Introduction

Alliant Techsystems/Global Environmental Solutions (GES), DYNEX, and Belair Excavation completed Phase I of the disposal of hazardous soils from Site F in December 1996. This involved removal and off-site transport/disposal of approximately 4420 tons of stockpiled contaminated soil, in accordance with a Minnesota Pollution Control Agency (MPCA)-approved operations plan. Following removal of the stockpiles, a grid pattern was established across the entire exclusion zone area (25 ft by 25 ft grids) and confirmatory samples were collected from the surface soil in each grid area.

Confirmatory sampling for antimony, barium, cadmium, chromium, copper, lead, mercury, nickel and silver was performed on 12/2/96 and 12/3/96. Analytical results were compared to agreed-upon cleanup goals, in accordance with the Site F Closure Plan, and are presented in Table 1. Agreed-upon cleanup goals for these metals are presented in Table 2.

A second phase (Phase II) is required because confirmatory sample results (listed in Table 1, which is attached) indicated that, although all soil samples met the cleanup goals for copper, cadmium, and chromium, underlying soils from some of the grids did not meet all of the designated cleanup goals, which are shown on the attached Table 2.

All but two grid areas (Grids 877 and 879) had mercury concentrations below 1.5 µg/g. A sample from one grid area (Grid 879) had a mercury concentration of 2.1 µg/g. The mercury cleanup level agreed upon in Addendum 7 was 6.0 µg/g. However, more recent soil reference value (SRV) guidelines regarding mercury concentrations have been developed by the MPCA since Addendum 7 was approved. Currently for Site F, it has been agreed that soils form the 503 pads that have mercury concentrations below 2.0 µg/g may be placed at Site F if a deed affidavit that will document the mercury concentration in the Site F soils is attached to the property deed. In accordance with this agreement, the grid area with a mercury concentration of 2.1 µg/g will not be scraped.

One sample of a duplicate pair from one grid area (Grid 877) exceeded 6.0 µg/g , the agreed-upon cleanup goal for mercury identified in Addendum 7. The other sample of the duplicate pair was below 6.0 µg/g but above 2.1 µg/g. This grid area will be scraped (it is also above the cleanup goals for lead and antimony) and additional sampling for mercury and any other elements that failed to meet the agreed-upon closure requirements in the Phase I sampling will be performed.

One grid area (Grid 891) had a nickel concentration of 105 µg/g, which is above the agreed-upon cleanup goal of 45 µg/g but is well below the more recent SRV guideline of 520 µg/g. Two grid areas (Grids 846 and 877) had silver concentrations (5.33 µg/g and 11.0 µg/g , respectively) that exceeded the Addendum 2 goal of 5 µg/g but were well below the more recently developed SRV of 174 µg/g. All three of these grid areas will be scraped.

Tasks for Phase II include scraping/excavation of approximately 3 to 6 inches of surface soils from the entire 25 x 25 foot area of grids that failed to meet cleanup goals, stockpiling of the scraped soil, collection of additional confirmatory samples from the scraped areas, loading of the stockpiled soils, and transport to the rail car loading area. The final steps will be the same as in Phase I and will include the transportation, via rail, of the soils for treatment and disposal in an off-site landfill.

C.15.12

Site Preparation

Marked Grid Areas

Initially, the grid areas that do not require scraping will be marked with flags. No vehicle that has been in contact with the soil in areas that require scraping will enter the flagged areas. Clean vehicles that are newly arrived at the site after being pre-washed in a shop area may, if necessary, be allowed to traverse a single pass in one direction over the flagged areas from other clean areas or from outside the exclusion zone. If a flagged area is contacted by the equipment during scraping operation, that grid area will be considered contaminated. The entire 25 x 25 foot grid area will then be scraped and sampled with other scraped areas. To ensure compliance with this requirement, GES will continually monitor the exclusion zone operation.

Decon Area/Truck Turn-around

The truck decon area will be set up as in Phase I (see attached Figure 1), if road conditions warrant use of this area. The decon pad will be constructed with asphalt as in Phase I, or with reinforced concrete if asphalt is not available. The decon pad will be part of a turn-around and the design of the decon pad allows both entrance and exit to extend outside the exclusion area. The trucks used for soil transport will not come in contact with exclusion zone base soils. This decon pad and turn-around, combined with strict dust/soil control practices, will eliminate the need to decontaminate the trucks with water before leaving the exclusion zone. Emergency absorbents will be maintained at the area and will be used to berm the area if the risk of runoff from light rain or snowfall exists. As in Phase I, the decon pad will be removed and disposal will take place with the rest of the soils.

Exclusion Area Operations

Stockpile Area

An area of soil to be scraped near the edge of the exclusion zone will be selected as a temporary soil stockpile area. Although the stockpile location will be selected from grid areas that are destined for additional scraping, the stockpile area will be underlain with a poly liner. This liner will be used to prevent loading of the metals of concern onto surface soils.

Scraping/Excavation

Only tracked vehicles will be used in the exclusion zone in order to minimize rutting and soil dragout from areas where the vehicles operate, and those vehicles will be pre-washed before entering the exclusion zone. A single trackhoe and a single traxcavator (front-end loader on tracks) will remain within the exclusion zone throughout the scraping. Vehicles will enter the exclusion zone from the decon area location and travel to the eastern portion of the site. The route will exclude grid areas determined to be clean. These will have been previously flagged, as noted above.

Scraping/excavation will be initiated at the eastern part of the exclusion zone. The trackhoe will be positioned adjacent to an area to be scraped. The trackhoe will scoop the soils and deposit them at a designated location. The traxcavator will then transfer the soils to a designated stockpile area.

Stockpile Development

One or more stockpiles will be initiated at an area near the western or southern edge of the exclusion zone near the location of the decon pad. The stockpiles will be developed as the excavation proceeds from the eastern edge of the site and continues toward the west.

Additional Scraping as Required

If confirmatory sampling (as described in the next section) indicates that a grid area must be scraped again, then the equipment will be decontaminated and plywood will be laid down before advancing across surface of clean grids. The grid area will be scraped again to collect another 3 to 6 inches of surface soil. The excavator (trackhoe) will place the scraped soils directly into the traxcavator bucket (approximately 50 percent larger than the trackhoe bucket), which will be extended into the space above the area to be scraped.

Confirmatory Sampling
After scraping the soil surface of designated grid areas, confirmatory soil samples will be collected. The samples will be analyzed only for the element(s) that failed to meet cleanup standards in Phase I for that grid area. If confirmatory sample results indicate that the grid area still does not meet the cleanup goal, then an additional 3 to 6 inches of soil will be scraped from the surface and deposited in the stockpiles. The grid area will then be sampled yet again and analyzed for the particular metal(s) that did not meet the Site F cleanup goal.

After results from all sampling rounds are complete, a technical memorandum detailing the sample results from all confirmatory sampling rounds will be developed and included in the Final Site F Closure Report.

Loading of Stockpile at Site F
After confirmatory sample results indicate that the scraped areas meet cleanup standards, the stockpiled soils will be loaded into 25-ton off-road trucks and transferred to the rail car loading area. These are the same trucks that were used for Phase I and are not adapted for tarping. Again, to control soil and dust, management practices will require that trucks be loaded to less than freeboard to ensure the soils remain in the truck during transport and thus control soil and dust. Stockpiled soil will be loaded into the trucks using the trackhoe, and loading operations will be continuously observed. Before a truck leaves the decon area, exposed truck surfaces and tires will be swept and soil that fell onto the poly liner during the loading process will be removed. Collected soils will be placed into the truck for transfer to the rail car loading area. This process will eliminate contaminated soil drag-out.

Final Decontamination of Equipment
The equipment will be decontaminated on the decon pad after soil removal is complete, using vigorous brushing. Water will be used if necessary, and in that case, decon water will be vacuumed from a temporary bermed area (sand berm), containerized, and tested for metals contamination before disposal.

Rail Car Loading Area
The same rail car loading operation used for Phase I disposal of Site F hazardous soils (Nov/Dec 1996) will be incorporated. Building 515 represents the shortest distance to rail access from Site F (see attached Figure 2). A large concrete loading pad is adjacent to the rail. The existing construction has the concrete pad and the rail sufficiently close that the rail car's side overlaps the pad. The pad slopes visibly away from the rail. As in Phase I, a sand berm underlain with poly will be constructed between the rail line and concrete pad. This approach will eliminate any ground contamination by allowing easy collection of soils that fall beneath the rail car during the car loading process. A visual inspection of the rail spur and concrete interface will be performed daily to observe potential soil spillage from the loading operations. If significant spillage occurs, the spilled soil will be collected from the liner and placed into the rail car. At project completion, the sand will be collected by vacuum and loaded onto the last rail car.

As in Phase I, soils will be off-loaded from trucks by dumping onto the concrete pad within a marked exclusion area, and a front-end loader will immediately reload these materials into the rail cars. Two laborers will sweep exposed truck surfaces and tires and clean the work area between each load. Collected soils will be placed in a rail car. The operation will cease if snow or heavy rain occurs. The work area will be covered with a plastic tarp at the end of each day. A single dedicated front-end loader used for rail car loading will remain in the defined exclusion zone on the concrete pad until project completion unless decontamination of the front-end loader was performed before it left the exclusion zone.

Final Loading Pad Equipment Decon
The front-end loader and all equipment will be decontaminated on the rail car loading pad with heavy brushing. Water will be used, if necessary, and as weather permits. If water is required, final decontamination of equipment will be done in a temporary sand-bermed, poly-lined area. Water that accumulates during decontamination will be collected in drums, analyzed, and properly disposed. Decon

water, if required, will be collected in a temporary poly-lined berm, containerized, sampled, and disposed of appropriately.

Final Loading Pad Decon

Per an agreement with the MPCA, a separate plan will be developed to describe the final decontamination of this area and provided to MPCA for review and approval. Currently, the pad remains covered and is inspected weekly, per MPCA agreement. It is anticipated that the pad will be decontaminated using scarification, which requires the use of equipment to be procured from out of state. The plan will be provided to MPCA no later than May 30, 1997.

Other Conditions

Soils will not be transported from the Site F exclusion zone under weather conditions likely to cause runoff at the rail car loading area. Loading into rail cars is a much faster operation than truck loading, therefore, soil will not accumulate on this pad at any time during the project. Each night the decon pad at the exclusion zone and the loading pad will be cleaned and covered to prevent potential migration of contamination due to high winds or precipitation. Emergency absorbents will be maintained at the pad areas and will be used if the risk of runoff from light rain or snowfall exists.

Transport Route

The Site F improved road leads to Snelling Avenue, south along Snelling approximately 500 feet to Utility Road, west approximately three blocks to the rail car loading area. Snelling Avenue and Utility Road are asphalt construction. They are the three roads used in Phase I to transport the Site F hazardous soils. The selected route is a well established route that exits off Snelling Avenue and partially leads to the exclusion zone along the north side of the Site F excavated area. Minimal construction was required in the previous phase of the work to complete this route to the hazardous soils. Previously stockpiled clean soils were moved, creating this access road. This same access road will be used for both entering and exiting the exclusion zone.

Dust Control/Air Monitoring

Inspection of the soils area indicates that the soil is damp and will not require dust control other than the management practices for loading and transport that are noted above. Conditions will be observed continuously, and if they change, sufficient water to minimize dust will be applied as necessary.

DYNEX performed perimeter air monitoring and air sampling for particulate lead during Phase I of this activity and found sample results to be below laboratory detection limits. Based on this data, because work and site conditions during Phase II will be similar to those in Phase I, DYNEX will not initially collect air samples and will not initially require air-purifying respirator use. A real-time air monitor (MiniRam) for particulates will be used to evaluate dust conditions in work areas and at the exclusion zone perimeter. DYNEX will observe site conditions and monitoring results from Phase II operations and initiate additional air monitoring, air sampling and respirator use as necessary, based on the requirements of the DYNEX Health and Safety Plan developed for the project. Air purifying respirators will be available at all times.

TABLE 1

Summary of Metal Analysis
Phase I Stockpile Removal
Site F

Grid Area	Lead (µg/g)	Antimony (µg/g)	Cadmium (µg/g)	Chromium (µg/g)	Copper (µg/g)	Mercury (µg/g)	Nickel (µg/g)	Silver (µg/g)
SB 833	**686**	5.3	<0.5	9.31	80.1	0.19	9.71	<0.5
SB 834	**2260**	10.8	<0.5	10.1	333	0.168	9.5	<0.5
SB 835	**908**	6.8	0.51	11.1	90.4	0.207	10.9	<0.5
SB 836	**1370**	**23.6**	<0.5	8.7	577	0.154	8.3	<0.5
SB 837	187	4.0	<0.5	10.5	56.9	0.032	11.2	<0.5
SB 838	**787**	**23.3**	0.5	12.5	253	0.069	10.5	<0.5
SB 839	**793**	**21.8**	<0.5	12.4	258	0.175	9.2	<0.5
SB 840	151	1.2	<0.5	13.4	32.4	0.02	14.2	<0.5
SB 841	**1000**	6.6	<0.5	9.1	184	0.072	8.4	<0.5
SB 842	**4950**	**41.7**	0.5	10.9	223	0.363	9.4	<0.5
SB 842 Dup	**2340**	**26.9**	<0.5	9.3	614	0.249	10.3	<0.5
SB 843	69.6	11.2	0.75	11.0	52.3	0.104	10.5	2.6
SB 844	61.3	1.3	<0.5	9.1	18.9	0.036	9.13	<0.5
SB 845	62.9	1.2	<0.5	8.11	43.4	0.330	7.85	<0.5
SB 846	156	8.29	<0.5	10.7	33.8	0.020	8.66	**5.33**
SB 847	**5660**	**43.1**	0.69	12.0	118	0.472	10.5	<0.5
SB 848	197	2.1	<0.5	10.6	65.7	0.274	11.3	<0.5
SB 849	**636**	13.4	<0.5	9.64	355	0.262	7.75	<0.5
SB 850	176	5.4	0.73	9.88	56.7	0.105	9.62	<0.5
SB 851	**528**	**27.9**	<0.5	11.8	68.6	0.486	8.61	<0.5
SB 852	**527**	10.8	<0.5	9.33	134	0.347	8.6	<0.5
SB 853	212	7.08	<0.5	8.63	61.2	0.723	7.15	<0.5
SB 854	**1510**	**16.4**	<0.5	9.9	498	0.306	11.0	<0.5
SB 855	**2680**	**28.4**	<0.5	11.0	241	0.759	10.9	<0.5
SB 855 Dup	**1460**	**22.5**	<0.5	9.98	533	0.344	9.24	<0.5
SB 856	253	4.5	<0.5	6.79	40.2	0.021	9.64	<0.5
SB 857	**420**	6.94	<0.5	11.6	73.4	0.142	19.2	<0.5
SB 858	**1560**	**20.3**	<0.5	8.98	450	0.273	7.9	<0.5
SB 859	**1580**	**27.8**	<0.5	9.64	421	0.516	8.67	<0.5
SB 860	**1920**	**18.4**	<0.5	10.0	316	0.503	10.6	<0.5
SB 861	26.6	1.2	<0.5	6.96	7.26	0.036	6.54	<0.5
SB 862	**1310**	**18.1**	0.62	10.9	751	0.278	10.2	<0.5
SB 863	**3850**	**42.7**	0.580	10.1	926	0.342	7.82	<0.5
SB 864	**308**	11.9	<0.5	9.53	54.6	0.299	8.17	<0.5
SB 864 Dup	**555**	**16.0**	<0.5	9.72	60.6	0.358	6.42	<0.5
SB 865	**1660**	**16.2**	<0.5	8.17	147	0.770	7.96	<0.5
SB 866	**6850**	5.01	0.520	10.7	167	0.896	9.25	<0.5
SB 867	**1560**	**30.4**	<0.5	8.89	383	0.258	8.59	<0.5
SB 867 Dup	**1300**	**25.4**	<0.5	10.3	225	0.960	7.82	<0.5
SB 868	**512**	<5.0	<0.5	8.68	87.9	0.944	9.48	<0.5
SB 869	**3850**	**66.3**	<0.5	10.0	369	0.580	9.89	<0.5
SB 870	189	13.3	<0.5	9.06	63.7	0.473	10.1	<0.5
SB 871	217	**18.0**	<0.5	13.1	45.6	1.0	12.0	<0.5
SB 872	**5360**	**99.0**	<0.5	10.1	502	1.4	11.2	<0.5
SB 873	190	11.7	<0.5	7.72	21.6	0.69	8.50	<0.5
SB 874	**382**	13.6	<0.5	7.76	82.1	0.54	9.06	<0.5
SB 875	**444**	8.96	<0.5	8.39	80.4	0.51	9.07	<0.5
SB 876	64.5	9.37	<0.5	9.05	18.5	0.17	9.55	<0.5

C 15-16

Summary of Metal Analysis
Phase I Stockpile Removal
Site F

Grid Area	Lead (µg/g)	Antimony (µg/g)	Cadmium (µg/g)	Chromium (µg/g)	Copper (µg/g)	Mercury (µg/g)	Nickel (µg/g)	Silver (µg/g)
SB 877	**1210**	**44.8**	<0.5	11.3	59.7	**6.8**	9.54	**11.0**
SB 877 Dup	**639**	**26.6**	<0.5	10.3	77.1	**4.5**	7.67	<0.5
SB 878	12.4	1.3	<0.5	5.36	7.53	0.08	6.88	<0.5
SB 879	191	11.8	<0.5	10.7	37.8	2.1	10.5	<0.5
SB 880	274	5.7	<0.5	11.9	167	0.34	11.3	<0.5
SB 881	**2500**	**42.4**	<0.5	11.8	250	0.86	11.8	<0.5
SB 882	**523**	9.88	<0.5	7.71	51.0	0.21	10.8	<0.5
SB 883	**4050**	**61.7**	<0.5	9.62	326	1.1	9.29	<0.5
SB 884	5.83	<1.0	<0.5	11.0	10.6	0.05	15.5	<0.5
SB 885	49.9	1.5	<0.5	9.34	20.4	<0.02	8.25	<0.5
SB 886	**1530**	**48.1**	<0.5	11.9	308	0.74	9.19	<0.5
SB 887	127	10.6	<0.5	9.74	30.6	0.45	10.6	<0.5
SB 887 Dup	121	7.72	<0.5	9.87	30.0	0.42	9.64	<0.5
SB 888	19.7	<1.0	<0.5	12.2	11.7	0.10	13.7	<0.5
SB 889	13.7	7.22	<0.5	13.3	11.7	0.07	15.4	4.05
SB 890	44.7	5.30	<0.5	18.9	13.4	0.65	11.5	<0.5
SB 891	195	6.52	<0.5	11.7	52.1	0.28	**105**	<0.5
SB 892	126	**14.6**	<0.5	8.89	38.6	0.57	9.18	<0.5
SB 893	96.4	6.13	<0.5	10.8	30.2	0.62	8.33	<0.5
SB 894	10.8	12.1	<0.5	7.19	42.9	0.26	8.13	<0.5
SB 895	267	5.5	<0.5	13.0	56.1	0.222	11.4	<0.5
SB 896	67.6	9.64	<0.5	14.6	19.7	0.108	12.6	<0.5
SB 897	17.9	1.2	<0.5	11.8	10.3	0.0413	15.5	<0.5
SB 897 Dup	18.9	1.4	<0.5	13.7	10.4	0.0435	12.8	<0.5
SB 898	259	8.94	<0.5	12.6	66.1	0.448	8.51	<0.5
SB 899	240	10.3	0.540	12.3	47.7	0.183	13.1	<0.5
SB 900	256	2.5	0.790	10.2	56.4	.242	9.44	<0.5
SB 901	238	3.2	0.810	11.2	63.4	0.138	14.6	<0.5
SB 902	73.9	5.0	<0.5	20.4	34.2	0.168	12.1	<0.5
SB 903	45.6	1.8	0.50	11.0	30.1	0.138	9.01	<0.5

TABLE 2

TCAAP Site F
Comparison of Remediation Goals

Metal	Addendum 1 Remediation Goals (µg/g)	Addendum 2 Remediation Goals (µg/g) [1]	MPCA-Approved Revision of Cadmium Remediation Goal (µg/g)	Addendum 7 Remediation Goals (µg/g)	Addendum 8 (Proposed) Remediation Goals (µg/g)
Antimony	2.0	4.0		6.0[2]	14.0[2]
Cadmium	1.2	1.2	2.0-4.0[3]		
Chromium	32.0	100			
Copper	25.5	80		840[2]	1300[2]
Lead	300	300			
Mercury	0.1	0.3[4]		6.0[4]	
Nickel	19.3	45			
Silver	1.4	5			

Notes:

(1) Addendum 2 remediation goals are the enforceable cleanup standards, except as modified in the MPCA-approved revision of cadmium and in Addendums 7 & 8.

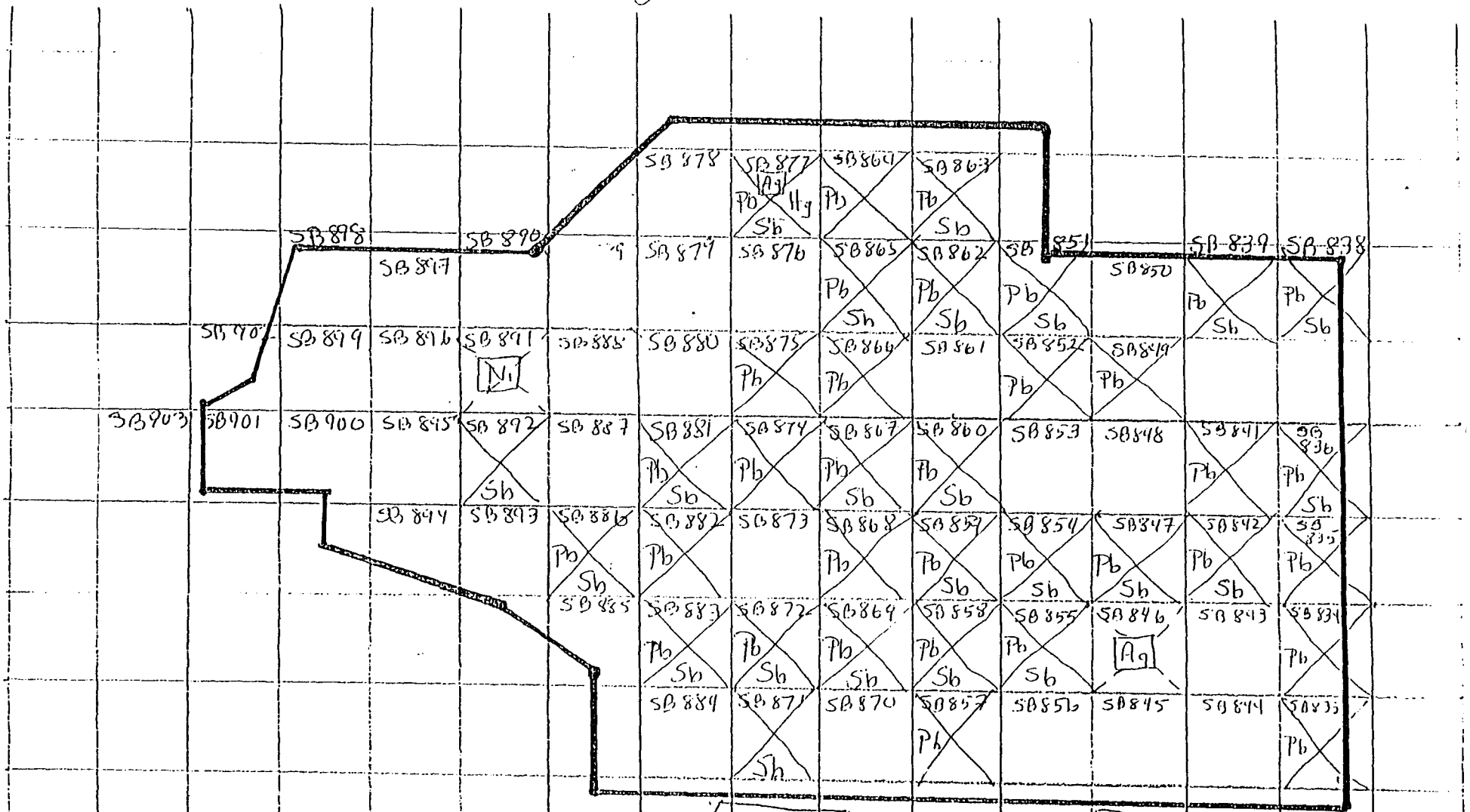
(2) Antimony and copper remediation goals were modified, based on MPCA guidance for residential (unrestricted) use soil reference values (SRV).

(3) Any unit of treated soil with 2.0 µg/g of cadmium or less in all samples (not an average) can be backfilled with no deed restriction for cadmium placed on the property. Other specific conditions of the revised cadmium remediation goal are discussed in the MPCA approval letter dated November 8, 1993.

(4) Although the cleanup goal for mercury was revised to 6.0 µg/g in Addendum 7, the Army and MPCA agreed to leave soils containing no more than 2.1 µg/g mercury at Site F and to place a notice regarding the mercury concentration in the property deed.

C.15-18

Figure 1



Area to be scraped, centered around sampling point failed for lead (Pb) and/or antimony (Sb)

Grid area failed for nickel (Ni), which was > 45 and less than 520 ug/kg

Grid area failed for Silver (Ag), which was > 5 ug/kg and less than [illegible] ug/kg

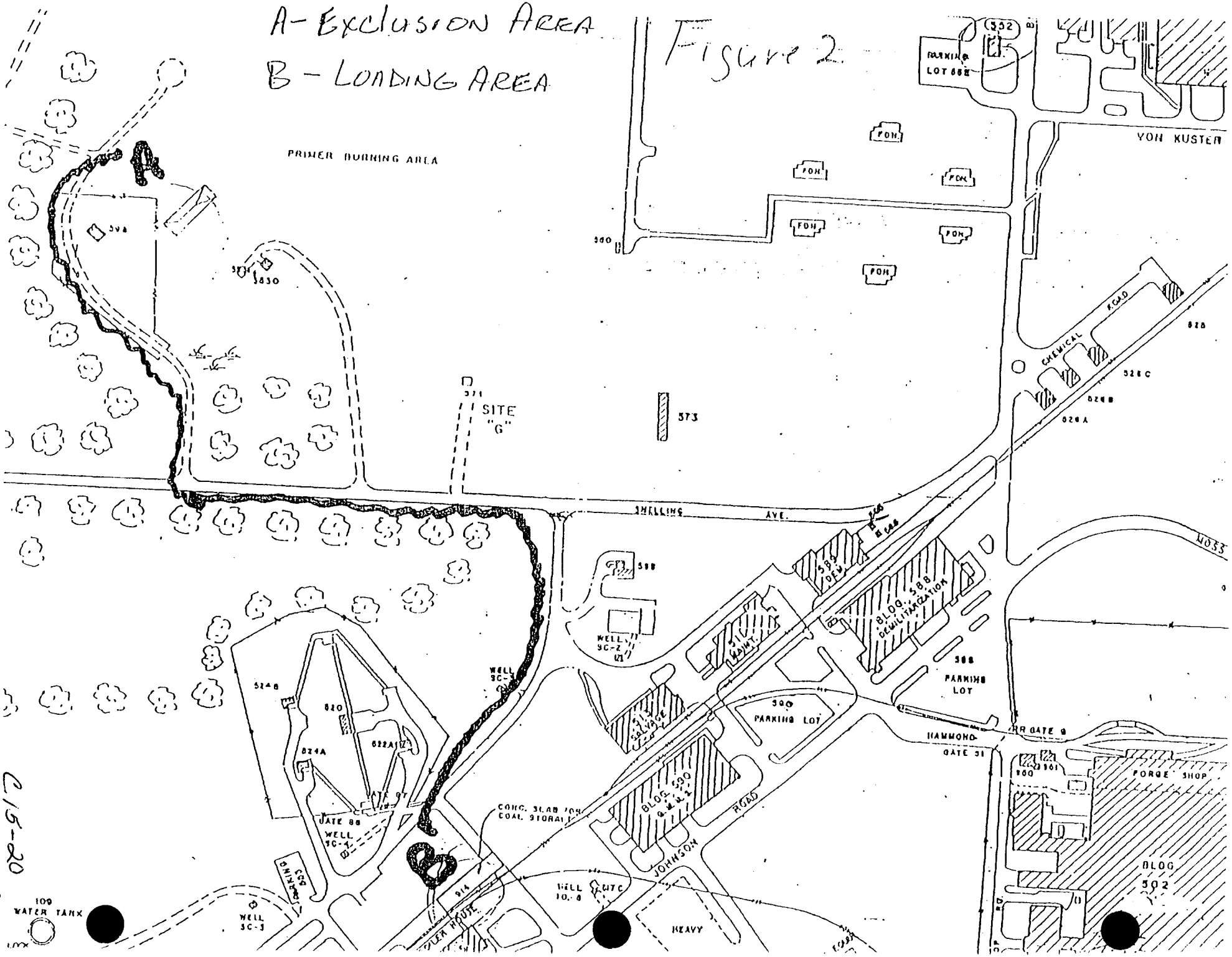
TCAAP
HAZARDOUS SOILS AREA

C15-19

A - Exclusion Area

B - Loading Area

Figure 2



C15-20

Minnesota Pollution Control Agency

September 4, 1997

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway 10 - Suite A
Arden Hills, Minnesota 55112-3928

RE: Site F Hazardous Soils Area -
Scraping of Grids SB-839, 851, and 863
Twin Cities Army Ammunition Plant
MN7213820908

Dear Mr. Fix:

We understand that additional Phase III scraping to a depth of three (3) inches is to begin around September 15, 1997, at grids SB-839, 851, and 863, which previously failed the Site F lead cleanup goal of 300 ug/g. On August 26, 1997, Dave Fuller of Global Environmental Solutions requested that polyethylene tarps be laid down for each truck load of scraped soils rather than installing another asphalt loading pad. For reasons discussed below, we approve of this request.

1. Given that only the top three (3) inches will be scraped from three (3) grids, no more than six (6) truckloads should be generated of contaminated soil.

2. Based on analysis to date, the maximum lead concentration in the contaminated soil to be scraped and loaded for off-site shipment should not exceed 400 ug/g.

3. Given that only three (3) grids need to be scraped, it is not economically feasible to construct another asphalt loading pad near the north east side of the hazardous soils area.

4. Using the existing asphalt loading pad located at the southern portion of the site would promote the possibility of spilling contaminated soil over recently scraped and confirmed clean central grids.

5. A new polyethylene tarp will be placed for each truck load to minimize spillage through tearing of the tarp. Used tarps will be disposed of with each truck load of scraped contaminated soil.

C.15-21

6. Tarps will be placed in grids SB-862 (for loading of scraped contaminated soils from grids SB-863 and SB-851) and SB-850 (for loading of scraped contaminated soil from grid SB-839).

7. After the last truck load is loaded and tarp removed, one (1) confirmatory sample will be taken beneath each tarpped area and analyzed for the lead cleanup goal of 300 ug/g. If necessary, additional soil will be scraped and confirmatory analysis repeated.

You may contact me at 612/297-8379 if you have any questions regarding this letter

Sincerely,

Dan R. Card, P.E.
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

DRC:mh

C15-22

ALLIANTTECHSYSTEMS

Alliant Techsystems Inc.
Twin Cities Arsenal
New Brighton, MN 55112

September 24, 1997

Contracting Officer's Representative
Twin Cities Army Ammunition Plant
Department of the Army
4700 Highway 10 - Suite A
Arden Hills, MN 55112-3928

ATTN: SIOTC-EV

Subject: Site F Closure, Variation to Phase II Work Plan

Reference: Contract: DAAA09-95-C-0113

Dear Sir:

The original work plan, dated May 22, 1997, states the location of the decontamination pad will be on the south side of the hazardous soils stockpile exclusion zone. A small portion of the road accessing this location consists of deep trenches. On Tuesday, September 16, 1997, a call was placed to Mr. Dan Card of the MPCA to discuss moving the decon pad to the southwest side of the hazardous soils stockpile exclusion zone. The road leading to the southwest side needed little improvement and was found stable enough to support heavy traffic.. Our contractor (Dynex) had bladed this road smooth and asked for the decon pad to be relocated to the southwest side. Mr. Card stated this would be acceptable if we documented this variation to the work plan. This letter to the Army and the attached information satisfies that requirement. Please forward it to the MPCA.

If there are any questions, please call Jim Persoon at 612/633-2301, ext. 1631.

Sincerely,

R.J. Rockney

R. J. Rockney
Government Facilities Manager

Enclosure

cc: Mr. Marty McCleery (w/encl)
Mr. Jim Persoon (w/encl)
Ms. Jean Brewster (w/encl)
Mr. Dave Fuller (w/encl)
GES Files (w/encl)
S. Huber MN24 (w/encl)
Central Files MN11-1453 (w/encl)

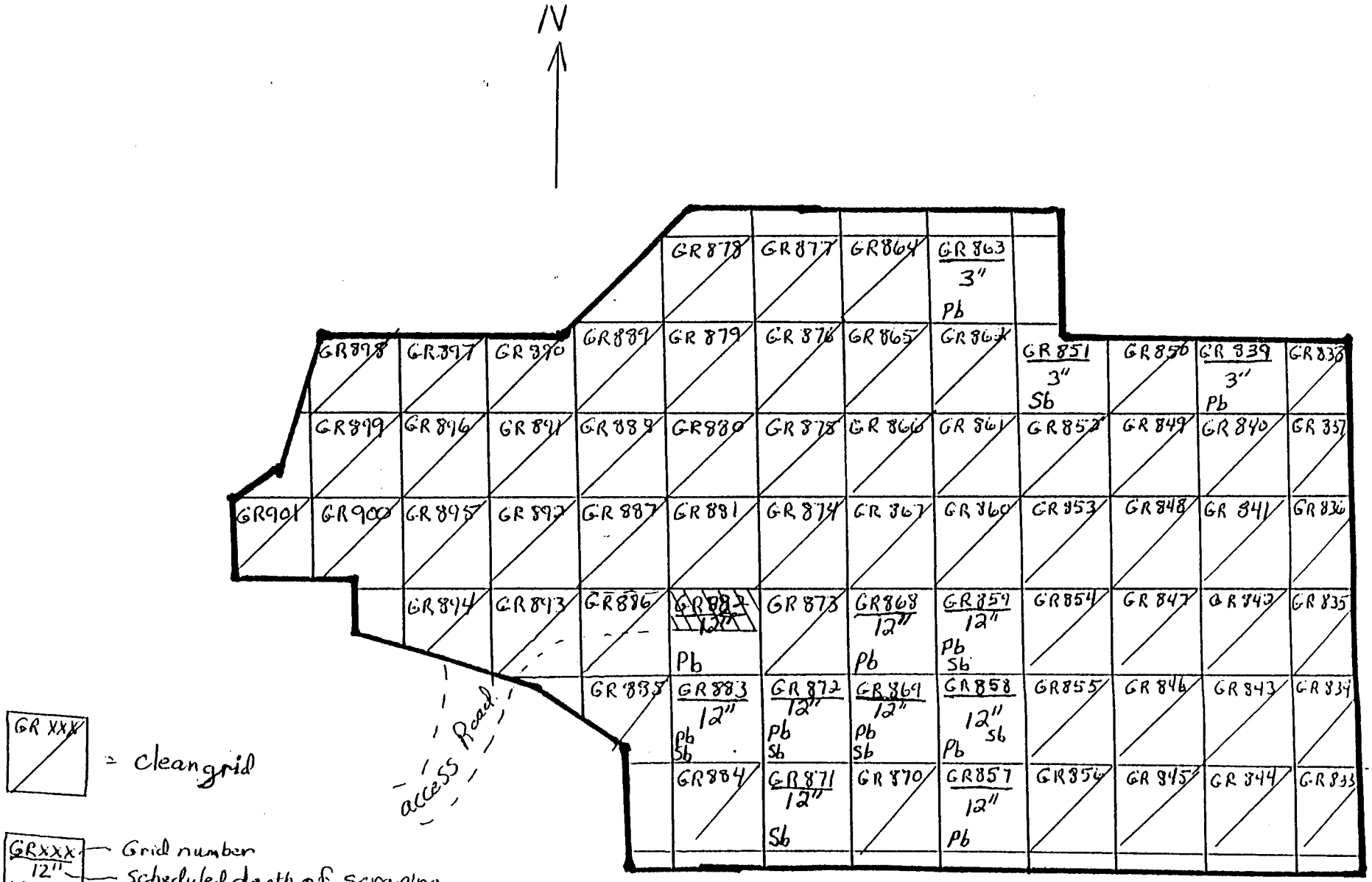
C15-23

Modification to TCAAP Site F
Additional Hazardous Soils Disposal Work Plan

The decon pad has been constructed on the southwest side of the hazardous soils stockpile exclusion zone.. Asphalt, above a gravel base, has been placed on Grid #882. (See attached figure.) The asphalt pad has berms on three sides. When all other grids have been scraped and hauled, the asphalt pad will be placed in a truck and hauled and disposed with the contaminated soil. As Grid #882 soils are scraped, transport trucks will park on individual tarps until all soil is removed. As scheduled, a sample will be collected from the center of Grid #882 and analyzed for lead. Additionally, a sample will be collected beneath the decontamination pad area and analyzed for lead and antimony.

The asphalt pad will be tarped overnight and during rainfall events.

C.15-24



Notes: • Trucks will park on grid 862 to receive scraped material from grids 863 and 851. The area beneath the truck will be Tarped for each truck. After completion of scraping, Grid 862 will be sampled for Pb & Sb. Similarly, Grid 840 will be sampled for lead related to scraping of Grid 839.

• In addition to the location of the decon pad, Grid 882 will be sampled for Pb and Sb.

C.16 Addendum No. 8 and Approval Letter

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
4700 HWY 10- SUITE A
ARDEN HILLS, MINNESOTA 55112-3922

REPLY TO
ATTENTION OF

April 22, 1997

SIOTC-EV (200-1b)

SUBJECT: Site F Closure Plan

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▶

To Dan Card From Marty McCleery

Dept./Agency MPCA Phone #

Fax # Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

P 584 726 625

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card
Hazardous Waste Division
Regulatory Compliance Section
520 Lafayette Road
St. Paul, MN 55155

Dear Mr. Card:

References:

(a) Addendum 8, Site F Closure Plan dated April 15, 1997 (enclosed).

(b) Memorandum, Alliant Techsystems Inc., Global Environmental Solutions, April 17, 1997, subject: Addendum 8 of Site F Closure Plan and Other Site F Issues - Conference Call with MPCA (enclosed).

Referenced Addendum 8 (ref a) is provided for your approval. Please provide your written approval ASAP but not later than April 30, 1997, so that we are able to carry out excavation and scraping of soils at Site F on schedule.

If you have any questions, please contact Mr. Marty McCleery, SIOTC-EV, 612.633-2301, ext. 1651.

Sincerely

Michael R. Fix
Commander's Representative

Enclosure

Copy Furnished:

GES, ATTN: Mr. Jim Persoon (wo/encl)

C. 16-2

Addendum 8

Site F Closure Plan

April 15, 1997

As of this date, the Minnesota Pollution Control Agency (MPCA) Soil Reference Values (SRVs) for residential (unrestricted) land use, which are listed below, will replace cleanup goals identified in Addendum 7 of the Site F Closure Plan for copper and antimony at Site F. These SRVs were developed by the MPCA Site Response Section (Reference: Draft Site Screening Evaluation Guidelines, Working Draft, last updated 4/26/96) based on the most recent risk assessment data and procedures. The MPCA Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Response Section and the EPA Region V office have reviewed and agree with these proposed changes. These new SRVs contain information that is more current than that presented in Addendum 7. The residential use SRVs listed here represent a very conservative calculation of cleanup goals for these metals.

Metal	SRV Cleanup Goal	Former Cleanup Goal
copper	- 1300 ug/g	(840 ug/g in Addendum 7)
antimony	- 14 ug/g	(6 ug/g in Addendum 7),

The former cleanup goals listed above, which were identified in Addendum 7, were developed by the Environmental Protection Agency (EPA) using less current procedures.

Minnesota Pollution Control Agency

April 29, 1997

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway Ten, Suite A
Arden Hills, Minnesota 55112-3928

RE: Addendum 8 Site F Closure Plan Approval
Twin Cities Army Ammunition Plant
MN7213820908

Dear Mr. Fix:

The Minnesota Pollution Control Agency (MPCA) staff of the Hazardous Waste Regulatory Compliance Section Permit and Review Unit has reviewed the April 22, 1997, proposed final Site F Closure Plan Addendum 8. This Addendum revises the Site F soil cleanup goals for copper and antimony to reflect current MPCA risk-based residential soil reference values. Based upon our human health risk evaluation of the proposed copper and antimony goals as they relate to existing goals, Addendum 8 is approved.

The following table reflects the most current MPCA approved cleanup goals for Site F, incorporating all approved Addendum's to date:

Metal	Original Goal (ug/g)	Addendum 7 Goal (ug/g)	Addendum 8 Goal (ug/g)	**Current approved Goal (ug/g)**
Antimony	4	6	14	**14**
Cadmium	4			**4**
Chromium	100			**100**
Copper	80	840	1300	**1300**
Lead	300			**300**
Mercury	0.3	6	2	**2**
Nickel	45			**45**
Silver	5			**5**

C16-4

As previously agreed to, the "Affidavit Concerning Real Property Contaminated With Hazardous Substances" will note that based on sampling and analysis, lead levels remaining in the treated soils range up to 300 ug/g; likewise for mercury up to 2 ug/g.

You may contact Dan Card or Beth Gawrys, of my staff, at 612/297-8379 or 612/297-8376, if you have any questions regarding this letter.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:mln

C.16-5

C.17 720-Ton Pile Correspondence

Global Environmental Solutions
An Alliant Techsystems Operation

Alliant Techsystems Inc.
Global Environmental Solutions
4700 Highway 10, Suite F Tel.: 612-633-2301
Arden Hills, MN 55112 Fax 612-633-7166

April 17, 1997

Contracting Officer's Representative
Twin Cities Army Ammunition Plant
Department of the Army
4700 Highway 10 - Suite A
Arden Hills, MN 55112-3928

ATTN: SIOTC-CO

Subject: Incident Report and Sampling Plan for 720-Ton Pile of Non-Hazardous Soils Stored on 503 Pad

Reference: Contract No. DAAA09-95-C-0113, P00008

Dear Sir:

This letter is a follow up to our verbal report of Friday, April 4, 1997, at which time Alliant Techsystems/Global Environmental Solutions (Alliant/GES) informed both the Army and the MPCA that a 720-ton pile of non-hazardous soil, which contained one 30-ton batch (Batch 276) of soil that exceeded the Site F cleanup goal for lead, was inadvertently transferred to Site F from the 503 pad before the required sampling had occurred. Per Addendum 7 of the Site F Closure Plan, this 720-ton soil pile was to have been subdivided into 10 sub-piles and each of these sub-piles sampled for lead. Those sub-piles with sample results indicating lead concentrations less than the cleanup goal would be then transferred to Site F. Sub-piles with lead concentrations exceeding the goal would require further mixing or other action. This sampling was required because one 30-ton batch (Batch 276) of non-hazardous soil with a total lead concentration of 490 ug/g had been inadvertently mixed with the other soils. This lead concentration is above the cleanup goal for Site F for lead, which is identified as 300 ug/g in Addendum 7 of the Site F Closure Plan.

The omission of sampling and analysis was discovered on the afternoon of Thursday, April 3, 1997. Alliant/GES immediately contacted the driver and bulldozer operator to obtain information about where at Site F these soils had been deposited. Based on that information, on April 4, GES notified the Army Remedial Program Manager (RPM) and the MPCA Hazardous Waste Division of the problem. Stakes were placed around the area at Site F where the 720-ton soil pile had been spread (see attached map).

Based on previous observation of the loading activities and additional discussion with equipment operators, Alliant/GES assembled a description of the procedures used to load and transfer the 503 pad soils. A brief summary follows:

> After the tarps were removed from the piles to be moved, a front end loader with a 3 cubic yard (cy) bucket was used to transfer the soil from the piles to dump trucks with 10- to 15-cy capacities. The front end loader scooped soil from the bottom portion of the various soil piles that were closest to a truck that was being loaded. Thus, some mixing of the soils in the piles occurred as the trucks were loaded. The trucks then transferred the soil to Site F where it was unloaded into piles near an unimproved road along the southern part of the site (see attached map). A bulldozer was used to push the soil from the piles into a depression at the southwest corner of the site. This was accomplished in 3" to 6" lifts (depth of soil layer deposited by the bulldozer).

Because the soils from the 720-ton pile were handled in this manner, Alliant/GES believes that significant mixing of this soil has already occurred. These soils are now believed to be in a layer 3 to 4 feet thick and approximately 3 to 4 feet below the surface since other non-hazardous soils from the 503 pad have been deposited on top of the soil from the 720-ton pile.

Proposed Sampling

As stated above, it appears that significant mixing of the 30-ton batch of soil which contained elevated lead levels has already occurred for the 720-ton pile during its transportation to Site F and deposition there. Some mixing of the original 30-ton batch had already occurred when the pile was deposited at the 503 pad along with 23 other 30-ton soil batches. The additional mixing that occurred during loading of the soils at the 503 pad and their deposition at Site F is expected to have reduced the lead concentration of the 30-ton batch to below the Addendum 7 cleanup goal for lead at Site F. Addendum 7 states that mixing of any of the sub-piles that failed the originally planned sampling would be an option to reduce the lead concentration to allowable levels. In order to comply with the intent of the sampling requirement in Addendum 7, and to document the lead concentration of the soils in question that were deposited at Site F, the following sampling activities will be performed:

1. Square-up the area at Site F that is currently staked to identify the locations of soil from the 720-ton soil pile to an area that is approximately 100 feet by 75 feet. Subdivide this area into 25x25-foot grids.

2. Collect soil samples with a hand auger at the center point of each 25x25-foot grid area. This sampling approach has previously been approved for other areas at Site F. Due to the depth of the soil in question beneath other soils from the 503 pad, collect a sample at each of two different depths, 3.5 feet and 6 feet.

3. Analyze the samples for total lead using the same analytical methods used previously for Site F soils.

4. If the sample results indicate that the soil meets the agreed-upon cleanup standards for lead at Site F, no further action will be required. If the soils within a particular grid area do not meet the agreed-upon cleanup goal then the soils from that grid area will either be mixed and re-sampled or they will be transported off site to a permitted landfill as non-hazardous solid waste material.

5. If performed, mixing will be accomplished as follows in order to manage the amount of soil to be mixed at one time. The grid area will be divided into sub-areas and the following steps for each sub-area will be performed.

   a) The top 3 feet of overlying soil (which is not part of the 720-ton pile) will be removed from a large part of the grid area and placed outside of the grid area.

b) For each sub-area where overlying soil has been removed, the soils will be excavated from successively deeper sections of a particular segment until the bottom part of the soil layer of concern (approximately 4 feet thick) is reached. These excavated soils will be thin-spread over unexcavated portions of the sub-area and then backfilled into the excavated segment along with some of the underlying soil.
c) Steps 5. a) and 5. b) will be continued until the entire grid area has been excavated.
d) One sample from the center portion of the grid area will be collected and analyzed for total lead using the method used previously for Site F soils.
e) If this analysis indicates that the mixed soil meets the agreed-upon cleanup goal for lead for Site F, then the previously excavated overlying soil will be placed back on the grid area and no further action will be required.
f) If this analysis indicates that the mixed soil does not meet the agreed-upon cleanup goal for lead, the situation will be reevaluated and other options will be considered including re-mixing (steps 5a and 5b), mixing the soil further by using the overlying soils, or removing the soil from the grid area and transporting it off site to a permitted landfill as non-hazardous solid waste material.

6. One composite sample will be collected from the 503 pad area where the 720-ton soil pile had been stored by brushing samples of the residual soil from 5 randomly selected areas into a mixing container and mixing thoroughly. The sample will be analyzed for total lead concentration using the method referenced above.
7. If the analysis indicates that the residual soil meets the agreed-upon cleanup goal for lead for Site F, the 503 pad will be swept and the residual soil will be deposited at Site F.
8. If the analysis indicates that the residual soil has a lead concentration above the agreed-upon cleanup goal for lead, then options including mixing the residual soils from this area of the 503 pad with residual soils collected from other areas of the 503 pad or transporting the soils off site to a permitted landfill as non-hazardous solid waste material will be evaluated.
9. If the sample is re-mixed, a sample from the mixed soil will be collected and analyzed for total lead concentration using the referenced analysis method. Steps 7, 8 and 9 will then be repeated as necessary.
10. A technical memorandum documenting the above actions will be developed and included in the Final Site F Closure Report.

Alliant/GES is submitting this letter to document the recent activities at Site F and provide the plans for future actions regarding the 720-ton pile of non-hazardous soil. Comments on a draft of the incident report and sampling plan were obtained from the MPCA and the Army RPM and these comments have been incorporated into this letter. We request that you forward this incident report and sampling plan to the MPCA as soon as possible so that arrangements can be made for the specified sampling and analysis.

Sincerely,

James R Persoon, Ph.D.
Program Director

cc: GES Files

jb\c:\winword\sitef\incdrpt2.doc

C.17-4

Global Environmental Solutions
An Alliant Techsystems Operation

Alliant Techsystems Inc.
Global Environmental Solutions
4700 Highway 10, Suite F Tel.: 612-633-2301
Arden Hills, MN 55112 Fax 612-633-7166

Memorandum

Date	April 18, 1997	From	Jean Brewster
Subject	**Non-hazardous (720 Ton) Soil Pile Incident Report and Sampling Plan - Conference Call with MPCA**	Organization	GES-TCAAP
		MS	MN24
To	Martin McCleery SIOTC-EV	Telephone	633-2301 ext. 1635
		Fax	633-7166

A teleconference call was held on April 14, 1997 between Dan Card of the MPCA and Dave Fuller and Jean Brewster from Alliant Techsystems/Global Environmental (Alliant/GES).

Jean Brewster initiated the call and indicated that she had received the telephone messages from both Dan and Beth Gawrys (MPCA) last week (April 10 and April 11, respectively) regarding the draft Incident Report and Sampling Plan which had been faxed on April 8, 1997. She noted that a revised sampling plan was being finalized based on those comments and asked if Dan had any other concerns.

Dan indicated that he had no required changes for the incident report and agreed with the approach used in the sampling plan, but wished some clarification of the language of Item 5, regarding sampling of residual soils and additional detail for item 4, describing the process to be used if mixing was required after sampling.

Beth Gawrys' comments were also discussed. The draft document had included a requirement for one sample of residual soils from a randomly selected location. This was included as a prudent measure to document the nature of the residuals, because no mixing or sampling had previously occurred for the 720-ton pile. In her comments, Beth had suggested that a composite sample would be appropriate. Jean noted that the sampling plan had been revised to indicate that a composite sample would be collected from 5 randomly selected locations in the area where the 720-ton pile had been located on the 503 pad.

Dan noted that Beth's comments had also included a request for clarification of the source of soils that had been deposited above the soils from the 720-ton pile. Jean noted that other soils from the 503 pad were the source and that this information would be added to the language of the incident report.

Alliant/GES informed Dan that these comments on the draft incident report and sampling plan would be incorporated and the final revised document would be provided to Army for finalization and forwarding to MPCA.

Jean asked about the status of the MPCA review of the Draft Addendum 8, which had also been faxed on April 8, 1997. Dan said that both he and Beth had reviewed it and agreed with the changes for antimony and copper but had concerns over the inclusion of lead. It was agreed to discuss Addendum 8 at 9:00 AM on April 15, 1997.

The call then ended.

cc: Mike Fix/SIOTC-CO
GES Files
Jim Persoon/GES
Kristi Maitland/GES
Dave Fuller/GES

jb\c:\winword\sitef\720pile\tele720.doc

C17-5

Minnesota Pollution Control Agency

April 29, 1997

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway Ten, Suite A
Arden Hills, Minnesota 55112-3928

RE: Incident Report and Sampling Plan for 720-Ton Pile
Inadvertently Returned to Site F
Twin Cities Army Ammunition Plant
MN7213820908

Dear Mr. Fix:

The Minnesota Pollution Control Agency (MPCA) staff of the Hazardous Waste Regulatory Compliance Section Permit and Review Unit has reviewed your letter of April 22, 1997. The letter referenced the April 17, 1997, incident report and sampling plan for 720-ton pile of non-hazardous soils stored on 503 pad. The 720-ton pile contained one 30-ton batch (#276) which exceeded the Site F cleanup goal for lead. The 720-ton pile was inadvertently returned to Site F prior to being subdivided and sampled for lead as required by the Site F Closure Plan Addendum 7. The related April 18, 1997, Global Environmental Solutions/Alliant Techsystems, Inc. memorandum was also reviewed.

It appears MPCA staff comments have been incorporated into this final proposed sampling plan which is hereby approved. MPCA staff request that in addition to incorporating analytical data into a technical memorandum to be included in the Site F Closure Report, please keep MPCA staff informed as to the status of the sampling, and please submit a summary report as soon as the mixing and analytical results becomes available.

We appreciate the Army and GES/Alliant Techsystem Inc. taking corrective action to mitigate this unintentional event.

C17-6

You may contact Dan Card or Beth Gawrys, of my staff, 612/297-8379 or 612/297-8376, if you have any questions regarding this letter.

Sincerely,

Bruce W. Brott, P.E., Supervisor
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

BWB:mln

C17-7

Global Environmental Solutions
An Alliant Techsystems Operation

Alliant Techsystems Inc.
Global Environmental Solutions
4700 Highway 10, Suite F Tel.: 612-633-2301
Arden Hills, MN 55112 Fax 612-633-7166

Memorandum

Date May 20, 1997
Subject **Telephone conversation with Dan Card of MPCA Regarding Additional Sampling of 720-ton Pile soils at Site F**

To Marty McCleery-EV

From Jean Brewster
Organization GES-TCAAP

MS MN24
Telephone 633-2301 ext. 1635
Fax 633-7166

GES called Dan Card of MPCA today to notify him that 2 of the 24 samples collected at from the 720-ton soils had failed to meet the cleanup goals for lead and after evaluating options we had decided to mix those two grid areas and then resample. He indicated that the verbal notification was sufficient to keep MPCA informed on this issue. When the task is complete, MPCA would like to review the data and the data will be included as part of the Site F Closure Report.

Dan then asked for a hard copy of the Phase II Operation Plan, revised to include responses to the MPCA letter which had minor comments regarding the previously Faxed copy of the plan. GES has already provided you with a copy of that letter. GES agreed to send a copy of the plan with added responses.
GES stated that the purchase order for the Phase II scraping was being developed and that they (MPCA) would be notified when a firm schedule is defined.

cc: Michael Fix/SIOTC-CO
GES Files

C17-8

C.18 Explosive Testing of Treated and Untreated Soils at Site F

Minnesota Pollution Control Agency

February 3, 1997

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway Ten, Suite A
Arden Hills, Minnesota 55112-3928

RE: Approval of Treated and Untreated Soils
Explosive Testing at Site F
Twin Cities Army Ammunition Plant
MN7213820908

Dear Mr. Fix:

As discussed during our January 30, 1997, conference call, the Department of the Army requested a separate cover letter addressing the Minnesota Pollution Control Agency's (MPCA) approval of treated and untreated soils explosive testing at Site F.

As noted in our January 22, 1997, letter, the following information was reviewed by MPCA staff:

- December 9, 1996, data (received via facsimile) from Wenck Associates, Inc. (supersedes November 19, 1996, explosive analysis).
- October 31, 1996, Interpoll Laboratories, Inc. Determination of Nitroaromatics and Nitramines by High Performance Liquid Chromatography in Soil, Sediment, and Sludge Samples.
- December 16, 1996, Interpoll Laboratories, Inc. Quality Assurance Quality Control Report, Project Number 8532.

Based on the available data, MPCA staff have determined that residual explosive levels in untreated soils and post-treated soils do not pose an unacceptable risk to human health. Therefore, it is not necessary to establish cleanup goals for explosives in these soils at Site F.

C18-2

Having completed investigation of residual explosives in soils to be left in place or backfilled at Site F, no further action is warranted at this time. We thank you for your cooperation in evaluating this concern.

You may contact me at 612/297-8379, or Beth Gawrys at 612/297-8376, if you have any further questions or concerns on this issue.

Sincerely,

Dan R. Card, P.E.
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

DRC:mln

C-18-3

C.19 Site D Pad and Building 515 Pad Decontamination Correspondence

Minnesota Pollution Control Agency

EV

August 14, 1997

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway 10 -Suite A
Arden Hills, Minnesota 55112-3928

RE: Site D Pad and Building 515 Pad Decontamination -
Use of Shotblasting Approval
Twin Cities Army Ammunition Plant
MN7213820908

Dear Mr. Fix:

The Minnesota Pollution Control Agency (MPCA) staff of the Hazardous Waste Regulatory Compliance Section Permit and Review Unit has reviewed the facsimile received August 8, 1997, sent by Dave Fuller of Alliant Techsytems, Inc.

We have reviewed the June 5, 1997, "Site D Pad Wipe Sample Results". Results for cadmium, chromium, copper, lead, and nickel exceeded the September 8, 1993, base-line wipe sample analysis. We therefore concur that decontamination is necessary for the Site D pad.

Shotblasting is proposed to decontaminate the Building 515 concrete pad which was used to load hazardous soils onto rail cars. While the original approved Site F Closure Plan called for steam cleaning the Site D concrete pad (used for soil washing soil leaching), shotblasting is now proposed for the Site D pad as well. We agree that shotblasting should provide a more thorough method of cleaning and as such, approve of this method of decontamination. We understand that appropriate equipment, dust control, and disposal methods will be used. Further, confirmatory sampling of the two (2) concrete pads will occur after shot blasting.

C.19-2

One (1) week prior to beginning shotblasting, please have staff from Alliant Techsytems, Inc. notify us so that we may schedule a site visit. Also, once decontamination is complete, please provide us with a summary of the Site D and Building 515 concrete pad confirmatory results.

You may contact me at 612/297-8379 if you have any questions.

Sincerely,

Dan R. Card, P.E.
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

DRC:ts

cc: James Persoon, Alliant Techsystems

ALLIANTTECHSYSTEMS

Alliant Techsystems Inc.
Twin Cities Arsenal
New Brighton, MN 55112

14 October 1997

Subject: Variation from Site F Closure Plan - Decontamination Method for Concrete Pads

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card and Ms. Beth Gawrys
Hazardous Waste Division
Regulatory Compliance Section
520 Lafayette Road
St. Paul, MN 55155

Dear Mr. Card and Ms. Beth Gawrys:

As we discussed in our telephone conversation of October 13, 1997, rather than power-wash the concrete pads used for handling hazardous soils from Site F, we intend to use a power scrubbing machine which has been used to successfully decontaminate other concrete surfaces. The pads to be cleaned include the Site D pad and the railcar loading pad at the former location of Building 515 (the 515 pad). As you have requested, the proposed process follows:

1.) Ponded rainwater that may be present on the pads will be removed and containerized in either 55-gallon drums, a holding tank or a vacuum truck. The pads will be hand-swept, as necessary, to remove gravel and debris and the material will be collected in 55-gallon drums. The poly cover at the 515 pad will be removed and containerized before sweeping begins.
2.) A surfactant that has been proven effective in aiding removal of heavy metals from concrete will be sprayed on the surface.
3.) A power scrubbing machine will be used to scrub the sprayed surface with brushes. Rinse water will be applied and the scrubbed area will be vacuumed.
4.) Vacuumed wash water will be containerized in either 55-gallon drums, a holding tank, or a tanker truck.
5.) A composite sample will be collected from the containers associated with each pad.
    a. For the Site D pad, the requirements of a previously granted special discharge approval from Metropolitan Council for Environmental Services (MCES) would be applicable; these include metals (cadmium, total chromium, copper, lead, mercury, nickel) and pH. Based on a telephone conversation with Mr. Robert Nordquist of MCES, additional analyses will be required for the wash water containing surfactant; these are chemical oxygen demand (COD) and total suspended solids (TSS).
    b. For the 515 pad, the same analyses will be performed since Site F soils were also staged at this location.
    c. If analyses indicate that analyte concentrations meet MCES requirements, the waters will be discharged to the sanitary sewer.

6) A composite sample will also be collected from the drummed sweeping materials and analyzed for the metals of concern at Site F (antimony, cadmium, chromium, copper, lead, mercury, nickel, and silver).
7) Based on sampling results, the wash water and solids will be disposed in accordance with both state and federal requirements.
8) Wipe samples will be collected from the pad(s) in the following manner:
   a.) At the Site D pad, one wipe sample will be collected from each section of the pad where background wipe samples had been collected. Samples from each location will be analyzed for those metals that were found above the baseline concentration during a recent wipe sampling (performed before cleaning) as shown in the attached table.
   b.) At the 515 pad, two wipe samples will be collected from portions of the exclusion zone (EZ) area (total dimension is approximately 40 by 80 feet) and one from the decon area. To establish baseline concentrations, two additional samples will be collected from portions of the 515 pad where no loading activities occurred. Samples will be analyzed for antimony, cadmium, chromium, copper, lead, mercury, nickel, and silver. These samples will be used to provide pre-existing concentrations at the pad and will be compared to the sample results for the EZ.
   c.) Samples will be collected and handled in the manner described in the Site F Closure Plan.

9.) Wipe samples collected from the pad(s) will be compared to pre-existing baseline concentration values. If the scrubbing action has not reduced the concentration to the pre-existing range, then the pad will be cleaned again, either by repeating the scrubbing actions described above, by pressure washing per the Site F Closure Plan, or by shot-blasting with the method previously approved by MPCA.

Based on your verbal approval of the use of the above-described scrubbing method for decon, we have contacted our contractor and tentatively plan to proceed on Monday of next week (October 20, 1997). We understand that you will review this document, provide any comments regarding the details of the method, then provide an approval letter when any comments have been addressed. Please call with any questions. The POC for this activity is Jean Brewster.

Sincerely

J.R. Persoon

cc: M. McCleery, SIOTC-EV
M. Fix, SIOTC-CO
Environmental Files

C. 19-5

Minnesota Pollution Control Agency

November 5, 1997

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway 10 -Suite A
Arden Hills, Minnesota 55112-3928

RE: Decontamination of Site D and Building 515 Concrete Pads
Twin Cities Army Ammunition Plant
MN7213820908

Dear Mr. Fix:

We have reviewed the October 14, 1997, "Variation from Site F Closure Plan - Decontamination Method for Concrete Pads" letter (received October 20, 1997) submitted by Alliant Techsystems, Inc., on behalf of the Army. It is agreed, and was observed during our October 20, 1997, site visit, that a surfactant power scrubbing machine will be used to decontaminated the Site D and Building 515 concrete pads rather than shot blasting as previously proposed and approved.

Decontamination, sampling, and analysis shall proceed in accordance with the procedures set forth in the October 14, 1997, letter, with the exception of the following. As discussed during our October 20, 1997, site visit, all five (5) sumps at Site D shall be cleaned by washing and pumped dry. One (1) wipe sample will be taken from one (1) sump (to be representative of all five (5) sumps) and analyzed for antimony, cadmium, chromium, copper, lead, mercury, nickel, and silver. Since no baseline samples were taken from the sumps, results will be compared to the maximum baseline September 1993, concentrations for the Site D pad. If the sump concentration exceeds the maximum baseline concentration, all sumps shall be washed again, and reanalyzed. This procedure shall be repeated until the maximum Site D baseline goals are met.

Further, as also discussed during our October 20, 1997, site visit, the Army will propose a new method for top soil placement and placement of prairie grass. We understand and concur that due to a limited volume of available topsoil, areas at Site F which stored treated soils will primarily received top soil placement, followed by areas which received scraping only to the extent top soil is available, unless the prairie grass expert recommends differently. Prairie grass and mulch will be disked into the sandy soil to provide through mixing.

FILE COPY

520 Lafayette Rd. N.; St. Paul, MN 55155-4194; (612) 296-6300 (Voice); (612) 282-5332 (TTY)
Regional Offices: Duluth • Brainerd • Detroit Lakes • Marshall • Rochester

C. 19-6

You may contact me at 612/297-8379 or Beth Gawrys at 612/297-8376 if you have any questions.

Sincerely,

Dan R. Card, P.E.
Permit and Review Unit
Regulatory Compliance Section
Hazardous Waste Division

DRC:mk

cc: James R. Persoon, Alliant Techsystems, Inc.

ALLIANTTECHSYSTEMS

4700 Highway 10, Suite F
Arden Hills, MN 55112

Memorandum

Date	11 March 1998	From	J.R. Persoon
Subject	**Minutes from Conference Call with MPCA Re: Cleaning of Site D and 515 Pads**	Organization	Environmental Services, Ammunition Systems
		MS	MN24
To	Marty McCleery Jean Brewster	Telephone	612-633-2301, Ext. 1631
		Fax	612-633-7166
			C:MYCDCOS\SITEF\0311PADS

A conference call was held between Dan Card and Beth Gawrys of the MPCA and Jean Brewster and Jim Persoon of Alliant on Wednesday, March 11, 1998 to discuss the results of the cleaning of the Site D and 515 Pads at TCAAP and a go forward plan for proceeding with closure of this project. Prior to the conference call, a copy of calculations regarding metal concentrations remaining at the pads was forwarded to the MPCA along with a data summary table and laboratory data for the samples taken after the second round of cleaning (bead blasting) at the 515 Pad. A copy of this material is attached.

Alliant started out by stating that the reason for the call was to discuss the analytical results after a single cleaning using a surfactant had been completed on the Site D Pad (surfactant/scrubbing) and two rounds of cleaning had been completed on the 515 Pad (one surfactant/scrubbing and one bead blasting). The wipe sampling and analyses performed for the pads after the cleanings indicated that some areas still had concentrations of Site F COCs above the background levels for the pads. Alliant had discussed the situation with the Army and the conclusion was reached that further cleaning of the pads would not be cost effective since there was no guarantee that additional cleaning would result in concentrations of Site F COCs below background levels. Therefore, calculations had been done by Alliant (as noted above) that estimated the amount of metals above background. These estimates show the amounts on the pads are small. Both the Army and Alliant believe that the data indicates that the remaining concentrations of metals do not pose a significant risk to human health and the environment but recognize that there are no standards on which a definitive risk-based conclusion can be based. The Army and Alliant recommend that no further cleaning of the pads should be performed. They would like the MPCA to concur with this recommendation.

If the MPCA does not concur with this recommendation, Alliant stated that the Army would not consider additional cleaning for the reasons previously noted. The alternative course of action would be to remove both pads and recycle the concrete, since the levels of metals contamination do not preclude that course of action. This is a costly option but is attractive since no further decontamination of the pads would be required. The MPCA had no objections to the removal of the pads. The MPCA did ask if the pads would be used for the CERCLA clean up actions scheduled to take place at TCAAP this summer. Alliant responded that there were no plans to use the pads for the remedial actions planned for the CERCLA sites at TCAAP. Plans are to use the 503 pad for the CERCLA remedial actions.

The MPCA responded that, since there are no standards for the risk posed by contamination of this sort (metals contamination on surfaces above background levels) on which a decision of no further action can be based, the MPCA requires that, if background levels can not achieved, it must be demonstrated that a "good faith effort" to clean the pads has been made and that further action is not practical, reasonable and feasible.

The MPCA has had experience with contaminated concrete in the past and recognizes that demonstration of decontamination to background and clean closure can be difficult or impossible. A "good faith effort" has been demonstrated in the past at other sites in one of several ways, e.g.,:

- Successive rounds of decontamination showing significant decreases in the concentrations of contaminants in the decontamination rinse water.
- Evaluation of exposure pathways and demonstration that contaminant levels are below known standards for the identified complete pathways.

Since only one round of cleaning has been conducted for the Site D Pad, it does not appear that a "good faith effort" has been made. For the 515 Pad, although two rounds of cleaning have been performed, a significant reduction in contamination has not been demonstrated. In both cases, there are insufficient data to demonstrate that there is no risk to human health and the environment as there are no standards for this situation. Therefore, the MPCA practice regarding demonstration of a "good faith effort" is applicable. It was noted that it is the Army's responsibility to demonstrate the "good faith effort" with the appropriate data.

Alliant then asked if it would be possible to justify no further action for the Site D Pad by obtaining more data based on additional sampling and analyses of the water currently collected on the Site D Pad. For example, if these analyses shows metal concentrations below a specified standard for the groundwater pathway, such as the groundwater protection standards/HRLs, would the MPCA agree that no further action was required? The MPCA responded that this could be one approach to obtaining data to support that determination but that they could not give a final answer at this time. Alliant asked if, for the 515 Pad, which does not collect water, if this approach, if approved, could be modified by doing successive rinsing of portions of the 515 Pad and analyzing the rinse water to demonstrate that the levels of contamination in this simulated run off water were below a standard such as the groundwater protection standards/HRLs. The Army would be responsible for collecting the data and presenting it to the MPCA to demonstrate that a "good faith effort" to clean the pads had been made. Alliant noted that the standards to be used for evaluation of the water pathway need to be determined. If there is no significant potential for impact to wetlands, then groundwater protection standards/HRLs may be the best ones to use. Alliant noted that they believed it was highly unlikely that there was a pathway for the runoff to reach the wetland, e.g., Marsden Lake. Alliant agreed to verify that this is the case. (Note: A subsequent investigation showed that the surface water would flow into ditches along the west side of Snelling Avenue and there are no culverts that carry this water beneath Snelling towards the wetlands.)

The MPCA emphasized that this conference call was an information sharing and brainstorming exercise and Alliant and the Army should not proceed until the MPCA had discussed the potential actions internally. It was stressed that the potential for a Deed Affidavit also existed, even with this modified approach, and this also needed to be discussed internally at the MPCA. It was also stressed that "good faith efforts" would be required even if a Deed Affidavit was also required.

Based on this information, it was concluded that Alliant would inform the Army of the potential actions discussed in this conversation. The MPCA would discuss the potential courses of action with their supervision and respond to Alliant and the Army with the results of that discussion. Alliant stated that they and the Army would take no further action until they hear from the MPCA.

The conversation was then concluded.

C.20 Addendum No. 9 and Approval Letter

DEPARTMENT OF THE ARMY
TWIN CITIES ARMY AMMUNITION PLANT
4700 HWY 10 - SUITE A
ARDEN HILLS, MN 55112-3928

October 5, 1998

REPLY TO
ATTENTION OF

SIOTC-EV (200-1b)

SUBJECT: Site F Closure Plan

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

Minnesota Pollution Control Agency
ATTN: Mr. Dan Card/Ms. Beth Gawrys
Hazardous Waste Division
Regulatory Compliance Section
520 Lafayette Road
St. Paul, MN 55155

Dear Mr. Card and Ms. Gawrys:

Attached is Addendum No. 9 to the Twin Cities Army Ammunition Plant (TCAAP) Site F Closure Plan (July 1993).

The Army has received funding for completing subject plan and would like to proceed with the following activities during the 1998 construction season. Your prompt written approval of Addendum No. 9 is appreciated. Upon your verbal approval (telephone call to Mr. Jim Persoon/Ms Jean Brewster, 651/633-2301, x1631/1635), we will initiate the Addendum No. 9 removal. Your written approval to Addendum No. 9 will be added to the Site F Closure Report.

The following activities will be necessary to complete Site F closure:

- Removal of Site D pad – Addendum No. 9
- Removal of 515 pad – Addendum No. 9
- Legal survey of Site F
- Submittal and approval of the Site F Closure Report

Because the annual hazardous waste license fee for Site F will be pro-rated, depending upon the month in which Army receives approval of the Site F Closure Report, Army intends to move as quickly as possible to perform these tasks.

The POC is Mr. Martin McCleery, Remedial Project Manager, 651/633-2301, ext. 1651.

Sincerely,

Michael R. Fix
Commander's Representative

Enclosure

Copies Furnished:
Alliant Techsystems Inc., ATTN: Jim Persoon/MN24 (w/encl)

C:20-2

C:\Data\SiteFClosure\AddendumNo 9ltr.doc

The concrete pads located at Site D (Site D pad) and near Building 515 (515 pad) will be removed and the concrete will be sent off-site for disposal.

EV

Minnesota Pollution Control Agency

October 23, 1998

Mr. Michael R. Fix
Commander's Representative
Department of the Army
Twin Cities Army Ammunition Plant
4700 Highway 10, Suite A
Arden Hills, Minnesota 55112-3928

RE: Approval of Addendum No. 9 - Site F Closure Plan, Twin Cities Army Ammunition Plant, MN7213820908

Dear Mr. Fix:

The Minnesota Pollution Control Agency (MPCA) staff of the RCRA/Superfund Unit, Site Remediation Section, Metro District Office has reviewed the Army's proposed October 5, 1998, Addendum No. 9 to the Toxicity Characteristic Army Ammunition Plant Site F Closure Plan (July 1993). This Addendum is approved and removal of the Site D and Building 515 concrete plans may commence with the following understandings.

1. You requested concurrence on remaining tasks to be completed for Site F Closure Activities. Addendum No. 9 identifies the following:

   - Removal of the Site D pad;
   - Removal of the 515 pad;
   - Legal survey of Site F; and
   - Submittal and approval of the Site F Closure Report.

One additional item that must be completed in order for the MPCA to certify Closure of Site F is completion of the "Site F Affidavit concerning Real Property Contaminated with Hazardous Substances." The April 8, 1997, proposed draft Affidavit was approved **and amended** by the April 21, 1997, MPCA comment letter. The legal survey of Site F shall be incorporated into the Affidavit. Documentation filing of the April 21, 1997, MPCA amended Affidavit with Ramsey County shall be included in the Site F Closure Report.

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2. It is our understanding that the Army will do lead Toxicity Characteristic Leaching Procedure on the Site D and Building 515 pads. If analysis shows that the levels of residual lead contamination is not Toxicity Characteristic Leaching Procedure hazardous, then the hazardous waste debris rule in 40 Code of Federal Regulations Part 268 is not applicable and the excavated concrete pads may be sent off-site for recycling or a demolition landfill. However, if analysis shows to be Toxicity Characteristic Leaching Procedure hazardous for lead, then those portions of the pads that are hazardous are subject to the hazardous waste debris rule.

3. Finally, for completeness, we ask that all Closure Plan Addendum's and approvals be incorporated into the Site F Closure Report.

We look forward to submission of the Site F Closure Certification Report.

You may contact me at (651) 297-8379 if you have any questions.

Sincerely,

Dan R. Card, P.E.
Senior Remediation Engineer
RCRA/Superfund Unit
Site Remediation Section
Metro District Office

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