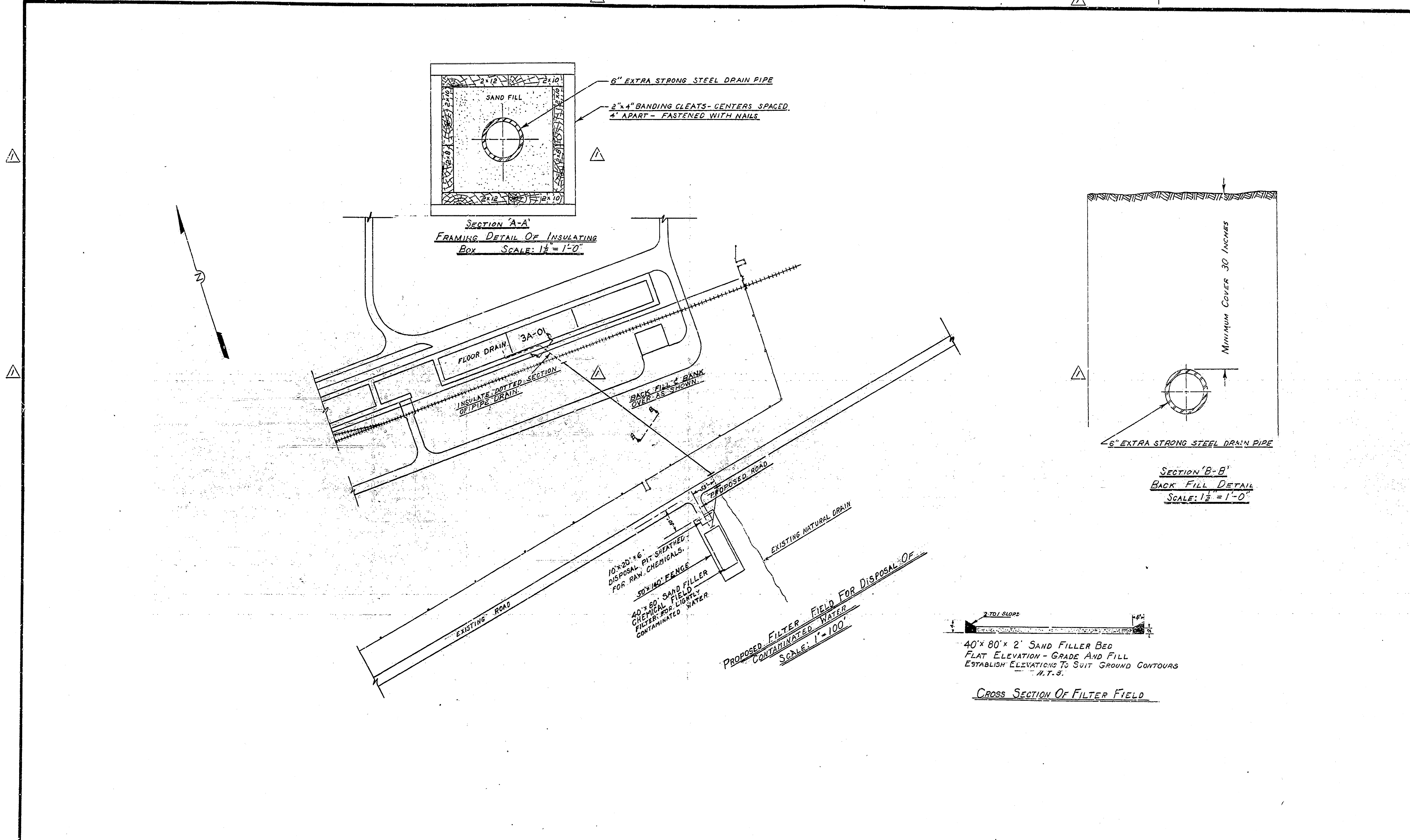
APPENDIX B
Line 3A Pond Proposed Leach Pond Drawing



REV.	DATE	BY	CHECK	DESCRIPTION	APPROVED BY	DATE	APPROVED BY	DATE
1	10-1-51	RAR	MW	CHANGED DRAIN PIPE				
	10-1-51	RAR		ADDED SECTIONAL VIEWS				

REVISION

ORIGINAL APPROVAL

DATE

PC.NO.	REQD.	MATL.	DESCRIPTION

BILL OF MATERIAL

ENGINEERS *Silas Mason Company* CONTRACTORS
BURLINGTON, IOWA

CHEMICAL DISPOSAL LAYOUT FOR BLD'G 3-A-01
500 & 1000# BOMB NORMAL MAINTENANCE

DESIGN	DRAWN	CHECK	SCALE	DATE	JOB	DRAWING NO.		REV.
SL	ADP.	MW	NOTED	7-15-51	85	3-A-01	U-151	1

U-151

DIETZGEN NO 168M AGEPROOF

APPENDIX C
Standard Operating Procedures

Standard Operating Procedure No.1
Surface Soil Sampling

1.1 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for collecting surface soil samples at Iowa Army Ammunition Plant (IAAAP). These procedures give descriptions of equipment, field procedures, documentation procedures, and Quality Assurance/Quality Control (QA/QC) procedures implemented for the collection of surface soil samples. These procedures described are sufficiently detailed to allow field personnel to properly collect surface samples. Field procedures for surface soil sampling were developed in accordance with USAGE EM 1110 (USACE 1998) and USAGE Omaha District Geology Scope of Services, and are detailed in this SOP. Specific sample locations and frequency of collection will be presented in future Field Sampling and Analysis Plan (FSAP) addenda.

These procedures are intended to be used together with FSAP and other appropriate SOPs. Health and safety procedures and equipment for the investigation are detailed in the IAAAP Health and Safety Plan (HSP). Applicable SOPs are listed below:

- SOP No. 7 - Sample Identification, Handling, and Documentation
- SOP No. 8 - Headspace Analysis
- SOP No. 10 - Equipment and Personnel Decontamination
- SOP No. 11 - Boring Abandonment
- SOP No. 12 - Permits and Clearances

Reference Standards

Wherever an ASTM designation is cited in this document, it shall mean the American Society for Testing and Materials Standard Specification of that designation appearing in the “1994 Annual Book of ASTM Standards,” published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania. “EM 1110-2-1906” refers to United States Department of the Army, “Engineering and Design, Laboratory Soil Testing,’ 30 December 1970.

1.2 PROCEDURES FOR SOIL SAMPLING

Surface soil samples will be collected using stainless-steel hand utensils or, for drilling rig borings, a stainless-steel split-spoon sampler. Surface soil samples will be collected from 0 to 0.5 feet below ground surface (bgs). If surface debris, such as rocks, will not allow sample collection at the target depth, surface soil samples may be collected by expanding the sampling area, without increasing depth.

1.2.1 Equipment List

The following list of equipment will be needed to collect surface soil samples at IAAAP:

Equipment for Surface Soil Sampling

- Stainless-steel spoon or trowel, hand auger equipment, or drill rig with appropriate drilling and sampling tools (stainless-steel split spoons)
- Weighted tape measure with 0.1-foot increments
- Surveyor's stakes and flags
- Ruler marked in 0.1-foot increments
- Field books/field sheets
- Stainless-steel knife, bowl, and spoon
- Sample bottles provided by the laboratory
- Sample bottle labels
- Label tape (clear)
- Paper towels
- Aluminum foil
- Camera and film
- Waterproof and permanent marking pens
- Plastic bags
- Plastic sheeting
- Appropriate health and safety equipment, as specified in the HSP
- Appropriate decontamination supplies, as specified in SOP No. 10
- Ice chest with ice

1.2.2 Decontamination

Before drilling or sampling begins, the drilling and sampling equipment will be decontaminated according to the procedures contained in SOP No. 10. Drilling and sampling equipment will be decontaminated between boring and sampling locations. Sampling equipment will also be decontaminated between collection of samples from different depths at the same location.

1.2.3 Surface Soil Sampling Procedures

The procedures for collecting surface soil samples are provided in the following sections.

1.2.3.1 Surface Soil Sampling Using Hand Utensils

This method of soil sample collection is to be used at IAAAP in situations where conditions will not permit the use of hand auger or drilling methods. Soil samples will be collected at the specific depth using a stainless-steel spoon and stainless-steel bowl. Before the sampling begins, clear and remove any vegetation or surface debris such as rocks, as necessary. The hand utensils and bowl will be decontaminated once the sample depth has been reached to avoid possible cross-contamination. When collecting surface soil samples, if additional soil is necessary to fill sample jars, the sample area is to be expanded without increasing the depth. The step-by-step procedure for collecting surface soil samples using hand utensils is described in Section 1.2.3.4.

1.2.3.2 Surface Soil Sampling Using Hand Auger

This method of soil sample collection is to be used at IAAAP in situations where conditions will not permit the use of hand utensils or drilling methods. Hand auger samples will be collected at the specified depth using a stainless-steel hand auger with a minimum 3-inch outside diameter (OD) bucket. Before the augering activities, clear and remove vegetation and any surface debris such as rocks, as necessary. The hand auger will be advanced in 6-inch intervals to the top of the specified sampling depth. The auger bucket will be decontaminated once the target depth has been reached to avoid possible cross-contamination. When collecting surface soil samples, if additional soil is necessary to fill sample jars, an additional borehole will be done adjacent to the initial borehole, without increasing depth. Hand auger borings will be completed in accordance with ASTM D 1452. The step-by-step procedure for collecting surface soil samples using a hand auger is described in Section 1.2.3.4.

1.2.3.3 Surface Soil Sampling Using a Split Spoon

This method of soil sample collection is to be used at IAAAP in situations where the site conditions are appropriate for the use of heavy drilling equipment or where a subsurface soil boring is to be completed. Clear and remove vegetation and any surface debris such as rocks, as necessary. The stainless-steel split spoon soil sampler will be driven or pushed by the drill rig prior to drilling activities. The soil cuttings will be treated as IDW according to Section 7, IDW Transportation and Disposal Plan.

Soil samples will be obtained according to specifications in future FSAP addenda and the resistance to soil penetration will be measured using a split spoon sampler in accordance with ASTM D 1586. Penetration resistance (blow counts) for each sampling depth will be recorded on the field boring log (Figure 2). The coupling head for the split-spoon sampler will be provided with a ball check valve and will have open vents. Where necessary for sample recovery, the sampler will also be equipped with a spring-type sample retainer or an equivalent retainer. The step-by-step procedure for collecting surface soil samples using a split spoon sampler is described in Section 1.2.3.4.

1.2.3.4 Surface Soil Sample Collection

The following step-by-step procedure should be used to collect surface soil samples:

- Record the sample location on a site map and in the field logbook.
- Decontaminate the sampling and drilling equipment according to SOP No. 10.
- Obtain PID background (BG) readings at the sampling location in the breathing zone.
- Before handling any samples, don a clean pair of gloves.
- Collect the soil samples at the depths specified in future FSAP addenda.

- For hand auger and split-spoon samples, measure the recovery, and scrape off any soil smear zone from the recovered sample with a stainless-steel knife. If the soil is not cohesive or if the smear zone cannot be easily removed, an attempt will be made to remove soil from the portion of the sample that has not come in contact with the sampler.
- Determine and identify the use of the recovered sample. This will always be for soil classification and stratigraphic logging and may be for chemical or headspace analysis.
- The sample must be handled quickly, especially if it is loose or crumbling, to avoid losing volatile contaminates.
- Collect any required volatile organic carbon (VOC) samples immediately in appropriate sample containers.
- A portion of selected surface soil samples will be collected in the appropriate glass container for headspace analysis according to SOP No. 8.
- Composite the remaining soil by thoroughly mixing the soil from the sampler in a clean stainless-steel bowl with a stainless-steel spoon. The bottles will then be filled with the composited soil for the specified samples. Collect any required SVOC samples immediately after compositing the soil, then collect any remaining parameters, using the appropriate containers. The required analyses and appropriate volume of containers of soil will be stated in future FSAP addenda.
- Complete the description of materials for the recovered sample according to the Unified Soil Classification System.
- Identify, handle, and document the samples (depending on the use of the sample) according to SOP No. 7.
- If no other samples will be collected, the boring will be abandoned according to SOP No. 11.
- Identify the location for future reference using surveying stakes and flags.

1.2.4 Field Quality Assurance/Quality Control Procedures and Samples

Field QA/QC samples are designed to help identify potential sources of external sample contamination and to evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analyses.

1.2.4.1 Field Blanks

No field blanks or QA split samples will be collected for soil sampling activities.

1.2.4.2 Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the soil sampling, a duplicate sample will be collected at the same time as the initial sample. The initial sample bottles for a particular parameter or set of parameters will be filled first, then the duplicate sample bottles for the same parameter(s), and so on until all necessary sample bottles for both the initial sample and the duplicate sample have been filled. The duplicate soil sample will be handled in the same manner as the primary sample. The duplicate sample will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory on the day it is collected. Duplicate samples will be collected for all parameters. The soil in the split spoon will be composited and containerized for nonvolatile analyses. Duplicate samples will be blind to the laboratory.

1.2.4.3 Matrix Spikes and Matrix Spike Duplicates

Matrix spikes (MS) and matrix spike duplicates (MSD) are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain-of-custody form and on the bottles. It may be necessary to increase the sample volume for samples where this designation is to be made.

1.2.5 Sample Identification, Handling, and Documentation

Samples will be identified, handled and recorded as described in this SOP and SOP No. 7. The parameters for analysis and preservation will be specified in future FSAP addenda

1.2.6 Documentation

Each field activity must be properly documented to facilitate a timely and accurate reconstruction of events in the field (see SOP No. 7). Sample Collection Field Sheets will be completed for all soil samples submitted for chemical analysis (Figure 1).

1.2.6.1 Sample Collection Field Sheet

A sample collection field sheet for surface soil samples (Figure 1) will be completed at each sampling location. The data sheet will be completely filled in. If items on the sheet do not apply to a specific location, the item will be labeled as not applicable (NA). The information on the data sheet includes the following:

- Sample location number
- Date and time of sampling
- Person performing sampling
- Type of sample
- Description of the soil sample
- Number of samples taken
- Sample identification number
- Preservation of samples
- Headspace analysis
- Record of any QC samples from site
- Any irregularities or problems which may have a bearing on sampling quality

1.2.6.2 Field Logbook

The most important aspect of documentation is thorough, organized, and accurate record keeping. All information pertinent to the investigation and not documented on the boring log will be recorded in a bound logbook with consecutively numbered pages. All entries in logbooks will be made in waterproof ink and corrections will consist of line-out deletions that are initialed and dated. Entries in the logbook will include the following, as applicable:

- Project name and number
- Sampler's name
- Date and time of sample collection
- Sample number, location, and depth
- Sampling method
- Observations at the sampling site
- Unusual conditions
- Information concerning drilling decisions
- Decontamination observations
- Weather conditions
- Names and addresses of field contacts
- Names and responsibilities of field crew members
- Names and titles of any site visitors
- Location, description, and log of photographs (if taken)
- References for all maps and photographs
- Information concerning sampling changes, scheduling modifications, and change orders
- Summary of daily tasks (including costs) and documentation on any cost or scope of work changes required by field conditions
- Signature and date by personnel responsible for observations

Field investigation situations vary widely. No general rules can include each type of information that must be entered in a logbook for a particular site. A site-specific logging procedure will be developed to include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks will be kept in the field team member's possession or in a secure place during the investigation. Following the investigation, the logbooks will become a part of the final project file.

Figure 1

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME __________ PROJECT NO. __________

SAMPLE NO. __________ WELL NO. __________

DATE/TIME COLLECTED __________ PERSONNEL __________

SAMPLE METHOD AND DEPTH __________ __________

SAMPLE MEDIA (Circle 1): Soil Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes No SPLIT SAMPLE NUMBER __________

FIELD DUPLICATE (Circle 1): Yes No DUPLICATE SAMPLE NUMBER __________

Sample Container	Preservative	Analysis Requested

DESCRIPTION:

DEPTH: DESCRIPTION:

Comments __________

FIGURE 2

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT	HOLE NUMBER
1. COMPANY NAME	2. DRILLING SUBCONTRACTOR	SHEET OF SHEETS

PROJECT	4 LOCATION
5. NAME OF DRILLER	6. MANUFACTURE'S DESIGNATION OF DRILL
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION
	9. SURFACE ELEVATION
	10. DATE STARTED / 11. DATE
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE

Standard Operating Procedure No.2
Subsurface Drilling, Soil Sampling, and Logging

SOP NO. 2 Subsurface Drilling, Soil Sampling and Logging

2.1 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for subsurface drilling and collection of soil samples at Iowa Army Ammunition Plant (IAAAP). These procedures give descriptions of equipment, field procedures, documentation procedures, and Quality Assurance/Quality Control (QA/QC) procedures implemented for the collection of subsurface soil samples. These procedures described here are sufficiently detailed to allow field personnel to properly collect subsurface soil samples and maintain descriptive logs on the HTRW drilling log form (Figure 1). These procedure were developed in accordance with IAC 567 Chapter 49 (IDNR 1998), USACE EM 1110 (USACE1998) and USACE Omaha District Geology Scope of Services, and are detailed in this SOP. Specific sample locations and frequency of collection will be presented in future Field Sampling and Analysis Plan (FSAP) addenda.

These procedures are intended to be used together with FSAP and other appropriate SOPs. Health and safety procedures and equipment for the investigation are detailed in the IAAAP Health and Safety Plan (HSP). Applicable SOPs are listed below:

- SOP No. 7 - Sample Identification, Handling, and Documentation
- SOP No. 8 - Headspace Analysis
- SOP No. 10 - Equipment and Personnel Decontamination
- SOP No. 11 - Boring Abandonment
- SOP No. 12 - Permits and Clearances

Reference Standards

Wherever IDNR 1998 is sited in this document, it will mean the IDNR Iowa Administrative Code 567 Chapter 49, for nonpublic water wells. Wherever USAGE EM 1110 (USACE 1998) is sited in this document, it will mean the United States Army Corps of Engineers, Engineering Manual 1110-1-4000, for monitoring well design, and documentation at hazardous, toxic, and radioactive waste sites. Wherever an ASTM designation is cited in this document, it shall mean the American Society for Testing and Materials Standard Specification of that designation appearing in the "1994 Annual Book of ASTM Standards," published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania. 'EM 1110-2-1906" refers to United States Department of the Army, "Engineering and Design, Laboratory Soil Testing," 30 December 1970.

2.2 PROCEDURES FOR SOIL SAMPLING

The characterization of the soils at IAAAP will be done by logging and sampling of surface and subsurface soils. A site geologist will be present during all drilling and soil sample collection activities to maintain descriptive logs (using the Unified Soil Classification System for unconsolidated soils) and collect appropriate samples for various analyses. The following section outlines the procedures used to collect subsurface soil samples at IAAAP.

2.2.1 Equipment List

Equipment for Soil Sampling

The following is an equipment list for soil sampling:

- Hand auger equipment or drill rig with appropriate drilling and sampling tools (stainless-steel split spoons)
- Roll-off bins or other bulk storage containers
- Weighted tape measure with 0.1-foot increments
- Surveyor's stakes and flags
- Ruler marked in 0.1-foot increments
- Field books/field sheets
- Stainless-steel knife, bowl and spoon
- Sample bottles provided by the laboratory
- Sample bottle labels
- Label tape (clear)
- Paper towels
- Aluminum foil
- Camera and film
- Waterproof and permanent marking pens
- Plastic sheeting
- Plastic bags
- Appropriate health and safety equipment, as specified in the HSP
- Appropriate decontamination supplies, as specified in SOP No. 10
- Ice chest with ice

2.2.2 Decontamination

Before drilling or sampling begins, the drilling and sampling equipment will be decontaminated according to the procedures contained in SOP No. 10. Drilling and sampling equipment will be decontaminated between boring and sampling locations. Sampling equipment will also be decontaminated between collection of samples from different depths at the same location.

2.2.3 Drilling Methods

The methods and procedures for subsurface drilling and soil sample collection are provided in the following section.

2.2.3.1 Hand Auger

Hand auger samples will be collected at the specified depth using a stainless-steel hand auger with a minimum 3-inch outside diameter (OD) bucket. Before the augering activities, clear and remove vegetation and any surface debris such as rocks, as necessary. The hand auger will be advanced in 6-inch intervals to the top of the specified sampling depth. The auger bucket will be decontaminated once the target depth has been reached to avoid possible cross-contamination.

When collecting soil for chemical analysis, if additional soil is necessary to fill sample jars, an additional borehole will be dug to the sample target depth. Hand auger borings will be completed in accordance with ASTM D 1452. If chemical analysis of the sample is required, the step-by-step procedure for collecting, labeling, storing, and transporting subsurface soil samples collected by hand auger is described in Section 2.2.3.4.

2.2.3.2 Auger Borings

Auger drilling a boring will be accomplished using machine-driven hollow stem flight augers (HSA) with a 4-1/4-inch minimum inside diameter to accommodate a 3-inch outside diameter stainless-steel split spoon sampler, 5-foot-long continuous core sampler, or NX, NQ, or wire line core sampler. Auger borings will be completed in accordance with ASTM D 1452. Soil cuttings will be treated as IDW, as described in Section 7, IDW Transportation and Disposal Plan.

When sampling with a split-spoon sampler, a HSA finger plug installed in the bit will be used to prevent soil material coming into the interior of the hollow stem augers. This method will use a standard split-spoon to measure the resistance to soil penetration in accordance with ASTM D1586. Penetration resistance (blow counts) for each sampling depth will be recorded on the HTRW field boring log (Figure 1). The coupling head for the split-spoon sampler will be provided with a ball check valve and will have open vents. Where necessary for sample recovery, the sampler will also be equipped with a spring-type sample retainer or an equivalent retainer.

When using the 5-foot long continuous sampler, the tip of the sampler will precede the HSA bit, and special care will be taken to ensure that maximum recovery is obtained on each section of soil core. Runs of 1 or 2 feet may be required to obtain acceptable core recovery. Grinding of the core after the core has been blocked will not be permitted.

When using a core barrel or core sampler all drilling will be in accordance with ASTM D2113.

Soil samples will be obtained according to specifications in future FSAP addenda. The step-by-step procedure for collecting subsurface soil samples from machine-driven HSAs is described in Section 2.2.3.4.

2.2.3.3 Rotary Wash Boring

The rotary wash boring (RWB) method may be used during deep test hole drilling and monitoring well installation activities where heaving sands are encountered. The borehole diameter for test holes will be 4 inches and a minimum of 8 inches for monitoring well installation. The drilling fluid for RWB monitoring wells will consist of potable water only, and no bentonite or synthetic additives will be allowed. However, bentonite may be added to potable water during test hole drilling using the RWB method. Subsurface soil sampling within a RWB hole will be accomplished using a stainless-steel split spoon, or NX, NQ, or wire line core sampler. Soil cuttings will be treated as IDW, as described in Section 7, IDW Transportation and Disposal Plan.

A standard split-spoon sampler will be used to measure the resistance to soil penetration in accordance with ASTM D1586. Penetration resistance (blow counts) for each sampling depth will be recorded on the field boring log (Figure 1). The coupling head for the split spoon sampler will be provided with a ball check valve and will have open vents. Where necessary for sample recovery, the sampler will also be equipped with a spring-type sample retainer or an equivalent retainer.

When using a NX, NQ, or wire line core sampler, all drilling will be in accordance with ASTM D2113.

Soil samples will be obtained according to specifications in future FSAP addenda. The step-by-step procedure for collecting subsurface soil samples from RWB method is described in Section 2.2.3.4.

2.2.3.4 Subsurface Soil Sample Collection

The following step-by-step procedure should be used to collect subsurface soil samples:

- Decontaminate sampling equipment according to SOP No. 10.
- Record the sample location on a site map and in the field logbook.
- Obtain PID background (BG) readings at the sampling location in the breathing zone.
- Collect the soil sample at the depths specified in future FSAP addenda.
- Don a clean pair of gloves.
- Open the sampler, measure the recovery, and scrape off any soil smear zone from the recovered sample with a stainless-steel knife. If the soil is not cohesive or if the smear zone cannot be easily removed, an attempt will be made to remove soil from the portion of the sample that has not come in contact with the sampler.
- Determine and identify the use of the recovered sample. This will always be for soil classification and stratigraphic logging and may be for chemical, geotechnical, or headspace analysis.
- The sample must be handled quickly, especially if it is loose or crumbling, to avoid losing volatile contaminants.
- Collect any required volatile organic compound (VOC) sample immediately in appropriate sample containers.

- A portion of selected subsurface soil samples will be collected in the appropriate glass container for headspace analysis according to SOP No. 8.

- Composite the remaining soil by thoroughly mixing the soil from the sampler in a decontaminated stainless-steel bowl with a decontaminated stainless-steel spoon. SVOCs will be sampled once the soil has been composited. Fill the remaining bottles with the composited soil for the specified analysis. The required analyses and appropriate volume of containers of soil will be presented in future FSAP addenda.

- Record applicable information on the Sample Collection Field Sheet (Figure 2).

- Complete the description of materials for the recovered sample according to the Unified Soil Classification System.

- Identify, handle, and document the samples (depending on the use of the sample) according to SOP No.7.

- If no other samples are to be collected from this sampling location, the boring will be abandoned according to SOP No. 11.

- Identify the location for future reference using surveying stakes and flags

2.2.4 Field Quality Assurance/Quality Control Procedures and Samples

Field QA/QC samples are designed to help identify potential sources of external sample contamination and to evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analyses.

2.2.4.1 Field Blanks

No field blanks or QA split samples will be collected for soil sampling activities.

2.2.4.2 Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the soil sampling, a duplicate sample will be collected at the same time as the initial sample. The initial sample bottles for a particular parameter or set of parameters will be filled first, then the duplicate sample bottles for the same parameter(s), and so on until all necessary sample bottles for both the initial sample and the duplicate sample have been filled. The duplicate soil sample will be handled in the same manner as the primary sample. The duplicate sample will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory on the day it is collected. Duplicate samples will be collected for all parameters. Duplicate samples will be blind to the laboratory.

2.2.4.3 Matrix Spikes and Matrix Spike Duplicates

Matrix spikes (MS) and matrix spike duplicates (MSD) are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain-of-custody form and on the bottles. It may be necessary to increase the sample volume for samples where this designation is to be made.

2.2.5 Sample Identification, Handling, and Documentation

Samples will be identified, handled and recorded as described in this SOP and SOP No. 7. The parameters for analysis and preservation will be specified in future FSAP addenda.

2.2.6 Documentation

Each field activity must be properly documented to facilitate a timely and accurate reconstruction of events in the field (see SOP No. 7). Sample Collection Field Sheets will be completed for all soil samples submitted for chemical analysis (Figure 2).

2.2.6.1 Sample Collection Field Sheet

A sample collection field sheet for surface water samples (Figure 2) will be completed at each sampling location. The data sheet will be completely filled in. If items on the sheet do not apply to a specific location, the item will be labeled as not applicable (NA). The information on the data sheet includes the following:

- Sample location number
- Date and time of sampling
- Person performing sampling
- Type of sample
- Description of sample
- Number of samples taken
- Sample identification number
- Preservation of samples
- Headspace analysis
- Record of any QC samples from site
- Any irregularities or problems which may have a bearing on sampling quality

2.2.6.2 Field Logbook

The most important aspect of documentation is thorough, organized, and accurate record keeping. All information pertinent to the investigation and not documented on the boring log will be recorded in a bound logbook with consecutively numbered pages. All entries in logbooks will be made in waterproof ink and corrections will consist of line-out deletions that are initialed and dated. Entries in the logbook will include the following, as applicable:

- Project name and number
- Sampler's name
- Date and time of sample collection
- Sample number, location, and depth
- Sampling method
- Observations at the sampling site
- Unusual conditions
- Information concerning drilling decisions
- Decontamination observations
- Weather conditions
- Names and addresses of field contacts
- Names and responsibilities of field crew members
- Names and titles of any site visitors
- Location, description, and log of photographs (if taken)
- References for all maps and photographs
- Information concerning sampling changes, scheduling modifications, and change orders
- Summary of daily tasks (including costs) and documentation on any cost or scope of work changes required by field conditions
- Signature and date by personnel responsible for observations

Field investigation situations vary widely. No general rules can include each type of information that must be entered in a logbook for a particular site. A site-specific logging procedure will be developed to include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks will be kept in the field team member's possession or in a secure place during the investigation. Following the investigation, the logbooks will become a part of the final project file.

2.2.6.3 Boring Logs

During drilling activities, the site Geologist will describe all activities on the field boring logs and in the field logbook. Original boring logs will be submitted to USACE as soon as possible following completion. As per USACE Omaha District Geology Scope of Services the following data will be recorded in the boring logs at the drill site. The HTRW Boring Log form is shown on Figure 1.

- The name of the site geologist(s), project name, boring location, and site ID
- Drilling agency
- General description of drilling equipment used, including the rod size, bit type, pump type, rig manufacture, model, drilling personnel, and method
- Start and completion dates for all borings, and chronological time-sequence of all significant events
- Depths in feet and fractions thereof (tenths of feet)
- Soil descriptions, in accordance with the Unified Soil Classification System (USCS) and prepared in the field by the attending site geologist, which includes the following information:

  - Classification
  - USCS symbol
  - Secondary components and estimated percentage
  - Color (using Munsell Color Chart)
  - Plasticity
  - Consistency (cohesive soil) or density (noncohesive soil)
  - Moisture content
  - Texture/fabric/bedding
  - Grain angularity
  - Depositional environment/formation name (e.g., Glasford Formation, Warsaw Formation)
- Cuttings description, including basic classification, secondary components, and other apparent parameters
- Visual estimates of secondary soil constituents (if terms such as “trace’, some are used, their quantitative meanings will be defined in a general legend)
- Blow counts, hammer weight, and length of fall for split spoon samples
- Estimated depth interval and length of sample recovered for each sample interval
- Field screening results for soil headspace, breathing zone, and borehole with PID
- Depth to water first encountered during drilling and the method of determination (any distinct water-bearing zones below the first zone will also be noted)
- Drilling sequence
- Any unusual problems
- Other remarks or observations

Figure 1

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT	HOLE NUMBER
1. COMPANY NAME	2. DRILLING SUBCONTRACTOR	SHEET OF SHEETS
3. PROJECT	4. LOCATION	
5. NAME OF DRILLER	6. MANUFACTURE'S DESIGNATION OF DRILL	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED	11. DATE COMPLETED
12. OVERBURDEN	15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING	
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE			
20. SAMPLES FOR CHEMICAL	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

Figure 1

HTRW DRILLING LOG

T	INSPECTOR	HOLE SHEET OF SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.

	PROJECT	HOLE NO.

Figure 2

SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME ____________________ PROJECT NO. __________

SAMPLE NO. ____________________ WELL NO. __________

DATE/TIME COLLECTED ____________________ PERSONNEL __________

SAMPLE METHOD AND DEPTH ____________________ __________

SAMPLE MEDIA (Circle 1): Soil Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes No SPLIT SAMPLE NUMBER __________

FIELD DUPLICATE (Circle 1): Yes No DUPLICATE SAMPLE NUMBER __________

Sample Container	Preservative	Analysis Requested

DESCRIPTION:

DEPTH: DESCRIPTION:

Comments ____________________

Standard Operating Procedure No. 3
Monitoring Well Installation and Development

SOP NO. 3 Monitoring Well Installation and Development

3.1 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for monitoring well installation and development at the Iowa Army Ammunition Plant (IAAAP). These procedures give descriptions of equipment, field procedures and documentation procedures implemented for the installation and development of Monitoring Wells. The procedures described here are sufficiently detailed to allow field personnel to properly install and develop the planned groundwater monitoring wells. Field procedure were developed in accordance with IAC 567 Chapter 49 (IDNR 1998), USACE EM 1110 (USACE 1998) and USACE Omaha District Geology Scope of Services, and are detailed in this SOP. Specific well location will be presented in future Field Sampling and Analysis Plan (FSAP) addenda.

These procedures are intended to be used together with FSAP and other appropriate SOPs. Health and safety procedures and equipment for the investigation are detailed in the IAAAP Health and Safety Plan (HSP). Applicable SOPs are listed below:

- SOP No. 1 - Subsurface Drilling, Soil Sampling, and Logging
- SOP No. 8 - Headspace Analysis
- SOP No. 9 - Water Level Measurement
- SOP No. 10 - Equipment and Personnel Decontamination
- SOP No. 11 - Boring Abandonment
- SOP No. 12 - Permits and Clearances

Reference Standards

Wherever IAC 567 Chapter 49 (IDNR 1998) is sited in this document, it will mean the IDNR Iowa Administrative Code 567 Chapter 49, for nonpublic water wells. Wherever USAGE EM 1110 (USACE 1998) is sited in this document, it will mean the United States Ai-my Corps of Engineers, Engineering Manual 1110-1-4000, for monitoring well design, and documentation at hazardous, toxic, and radioactive waste sites. Wherever an ASTM designation is cited in this document, it will mean the American Society for the Testing and Materials Standard Specification of that designation appearing in the "1994 Annual Book of ASTM Standards", published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania. "EM 1110-2-1906" refers to the United states Department of the Army, 'Engineering Design, Laboratory Soil Testing," 30 December 1970.

3.2 PROCEDURE FOR DRILLING AND MONITORING WELL INSTALLATION

The installation of groundwater monitoring wells (including piezometers) will be done to allow water level measurements, hydraulic conductivity testing, and collection of groundwater samples at IAAAP.

Monitoring wells are scheduled to be installed with hollow-stem augers, placing the well materials through the center of the augers. However, if heaving sands are encountered or bedrock wells are required, rotary wash boring (RWB) methods may be required.

Small diameter injection piezometers will be installed using direct push methodologies which are described in detail in SOP No. 13.

The following equation shall be used to calculate the volume of water to be removed during well evacuation:

For 2-inch wells:

One Evacuation Volume (gal) = (Total Well Depth [fi] - Water Level Depth [ft]) x 0.16 gal/ft.

Multiply the volume of one well casing volume by five to obtain the minimum volume of water to be evacuated. Note: if water was added during installation or drilling, at least three times this volume must be removed before well development evacuation begins. This is especially important if RWB methods are used.

3.3.3 Documentation

Documentation of observations and data acquired in the field will provide information on well development and also provide a permanent record. These observations and field data will be recorded with waterproof ink in a bound weatherproof field logbook with consecutively numbered pages and on the well development log shown on Figure 3. As pad of the development process, the following information will be recorded:

- Well designation
- Well location
- Date(s) and time of well development
- Static water level from top of well casing before and after development
- Volume of water in well prior to development
- Volume of water removed and time of removal
- Depth from top of well casing to bottom of well
- Screen length
- Depth from top of well casing to top of sediment inside well, if present, before and after development
- Field measurements of pH, specific conductance, temperature, turbidity, DO, and redox taken during and after development
- Physical characteristics of removed water throughout development (color and odor)
- Type and size/capacity of pump and/or bailer
- Description of development technique
- Decontamination observations
- Instrument calibration record

3.2.1 Equipment List

The following is an equipment list for well installation:

- Well casing and well screen (continuous-slot/PVC wire-wrapped)
- Stainless-steel centralizers (if required)
- Bentonite (pellets, powder, or chips)
- Filter pack and buffer sand
- Potable water
- Portland Type I or II Cement, powdered bentonite for grouting
- 4-inch, square channel, locking protective, 6-foot steel casing
- 2-inch, 6-foot long guard posts
- High-pressure steamer/cleaner
- Long-handled bristle brushes
- Wash/rinse buckets
- Alconox type detergent
- Location map
- Drill rig capable of installing wells to the desired depth with the proper diameter in the expected formation materials and conditions
- Plastic bags
- Self-adhesive sample bottle labels
- Weighted tape measure with 0.1-foot increments
- Water level probe with 0.01-foot increments
- Deionized water and pressure sprayer
- Appropriate health and safety equipment, as specified in the Health and Safety Plan (HSP)
- Field Logbook
- Boring log sheets (USACE Engineering Form 5056-R)
- Well construction form
- Well locks (keyed alike)

3.2.2 Decontamination

Before drilling or sampling begins, the drilling and sampling equipment will be decontaminated according to the procedures contained in SOP No. 10. Drilling and sampling equipment will be decontaminated between boring and sampling locations. Sampling equipment will also be decontaminated between collection of samples from different depths at the same location.

3.2.3 Preparation for Drilling

Several activities must be completed prior to any drilling work including:

- Staking the boring position
- Confirming accessibility of the monitoring well location to the proposed drilling equipment
- Clearing underground utilities or structures at the boring site, according to SOP No. 12

All sites must be checked for access prior to mobilization of the drill crew. Remember to check for overhead utilities or obstructions, security requirements and access to keys to pass through locked gates. SOP No. 12, Permits and Clearances should be reviewed.

3.2.3.1 Drilling Methods

Hollow-stem auger and rotary wash boring methods are described in the following sections.

Hollow-Stem Auger Drilling

Hollow-stem auger (HSA) methods are commonly used in cohesive soils or in granular soil formations, where the boring walls may be unstable, and the augers form a temporary casing to allow sampling of the "undisturbed soil" below the bit. The hollow-stem augers provide a casing that supports the borehole walls and provides clear access to the bottom of the boring. Samplers can be easily inserted into the central core of the augers to obtain soil samples with a reduced risk of contamination by contact with soil strata at higher elevations. In a similar manner the augers allow installation of the monitoring well materials through the central core greatly reducing the potential for contact with the surrounding soil formations and resulting contamination.

The hollow-stem augers were designed to be advanced with a center bit or plug attached to drill rods. This center bit is intended to prevent soil cuttings from entering the hollow-stem augers during drilling and is removed to allow soil sampling. Use of a center plug or a special retainer basket to keep the core of the augers free of soil is essential.

Significant problems can occur where hollow-stem augers are used to sample soils below the water table. The unbalanced water pressure acting against the soil at the bottom of the boring can significantly disturb the soil, particularly in granular soils or soft clays and silts. Often the soils will heave and plug the auger preventing the sampler from reaching the bottom of the boring. Where heave or disturbance occurs, the penetration resistance or strength of the sample can be significantly reduced and the augers can become contaminated. Use of a retainer basket or filling the center of the augers with water may be required in some soil formations. Any water introduced into the augers must be potable and the quantity used recorded in the logbook. If heaving occurs, contact the site manager for specific instructions to modify the drilling method.

The hollow-stem auger drilling method generally produces limited cuttings for visual observation, thus reducing the information available to detect changes between sample intervals. As the boring is advanced to greater depths a considerable delay may occur before the soil cuttings appear at the ground surface and the large size of the augers may limit the ability of the driller to detect changes in the soil conditions by monitoring the response of the drilling equipment. The field geologist must be aware of these limitations in identification of soil conditions between sample locations. Soil cuttings will be treated as IDW, according to Section 7, IDW Transportation and Disposal Plan.

Rotary Wash Boring

Rotary wash boring (RWB) methods are commonly used in soil formations below the groundwater level where the boring walls are unstable or the formation is too hard to penetrate (i.e., bedrock) using augering methods.

In rotary wash boring, the drilling fluid, consisting of potable water which mixes with natural formation materials, is pumped down the drill rods and through a bit that is attached at the lower end of the drill space between the drill rods and the wall of the borehole. At the surface, the fluid discharges through a pipe or ditch and enters into a segregated or baffled sedimentation tank, pond or pit. The settling pit overflows into a suction pit where a pump recirculates the fluid back through the drill rods.

During rotary wash boring, drilling fluid tends to infiltrate permeable zones. This is why the fluid must be removed prior to well placement and again during the development process. Drilling fluid can interfere with the specific function of a monitoring well and prevent collection of a sample that is representative of the *in situ* groundwater quality. However, in higher yielding formations, this potential problem typically can be alleviated.

For well borings requiring soil sampling, split spoon, thin-wall or wireline core sampling methods will be used. If coring is required, ream the borehole with a 6-inch bit after coring activities have been completed. Soil cuttings will be treated as TDW according to Section 7, IDW Transportation and Disposal Plan.

The amount of potable water used during drilling, and lost to the formation, must be calculated or estimated and recorded in the field logbook. This calculation will be used during the well development activities.

Soil Sampling

Soil samples for material description, chemical analysis, or geotechnical analysis may be required. Where analytical or geotechnical testing is required, the soil samples will be obtained in accordance with SOP No. 2.

The sample will be classified in the field by the field geologist using the methods described in SOP No. 2 and the description recorded on the boring log (Figure 1). The strength of the soil sample will be measured with visual methods, evaluation of the driving resistance, or a hand penetrometer test.

Boring Logs

During drilling activities, the site Geologist will describe all activities on the field boring logs and in the field logbook. Original boring logs will be submitted to USACE as soon as possible following completion. As per USACE Omaha District Geology Scope of Services, the information described in Section 2.2.6.3 of SOP No. 2 will be recorded in the boring logs at the drill site. The HTRW Boring Log form is shown on Figure 1.

3.2.3.2 Well Materials Specifications

Well Casing

Well casing will consist of new, threaded, flush-joint, 2-inch ID, schedule 40 PVC. Teflon O-rings will be used at all joints. Heat-welded joints and or gaskets will not be used. The tops of all well casings will be fitted with locking caps that can be easily removed by hand.

Well casing for injection wells will be 1-inch ID, schedule 40 PVC. Teflon O-rings will be used at all joints.

Well Screen

Well screen will consist of new 2-inch ID PVC continuous-slot/PVC wire-wrapped screen with a bottom screw-type plug. The screen slot size will be 0.0 10 inches. The screen length of the monitoring wells will be 5 to 10 feet depending upon the saturated thickness and the seasonal fluctuations of the water table. The screen length of monitoring wells will not exceed 10 feet in length. The screen depths will be specified in future FSAP addenda. All well screens will have an inside diameter equal to or greater than that of the well casings.

Centralizers

Stainless-steel centralizers will be used on wells installed using RWB methodology below a depth of 50 feet. Centralizers will be attached at the base and top of the well screen, and every 15 feet thereafter.

Filter Pack

The filter pack material for the monitoring wells will consist of clean, washed, well-rounded silica sand to form a filter between the natural formation material and the well screen. Assume a commercially-available grain-size distribution (e.g., #16-30, #20-40 or other available sizes). Constant probing of pack thickness will be done to prevent bridging. The filter pack will be placed from the bottom of the boring to about 2 to 3 feet above the top of the screen.

Bentonite Seal

A bentonite seal will be installed directly above the filter pack sand in the monitoring wells. The seal will consist of a layer of commercially-available, less than one-half inch, sodium bentonite pellets or chips that are approximately 3 feet thick as measured immediately after placement, without allowance for swelling. The bentonite seal will be allowed to hydrate for a minimum of 4 hours before grouting begins. For bentonite seals above the saturated zone, about one gallon of potable water per foot of chips or pellets will be added to initiate hydration of the bentonite. Each 1-foot lift will be allowed to hydrate for 30 minutes. After the placement of the final lift, the bentonite will be allowed to hydrate for an additional 2 hours prior to placement of the grout. Manufactured, coated, sodium bentonite pellets will be used for wells installed using HSA drilling methods. However, placement of pellets far below the water level, inside HSAs, may be problematic. If pellets are not feasible, then a buffer sand seal used.

Buffer Sand Seal

A buffer sand seal shall be installed directly above the filter pack sand for monitoring wells where a bentonite seal is problematic (i.e., seals below the water table). The seal will consist of a 5-foot thick layer of clean fine sand (e.g., #100).

Cement/Bentonite Grout

The annular space between the well casing and the boring in the wells will be filled with a cement/bentonite grout from the top of the bentonite or buffer sand seal to 3-feet below the ground surface. The grout will consist of a mixture that is blended to produce a thick, lump-free, cement/bentonite grout. The grout will be prepared in an aboveground rigid container by first thoroughly mixing the bentonite powder with water and then mixing in the cement. All monitoring wells will be pressure grouted from immediately above the seal by a side discharge tremie pipe. The grout will be pumped through the tremie pipe until undiluted grout flows from the annular space at the ground surface.

Concrete Surface Seal

Following placement of the cement/bentonite grout, the remaining 3 feet of annular space will be at least 1-foot in diameter and will be filled with at least 3000 psi portland cement concrete.

Above ground Completion

Following placement of the concrete surface seal, a minimum 4-inch, square channel, locking protective, 6-foot-long, protective steel casing shall be placed over the monitoring well casing projecting above the ground surface. The protective casing will be placed about 3 feet into the concrete surface seal, leaving about 3 feet above the ground surface. A concrete surface pad will be placed around the protective cover extending a minimum of 1.5 feet (3-foot diameter) from the cover and a minimum of 6 inches thick with a slight mound above the ground surface. All well will have an aboveground completion.

Monitoring wells located in off-site locations may be flush mount surface completions in accordance with the requests of the county or other property owner.

Guard Posts

Four 2-inch-diameter steel posts will be installed around the wells with aboveground completions. The posts will be located radially from the well casing at a distance of about 4 feet. The guard posts will be placed about 3 feet below the ground surface and have a minimum of 3 feet aboveground exposure. The inside of each post will be filled with concrete.

3.2.3.3 Well Installation Procedure

The procedures for installation of shallow, intermediate, and deep monitoring wells are included in the following section:

Shallow and Intermediate Wells (HSA)

1. Decontaminate all drilling equipment according to procedures outlined in SOP No. 10.

2. Advance the boring to the planned depth using hollow stem augers or other approved drilling method. Collect any required soil samples soil samples using a split spoon sampler or a continuous sampler advanced with the hollow-stem augers.

3. Measure depth of completed boring using a weighted tape.

4. Decontaminate all well materials according to SOP No. 10. Following decontamination, all personnel that handle the well materials will don a clean pair of gloves.

5. Measure the length of each section of well casing and screen to nearest 0.10 foot.

6. Assemble the well screen and casing as it is lowered into the boring inside the hollow stem augers.

7. Lower screen and casing until the screen interval is at the desired depth.

8. Record level of top of casing and calculate screened interval. Adjust screen interval by raising the assembly to the desired the interval, if necessary, and add filter pack sand to raise the bottom of the boring to the base of the casing.

9. Calculate and record the volume of the filter pack, bentonite or buffer sand seal, and grout/bentonite chips required for existing boring conditions. (Annular Space Calculation:= itr^{2}h ; Vc = rr^{2}h ; VA = V~ - Vc where V~ = Volume of borehole, Vc = Volume of casing, **VA** = Volume of annulus, r = Radius of borehole, and h = Vertical length of borehole.)

10. Install the monitoring well filter pack sand, seal, and backfill.

    a. Begin adding filter pack sand around the annulus of the casing. Repeated depth soundings shall be taken to monitor the level of the sand. Record the amount of water (if any) used during filter pack sand placement in field logbook.

    b. Allow sufficient time for the filter pack sand to settle through any water column outside the casing before measuring the sand level.

    c. Extend the filter pack sand to about 2-3 feet above the top of the well screen.

    d. Following filter pack sand placement, install a 3-foot thick annular seal of bentonite chips or pellets on top of the filter pack sand. Slowly add the bentonite chips or pellets through the Hollow-Stem Augers to avoid bridging. The bentonite pellet seal will be allowed to hydrate for a minimum of 4 hours.

e. Add one gallon of potable water per one foot lift of bentonite to initiate swelling of the bentonite if annular seal is above the water table. Each 1-foot lift will be allowed to hydrate for 30 minutes. The bentonite seal will be allowed to hydrate for an additional 2 hours prior to placement of the cement/bentonite grout.

f. A 5-foot buffer sand seal will be installed directly above the filter pack sand for monitoring wells where a bentonite seal is problematic (i.e., seals below the water table). Allow sufficient time for the buffer sand to settle through any water column outside the casing before measuring the sand level.

g. Add cement/bentonite grout to the remaining annulus from the top of the bentonite or buffer sand seal to 3 feet below the surface. The grout will be tremied into the borehole until the annulus is completely filled. The base of the side discharge tremie pipe should be placed approximately 3 feet above the seal when grouting begins.

h. After the column of grout has set for at least 24 hours it will be checked for settlement. If necessary, additional grout will be added to accommodate any settlement.

11. After the monitoring well backfill grout sets, the 3-foot thick concrete surface seal will be installed. The excavation will be filled with concrete. A protective casing will be centered on the well casing riser and inserted into the concrete. The well number, depth, and installation date will be inscribed on the well casing cap.

12. See Figures 4 and 5 for the shallow and medium monitoring well construction logs.

Deep Wells (HSA and RWB)

1. Decontaminate all drilling equipment according to procedures outlined in SOP No. 10.

2. Advance the boring with HSAs to the top of bedrock. Collect any required soil samples using a split-spoon sampler or a continuous sampler.

3. At the bedrock contact, set a 6-inch PVC double casing inside the HSAs and grout in place. Other techniques include grouting the entire boring and reaming out the grout.

4. Convert to RWB after grout has been allowed to set for 24 hours.

5. Drill through the bottom of the PVC double casing and grout.

6. Borings will be rock cored 20-feet into the bedrock, and then reamed to 6-inch OD. All rock cores will be retained.

7. Measure depth of completed boring using a weighted tape.

8. Flush the borehole with clean, potable water to remove cuttings. Record amount of water lost to formation. If coarse material or cuttings settle to the bottom of the borehole, a split-spoon will be used to remove the material.

9. Decontaminate all well materials according to SOP No. 10. Following decontamination, all personnel that handle the well materials will don a clean pair of gloves.

10. Measure the length of each section of well casing and screen to nearest 0.10 foot.

11. Assemble the well screen and casing as it is lowered into the double casing.

12. Lower screen and casing until the screen interval is at the desired depth..

13. Record level of top of casing and calculate screened interval. Adjust screen interval by raising the assembly to the desired interval, if necessary, and add filter pack sand to raise the bottom of the boring to the base of the casing.

14. Calculate and record the volume of the filter pack, bentonite seal, and grout/bentonite chips required for existing boring conditions. (Annular Space Calculation: VR = $7rr^2h$; Vc = **VA** = V-~ -. where V~ = Volume of borehole, Vc = Volume of casing, **VA** = Volume of annulus, r = Radius of borehole, and h = Vertical length of borehole.)

15. Install the monitoring well filter pack sand, seal, and backfill.

    a. Begin adding filter pack sand around the annulus of the casing. Repeated depth soundings shall be taken to monitor the level of the sand. Record the amount of water used during filter pack sand placement in field logbook.

    b. Allow sufficient time for the filter pack sand to settle through any water column outside the casing before measuring the sand level.

    c. Extend the filter pack sand to about 2-3 feet above the top of the well screen.

    d. A 5-foot buffer sand seal will be installed directly above the filter pack sand for monitoring wells. Allow sufficient time for the buffer sand to settle through any water column outside the casing before measuring the sand level.

    e. Add cement/bentonite grout to the remaining annulus from the top of the buffer sand seal to 3 feet below the surface. The grout will be tremied into the borehole until the annulus is completely filled. The base of the side discharge tremie pipe should be placed approximately 3 feet above the seal when grouting begins.

    f. After the column of grout has set for at least 24 hours it will be checked for settlement. If necessary, additional grout will be added to accommodate any settlement.

16. After the monitoring well backfill grout sets, the 3-foot thick concrete surface seal will be installed. The excavation will be filled with concrete. A protective casing will be centered on the well casing riser and inserted into the concrete. The well number, depth, and installation date will be inscribed on the well casing cap.

17. See Figure 6 for the deep monitoring well construction log.

3.2.4 Documentation

Observations and field data acquired during drilling and installation of the monitoring wells will be recorded to provide a permanent record. These observations will be recorded with waterproof ink in a bound weatherproof field logbook with consecutively numbered pages. Notes will be recorded daily when in the field. The information in the field logbook will include the following as a minimum:

- Project name and number
- Observer's name
- Drilling and well installation observations as described in Section 3.2.3.3 of this SOP
- Decontamination observations as described in SOP No. 10
- Weather conditions
- Other pertinent information

A boring log (Figure 1) will be completed for each boring. The observations made during the boring will also be recorded in the field logbook. The well installation details will be shown in a diagram that will be completed in the field logbook and on the monitoring well construction log (Figure 2). Each well diagram will consist of the following (denoted in order of decreasing depth from ground surface):

- Bottom of the boring
- Casing depth
- Casing and screen type
- Screen location(s)
- Filter pack
- Bentonite or buffer sand seal
- Well backfill material (chips or grout)
- Cave-in locations
- Depth of riser without cap (below ground surface)
- Concrete surface seal and protective casing details

Additional documentation for well construction noted in the field logbook will include the following:

- Grout, sand, and bentonite volume calculations prior to well installation.

- The quantity and composition of the grout, seals, and filter pack actually used during construction.
- Screen slot size (in inches), slot configuration, outside diameter, nominal inside diameter, schedule/thickness, composition, and manufacturer.
- Coupling joint design and composition.
- Protective casing composition and nominal inside diameter.
- Start and completion dates.
- Discussion of all procedures and any problems encountered during drilling and well construction.
- Need to add water during well installation. Note the depth that water was added and the quantity.

3.2.5 Well Acceptance Criteria

Well acceptance will be on a case-by-case basis. The following criteria will be used along with individual circumstances in the evaluation process.

a. The well and material placement will meet the specifications of the Project Work Plan, FSAP, and all pertinent SOPs unless modified by any amendments.

b. Wells will not contain portions of drill casing or augers unless they are specified in the Work Plan as permanent casing.

c. All well casing and screen materials will be free of any unsecured couplings, ruptures, or other physical breakage/defects before and after installation.

d. The annular material (filter pack, bentonite, buffer sand, and grout) of the installed well will form a continuous and uniform structure, free of any detectable fractures, cracks, or voids.

e. All risers will be set round, plumb and true to line, allowing the insertion and retrieval of the pump and/or bailer optimally designed for that size casing. A 10-foot long section of pipe will be run through the entire length of well to check alignment.

f. All joints will be constructed to provide a straight, non-constricting, and watertight fit.

g. Completed wells will be free of extraneous objects or materials; e.g., tools, pumps, bailers, packers, excessive sediment thickness, grout, etc. This prohibition should not apply to intentionally installed equipment per the Work Plan.

3.3 WELL DEVELOPMENT PROCEDURE

The purpose of well development is to remove well drilling fluids, solids, or other particulates which may have been introduced or deposited on the boring wall in a recently installed well during drilling and construction activities. This restores the hydraulic conductivity of the aquifer material surrounding the well to near pre-well installation conditions. Properly developed monitoring wells allow for the collection of low turbid ground water samples that are chemically and physically representative of the aquifer of concern, and accurate water level measurements. The procedure is also applicable to older or improperly developed wells that are suspected of not providing representative groundwater samples.

This section describes the equipment, methods, and documentation that shall be used for developing groundwater monitoring wells.

3.3.1 EQUIPMENT LIST

The following items are required to properly develop groundwater monitoring wells:

- Well keys
- Water level probe with 0.01-foot increments
- Weighted tape measure with 0.1-foot increments
- Calculator
- Field notebook and well development log
- Waterproof pen
- Submersible pump
- Teflon disposable bailer (sized appropriately for well)
- Nylon rope or wire line for bailing
- Surge block (sized appropriately for well)
- PVC or stainless-steel pipe for operating surge block (sized appropriately for well)
- Multi-parameter water quality probe with flow-through cell (pH, specific conductance, temperature, Dissolved Oxygen (DO), and Oxidation Reduction Potential (ORP).
- Turbidity meter
- Calibration solutions
- Polyethylene or glass container (for field parameter measurements)
- Plastic squeeze bottle filled with deionized water
- 5-gallon bucket
- Appropriate IDW containers for storage of development water
- Appropriate health and safety equipment
- Alconox soap (or equivalent)
- Potable tap water
- Distilled or deionized water
- Decontamination buckets/pails
- Plastic brushes
- Well completion information

3.3.2 Procedure

The development of a newly installed monitoring well will proceed only after the cement/bentonite grout or hydrated bentonite chips have been allowed to set for a minimum of

48 hours. Monitoring well development activities will be completed prior to purging and groundwater sampling for analytical testing. Before development begins, the development equipment will be decontaminated according to the procedures described in SOP No. 10. Equipment coming in contact with the well will also be decontaminated between wells.

Before development begins, the field personnel will verify that the water quality probe, and water level probe are operating properly. The water quality probe will be calibrated at the beginning and end of each week. Calibration checks will be done every day prior to use. Calibration times and readings will be recorded in the field logbook. Specific instructions for calibrating the probes are given in the manufacturer's manual.

Monitoring well development is accomplished using a surge block and/or a bailer, hand pump, or submersible pump to flush the screen, sand pack material, and borehole wall of drilling fluids and fine sediment resulting from well drilling and installation activities. This procedure also allows for the removal of fine sediment which may have accumulated within the inner well casing.

Development consists of removing water during repeated surging and well evacuation episodes. Well surging is the process of causing water to move through the screen and into and out of the sand pack and aquifer formation. This will be accomplished by gently surging the entire length of well screen either mechanically using a surge block or hydraulically utilizing a bailer or pump. **Note: Surging will be done only on wells screened within sand formations.** This allows for the proper packing of the sand pack material. Well evacuation is the process of removing water from throughout the entire water column by periodically lowering and raising the pump intake or the point to which the bailer is lowered. Development water will be collected in drums or portable bulk storage tanks for transportation and disposal. Development water will be treated as IDW, as described in Section 7, IDW Transportation and Disposal Plan.

Development of monitoring wells installed in formations with a relative high hydraulic conductivity (e.g., sand or silty sand) will be completed by alternating between surging and extraction methods with either a hand or submersible pump.

Development of monitoring wells installed in formations with a relatively low hydraulic conductivity (e.g., clay or silt) will be completed with a bailer, hand or submersible pump. The initial development will attempt to remove highly turbid water from the well. Subsequent development will be completed slowly to minimize any surging. Water will be evacuated slowly to allow the filter pack to trap the fine suspended sediment and allow the introduction of lower turbidity formation water into the well.

During the well development activities, field parameters (temperature, pH, specific conductance, turbidity, DO, and ORP) are measured and the clarity, color, any presence of odors, and other comments regarding water quality are noted in the field logbook and on the well development log (Figure 3). The date, time, and volume of water removed are also recorded at this time. A sample of water will be collected for measurement of field parameters at the beginning of well development in order to establish a baseline for comparison with the water quality as well development proceeds. Measurements of field parameters along with observations will be recorded after a minimum of one well casing volume of water is removed.

3.3.2.1 Development Duration

Monitoring well development will continue until a minimum of five well volumes are removed. If water was added to the well during drilling or construction activities, at least three times the volume of water added will be removed in excess of the five well volumes of water to be removed for development. Additionally, field water quality parameters will be measured during development purging. Development will continue until parameters have stabilized according to the following:

— pH	± 0.2 units
— Temperature	± 10%
— Specific conductivity	± 10%
— Dissolved Oxygen	± 10%
— Oxidation Reduction Potential	+10%
— Turbidity	± 10% (or clear and free of fines)

Regardless of the volume of water removed or the stability of the parameters, development will continue for a minimum of 2-hours. If the well is pumped or bailed dry, it will be allowed to recover. No agents or additives will be used or introduced into the well during development or at any other time.

3.3.2.2 Well Volume Calculations

The volume of water required for removal during development is calculated using the following method:

I. Measure the depth to water in the well from the measuring point. This is usually a notched point on the top of PVC riser pipe that has been surveyed.

2. Measure the total depth of the well from the same measuring point used for measuring the depth to water.

3. Calculate the height of water in the well casing by subtracting the depth of water from the total well depth.

4. Calculate the number of gallons of water corresponding to one well volume. This is done by multiplying the height of water in the well casing by the conversion factor corresponding to the inside diameter of the well casing.

Figure 1

1.5

HTRW DRILLING LOG

HTRW DRILLING LOG			DISTRICT			HOLE NUMBER
1. COMPANY NAME			2. DRILLING SUBCONTRACTOR			SHEET OF SHEETS
3. PROJECT			4. LOCATION			
5. NAME OF DRILLER			6. MANUFACTURE'S DESIGNATION OF DRILL			
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT			8. HOLE LOCATION			
			9. SURFACE ELEVATION			
			10. DATE STARTED		11. DATE COMPLETED	
12. OVERBURDEN			15. DEPTH GROUNDWATER ENCOUNTERED			
13. DEPTH DRILLED INTO			16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING			
14. TOTAL DEPTH OF HOLE			17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)			
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE			
20. SAMPLES FOR CHEMICAL	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

Figure 1

HTRW DRILLING LOG		HOLE
PROJECT	INSPECTOR	SHEET OF SHEETS

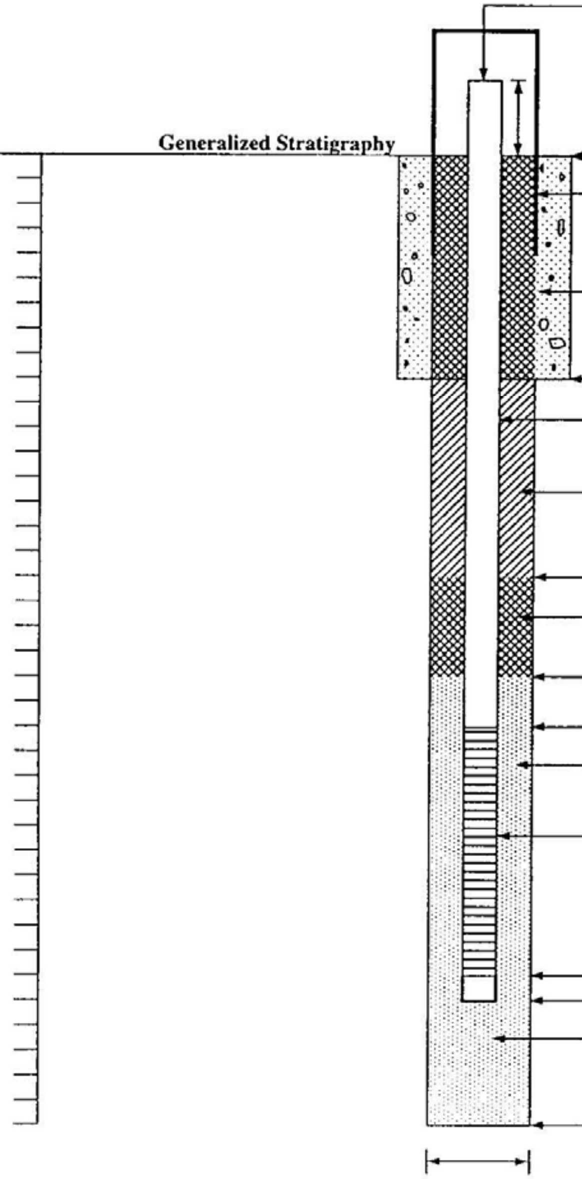
ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.

	PROJECT	HOLE NO.

Figure 2

MONITORING WELL CONSTRUCTION LOG

Project Name ____________________ **Piez./Well No.** __________
Location ____________________ **Project No.** __________
Installed By ____________________ **Date** ________ **Time** ______
Inspected By ____________________
Method of Installation ____________________
Remarks ____________________
____



Elevation of top of riser ______

Height of riser above ground ______

Ground Elevation ______

I.D./Type of surface casing
______
______

Type of surface seal ______
______

Depth of surface seal ______

I.D./Type of riser pipe ______
______

Type of backfill ______
______

Depth to top of seal ______

Type of seal ______

Depth of top of filter pack ______

Depth of top of screen ______

Type of filter pack ______
______

I.D./Type of screen ______
______

Screen slot size ______

Depth of bottom of screen ______

Depth of bottom of plugged blank section ______

Type of backfill below observation well ______

Depth of bottom of boring ______

Diameter of boring ______

Figure 4

PROPOSED MONITORING WELL CONSTRUCTION LOG

Project Name Iowa Army Ammunition Plant — Well No. Shallow Wells
Location Middletown, IA — Project No. 45-FM9602WW.00
Remarks This is a typical monitoring well above ground construction for IAAAP.
AGS=Above Ground Surface, BGS=Below Gound Surface, *=Typical depths for monitoring well construction

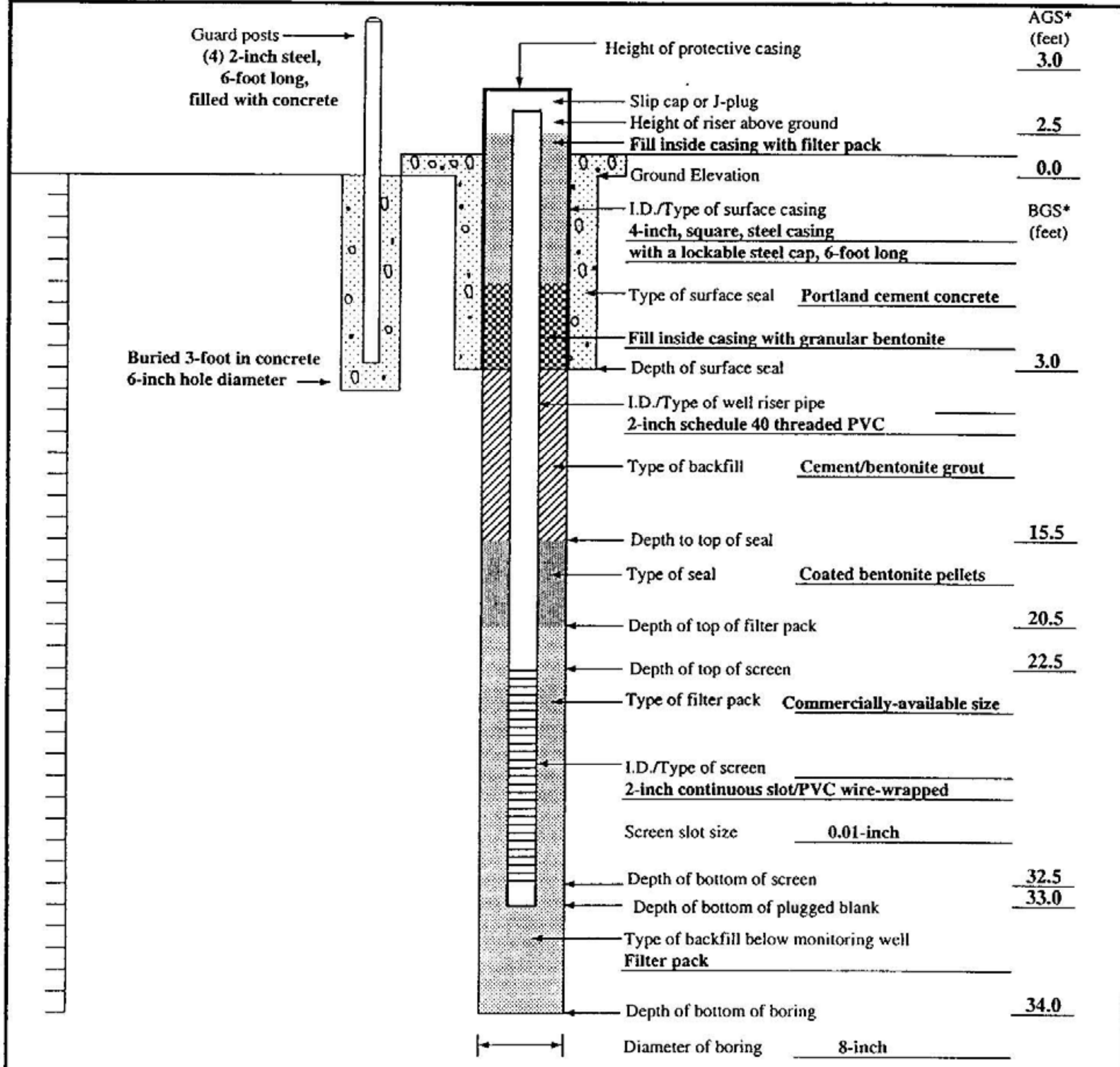


Figure 5

PROPOSED MONITORING WELL CONSTRUCTION LOG

Project Name: Iowa Army Ammunition Plant
Location: Middletown, IA
Remarks: This is a typical monitoring well above ground construction for IAAAP.
AGS=Above Ground Surface, BGS=Below Ground Surface, *=Typical depths for monitoring well construction

Well No.: Intermediate Wells
Project No.: 45-FM9602WW.00

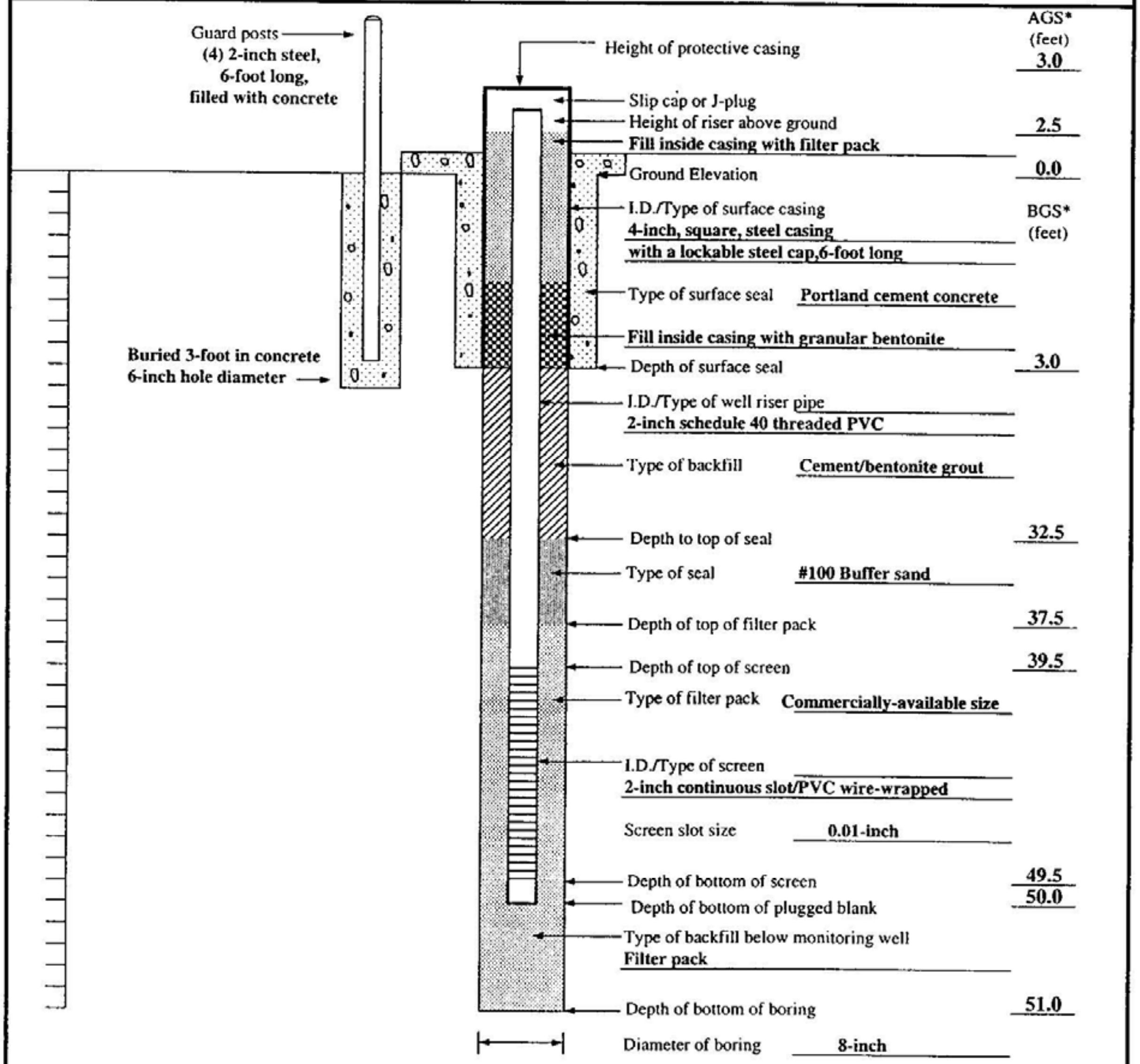
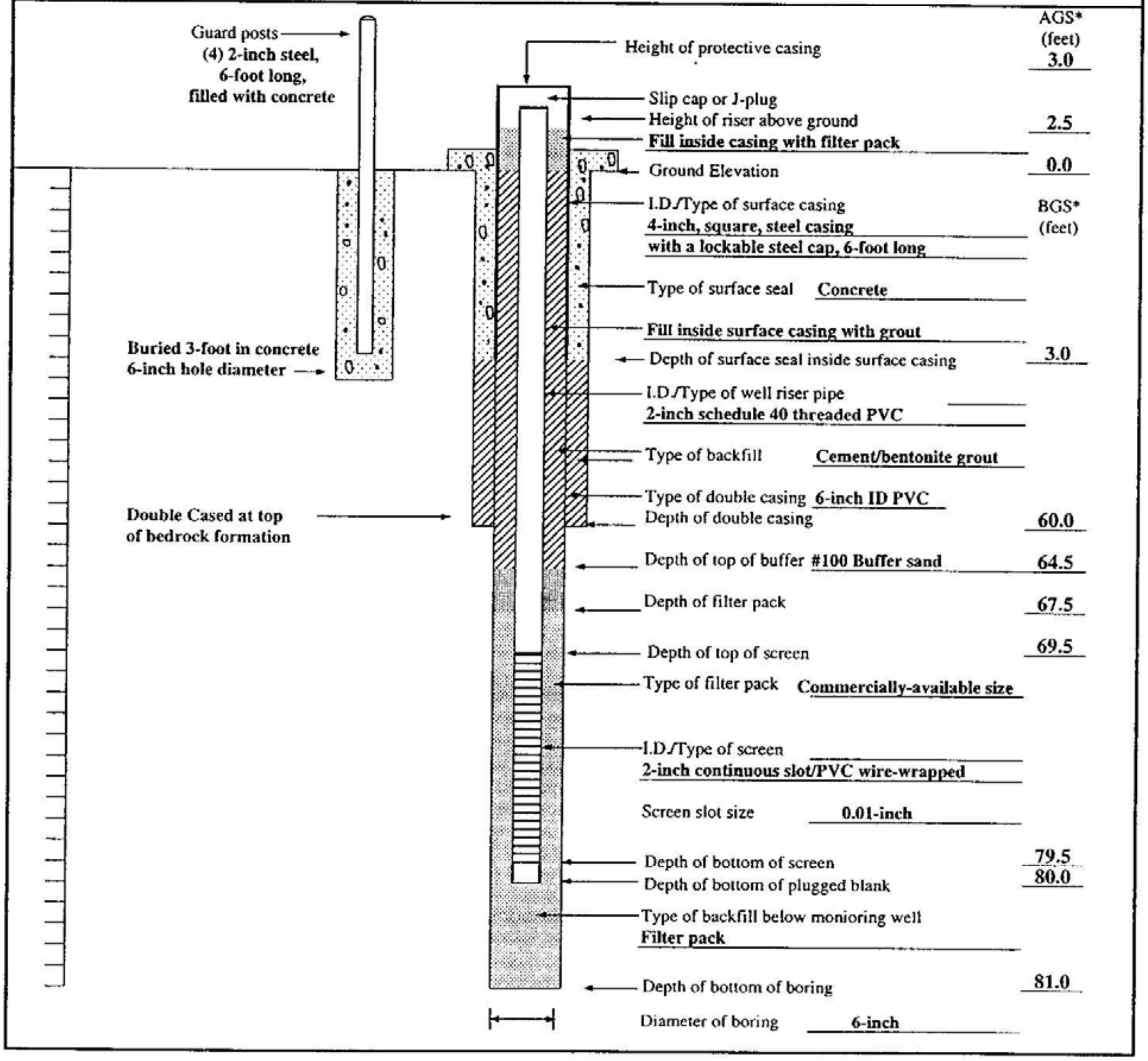


Figure 6

PROPOSED MONITORING WELL CONSTRUCTION LOG

Project Name Iowa Army Ammunition Plant
Location Middletown, IA
Remarks This is a typical monitoring well above ground construction for IAAAP.
AGS=Above Ground Surface, BGS=Below Ground Surface, *=Typical depths for monitoring well construction

Well No. Deep Wells
Project No. 45-FM9602WW.00



Standard Operating Procedure No.4
Hydraulic Conductivity Testing Slug Test Method

SOP NO. 4 Hydraulic Conductivity Testing/Slug Test Method

4.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for measuring hydraulic conductivity in all new monitoring wells at the Iowa Army Ammunition Plant (IAAAP). The wells will be presented in future Field Sampling and Analysis Plan (FSAP) addenda. This procedure is intended to be used together with FSAP and other SOPs. Applicable SOPs are listed below:

- SOP No. - 8 Headspace Analysis
- SOP No. - 9 Water Level Measurement
- SOP No. - 10 Equipment and Personnel Decontamination

4.2 PROCEDURE FOR HYDRAULIC CONDUCTIVITY TESTING

Hydraulic conductivity is to be determined using the slug test method, by measuring the change in water level over time, after a “slug” is instantaneously placed into and/or removed from the monitoring well. Field personnel conducting the tests will be responsible for selecting the test method and gathering the required equipment and materials. At the site, the equipment will be set-up and pre-test checks will be performed. Field personnel will be required to record all measurements and document the test procedure. Results will be plotted and analyzed.

Testing procedures were developed in accordance with ASTM Standard Test Method D4044-91 and USACE Omaha District Geology Scope of Services. Tests may include falling head, rising head, or bail out tests, depending on individual well conditions. Well development data will be used to determine the appropriate test method. If a well is installed in a high hydraulic conductivity formation, a slug will be used. If a well is installed in a low hydraulic conductivity formation, a bailer will be used. In no case will water-added type slug tests be conducted in monitoring wells, even if saturated thicknesses are insufficient for testing. Where a portion of the well screen is above the water table (i.e., in the unsaturated zone), only rising head tests will be conducted.

4.2.1 Equipment List

The following is an equipment list for slug testing:

- Keys to well locks
- Photoinization detector (PID)
- Electronic water level indicator
- Field logbook
- Development data and well construction logs, for each well
- Slug or disposal bailer of known volume
- Pressure transducer

- Data logger and field printer
- Manufacturer's manuals for data logger and pressure transducer
- Weighted measuring tape with 0.1-foot increments
- Nylon rope
- Paper towels
- Stainless-steel knife
- Waterproof and permanent marking pens
- Clock
- Appropriate health and safety equipment, as specified in the HSP
- Appropriate decontamination equipment, as specified in SOP No. 10

The pressure transducer and data logger will be used to measure, record and output *water* level data. They will be packed, assembled and operated in accordance with manufacturer's instructions.

4.2.2 Pre-Test Data Recording

Pre-test data will be collected in accordance with the following procedures:

- The well casing will be approached from upwind with continuous air monitoring using a PID.
- The well cap will be unlocked and removed, and PID readings will be taken in the well.
- Before beginning the slug test, the following information will be recorded in the field logbook:

  1. Monitoring well identification number
  2. Location of the reference point from which water depth measurements are made (top of PVC well casing)
  3. Depth to groundwater and total depth of the well
  4. Date and time of test
  5. Well depth, screen length, well radius, radius of filter pack (from the construction logs)
  6. Aquifer or groundwater zone (stratigraphic profile) being tested (from the construction logs)
  7. Volume of slug or bailer
  8. Type of transducer
  9. Name of personnel conducting test

4.2.3 Testing Procedures

Slug testing will be conducted in accordance with the following procedures.

1. The static water levels in the well and total depth of the well will be determined to the nearest 0.01 foot. Select the test method based on the water column height and development data, as appropriate, and record the selected method in the field logbook.

2. The appropriate pressure transducers will be inserted slowly. The transducer will be set at a maximum depth of 9 feet below the static water level in the well. The water level and the transducer will be allowed to equilibrate in the well for 15 minutes. The data logger will be activated to determine when the water level has equilibrated.

3. The transducer cable will be secured to the well casing with duct tape to ensure that the reference point does not move once the test has started.

4. The pre-run checkout will be done prior to starting the test to ensure that all the cable connections and the initial head reading are correct.

5. Set the measurement time increment on the data logger to suitable increments based on development data. Rapidly recharging wells should use small increments and slowly recharging wells should use larger increments.

6. Slug testing of monitoring wells installed in formations with high hydraulic conductivity (e.g., sand or silty sand) will be completed with a slug of known volume. The slug, secured with nylon rope, will be instantaneously introduced to or removed from the well, taking care to fully submerge or withdraw the slug. It is important to add or remove the volume as quickly as possible because the analysis assumes an "instantaneous" change in volume, in the well.

7. Slug testing of monitoring wells installed in formations with low hydraulic conductivity (e.g., clay or silt) will be completed with a disposable bailer. The bailer will be introduced to the well and allowed to equilibrate. The bailer will be instantaneously removed from the well to start the test. It is important to remove the bailer and volume of water as quickly as possible because the analysis assumes an "instantaneous" change in volume, in the well.

8. With the moment (time) of volume addition or removal assigned time zero, the depth of water will be measured and recorded. The pressure transducer will monitor water level change. Care must be take to ensure that the transducer is submerged throughout the test. Once the test has started, the transducer elevation must not be changed.

9. The test will continue until the water level has stabilized.

10. The slug testing equipment will be removed and decontaminated before the next test, accord to SOP No. 10.

11. The test data will be downloaded from the data logger to a field printer to confirm the successful completion of the test prior to departing the site.

4.3 TEST DATA ANALYSIS

Test data will be evaluated using the method of Bouwer and Rice (1976) and Bouwer (1989). The Bouwer and Rice method is applicable to unconfined and confined aquifers, and considers the effect of partial penetration, radius of the filter pack and the effective radius of influence of the test.

Other methods, such as those provided in ASTM Standard Guide D4043-91, will be used if required by the site hydrogeology.

Standard Operating Procedure No.5
Surface and Seep Water Sampling

5.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for collecting surface water samples at the Iowa Army Ammunition Plant (IAAAP). This procedure gives descriptions of equipment, field procedures, and Quality Assurance/Quality Control (QA/QC) procedures necessary to collect surface water samples. These procedures described are sufficiently detailed to allow field personnel to properly collect surface water samples. Field procedures for surface water sampling were developed in accordance with USACE EM 1110 (USACE 1998) and USACE Omaha District Geology Scope of Services, and are detailed in this SOP. The sample locations and frequency of collection will be presented in Field Sampling and Analysis Plan (FSAP) addenda.

This SOP is intended to be used together with FSAP and other appropriate SOPs. Health and safety procedures and equipment that will be required during the investigation are detailed in the Health and Safety Plan (HSP). Applicable SOPs are listed below:

- SOP No. 7 - Sample Identification, Handling, and Documentation
- SOP No. 10 - Equipment and Personnel Decontamination

5.2 SURFACE WATER SAMPLING PROCEDURES

Surface water samples will be collected as grab samples starting at the furthest downstream point and proceeding in an upstream direction. Grab samples characterize a medium at a particular point in space and time. Grab samples are collected by sample container immersion or by using a transfer device, such as a beaker, dipper, or bailer.

Grab water samples are typically collected by filling a container held just beneath the surface of a body of water. If an open bottle is lowered to the bottom and raised to the surface at a uniform rate, and at such a rate as to have the bottle filled when reaching the surface, the resulting sample will roughly approach the collection of what is known as a depth-integrated sample. This approach may be used for grab samples that will be collected or collected and transferred when the depth of water exceeds 1.0 foot. If depth is less than 1.0 foot, the bottle will be held just beneath the surface of the water and filled. Another approach, which may be used for water sampling of any depth, is the use of a bailer that is lowered to just above the bottom of the water column, withdrawn, and used to fill the sample containers. This method probably provides the most representative sample and also prevents preservative loss.

Field water quality parameters of the surface and seep water may be collected if required by future FSAP addenda. Parameters will include: pH, temperature, specific conductance, and turbidity.

5.2.1 Equipment List

The following equipment will be used during surface and seep water sampling:

- Laboratory-provided sample containers
- Self-adhesive sample bottle labels
- Teflon, stainless-steel, or glass beakers, dippers, or bailers
- Disposable Teflon bailer or equivalent
- Appropriate health and safety equipment specified in the HSP
- Field Logbook and data sheets (DQCR, Sample Collection Field Sheet, COC)
- Waterproof and permanent marker
- Paper towels
- Clear label and strapping tape
- Plastic bags
- Cooler with ice

5.2.2 Sampling Procedures

Laboratory-provided sample containers will be used to directly collect water samples, if sample containers do not have preservatives. Where required by site conditions, remote sampling into sampling containers will be allowed by clamping the container onto the end of a stainless-steel extension rod.

Beakers or dippers, which may be attached to stainless-steel or aluminum rods, may be used if sampling containers do not have preservatives or remote sampling site conditions prevent sampling by direct sample container immersion. The beakers or dippers will be obtained from a scientific instrument supplier so that the material composition of such a sampling container may be documented in the field notes. The selected type of transfer device, the composition of this device, and the volume of the device will be recorded in the field notes. Bailers may be used if direct access to the sampling point can be reached.

5.2.2.1 Equipment Decontamination

Before any sampling begins, all bailers, beakers, dippers, and other sampling devices shall be decontaminated. Mobile decontamination supplies will be provided so tat equipment can be decontaminated in the field. Each piece of sampling equipment shall be decontaminated before sampling operations and between sampling locations. The procedures presented in SOP No. 10, Equipment decontamination, will be followed for decontamination of field equipment and for personnel decontamination.

5.2.2.2 Samples Collected by Container Immersion

Surface water sample collection by container immersion will be done in accordance with the following procedures:

- Samples will be collected from areas that are suspected of being the least contaminated first to minimize the risk of sample cross contamination.

- Prior to sampling, the water body characteristics (e.g., size, depth, flow) should be observed and described in the field logbook

- Don a clean pair of gloves.

- The outside of all capped sample bottles shall be triple rinsed with the surface water being sampled before filling the bottles with the sample to be analyzed.

- Surface debris (i.e., sticks, leaves, vegetation) will be cleared from the sample location prior to sample collection.

- Surface and seep water will be collected from an area with low flow and minimal turbulence.

- Submerge the sample bottle below the water surface with minimal surface disturbance and with the open end pointed upstream.

- Allow container to fill to desired volume.

- Remove the container.

- Add preservative to the sample, if necessary, and place the cap on the container and tighten.

- Identify, handle and document the sample according to SOP No. 7.

- Decontaminate the container’s outside surface as required.

- Record time of sampling.

- Store samples on ice in cooler.

5.2.2.3 Samples Collected by Bailer

Surface water sample collection with a bailer will be done in accordance with the following procedures:

- Samples will be collected from areas that are suspected of being the least contaminated first to minimize the risk of sample cross contamination.

- Prior to sampling, the water body characteristics (e.g., size, depth, flow) should be observed and described in the field logbook.

- A disposable Teflon® bailer or equivalent will be used.

- Don a clean pair of gloves.

- Surface debris (i.e., sticks, leaves, vegetation) will be cleared from the sample location prior to sample collection.

- The depth of standing water will be determined, and the bailer will be lowered to the appropriate sampling location in accordance with the sampling plan. The bailer will be lowered no closer than 3 to 6 inches above the bottom sediments.

- The bailer will be inserted and withdrawn very slowly and carefully to avoid agitation of the bottom sediments.

- The required sample containers will be filled in the appropriate sequence from the water in the bailer. VOCs will be collected first, followed by SVOCs. The remaining sample containers will be filled in a parameter-specific order as described in Section 6.2.2.4 of SOP No. 6.

- Identify, handle, and document the samples in accordance with SOP No 7.

- Record time of sampling.

- Store samples on ice in a cooler.

5.2.2.4 Storm Event Sampling

Storm event samples will be collected to determine the amount of contamination in surface runoff and site drainage water following a rain event. Samples will be collected from existing surface water features that receive surface runoff during a storm event. Samples will be collected within the first 30 minutes (or a maximum of 1 hour) after runoff due to rainfall begins. Samples will be collected every hour thereafter for an 8-hour duration. The sample must be collected from a discharge resulting from a storm event that is greater than 0.1 inch in magnitude and that occurs at least 72 hours from the previous storm event of magnitude greater than 0.1 inch. Storm event sampling will be conducted in accordance with the following procedures:

- Prior to sampling, the existing water body will be characterized (e.g., size, depth, flow) and described in the field logbook.

- Don a clean pair of gloves.

- The outside of all capped sample bottles shall be triple rinsed with the surface water being sampled before filling the bottles with the sample to be analyzed.

- Surface debris (i.e., sticks, leaves, vegetation) will be cleared from the sample location prior to sample collection.

- Surface and seep water will be collected from an area with low flow and minimal turbulence.

- Submerge the sample bottle below the water surface with minimal surface disturbance and with the open end pointed upstream.

- Allow container to fill to desired volume.

- Remove the container.

- Add preservative to the sample, if necessary, and place the cap on the container and tighten.

- Identify, handle and document the sample according to SOP No. 7.

- Decontaminate the container's outside surface as required.

- Record time of sampling.

- Store samples on ice in cooler.

5.2.2.5 Field Quality Assurance/Quality Control Procedures and Samples

QA/QC samples will be collected during surface water sampling. Field QA/QC samples are designed to help identify potential sources of external sample contamination and evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analyses.

Field Blanks

Field blanks are QC samples that check for potential external contamination of samples and will consist of trip blanks. The sample collection coordinator or the project QA/QC coordinator will designate trip blanks. The samples will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory with the other samples.

A trip blank serves as a check on sample contamination originating from the container or sample transport. One trip blank will be sent with each cooler containing water samples for volatile organic analyses.

Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the surface water sampling, a duplicate sample will be collected at the same time as the initial sample. The initial sample bottles for a particular parameter or set of parameters will be filled first, then the duplicate sample bottles for the same parameter(s), and so on until all necessary sample bottles for both the initial sample and the duplicate sample have been filled. The duplicate surface water sample will be handled in the same manner as the primary sample. The duplicate sample will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory on the day it is collected. Duplicate samples will be collected for all parameters. Duplicate samples will be blind to the laboratory.

Matrix Spikes and Matrix Spike Duplicates

Matrix spikes (MS) and matrix spike duplicates (MSD) are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain-of-custody form and on the bottles. It may be necessary to increase the sample volume for samples where this designation is to be made.

5.2.3 Sample Identification, Handling, and Documentation

Samples will be identified, handled and documented as described in this SOP and SOP No. 7.

5.2.4 Documentation

Each field activity must be documented to facilitate a timely and accurate reconstruction of events in the field (see SOP No. 7). Sample Collection field Sheets will be completed for all surface and seep water samples submitted for chemical analysis (Figure 1).

5.2.4.1 Sample Collection Field Sheet

A sample collection field sheet for surface water samples (Figure 1) will be completed at each sampling location. The data sheet will be completely filled in. If items on the sheet do not apply to a specific location, the item will be labeled as not applicable (NA). The information on the data sheet includes the following:

- Sample location number
- Date and time of sampling
- Person performing sampling
- Type of sample
- Number of samples taken
- Sample identification number
- Preservation of samples
- Field water quality parameters (if taken)
- Record of any QC samples from site
- Any irregularities or problems which may have a bearing on sampling quality

5.2.4.2 Field Notes

Field notes shall be kept in a bound field logbook using waterproof ink: The following information will be recorded using waterproof ink:

- Names of personnel
- Weather conditions

- Sample location number
- Date and time of sampling
- Site conditions
- Decontamination information
- Water depth
- Depth of sample
- Analyses that will be performed by the laboratory

Standard Operating Procedure No.6
Monitoring Well Groundwater Sampling

6.1 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for the collection groundwater samples from monitoring wells at the Iowa Army Ammunition Plant (IAAAP). This procedure gives descriptions of equipment, field procedures, and Quality Assurance/Quality Control (QA/QC) procedures necessary to collect groundwater samples. These procedures described are sufficiently detailed to allow field personnel to properly collect surface water samples. Field procedures for surface water sampling were developed in accordance with USACE EM 1110 (USAGE 1998) and USACE Omaha District Geology Scope of Services, and are detailed in this SOP. The sample locations and frequency of collection will be specified in future Field Sampling and Analysis Plan (FSAP) addenda.

This SOP is intended to be used together with FSAP and other appropriate SOPs. Health and safety procedures and equipment that will be required during the investigation are detailed in the IAAAP Health and Safety Plan (HSP). Applicable SOPs are listed below:

- SOP No. 7 - Sample Identification, Handling, and Documentation
- SOP No. 8 - Headspace Analysis
- SOP No. 9 - Water Level Measurement
- SOP No. 10 - Equipment and Personnel Decontamination

Additionally, purge water will be containerized in accordance with Section 7.0, IDW Transportation and Disposal Plan, of the Work Plan.

6.2 PROCEDURES FOR GROUNDWATER SAMPLING

6.2.1 Equipment List

The following equipment will be used during well purging and sampling:

- Well keys (if required)
- Appropriate health and safety equipment as specified in the HSP
- Water level probe with 0.01-foot intervals
- Assorted tools (ratchet, screwdriver, etc.)
- Grundfos® Redi-Flo 2 pumps or equivalent with check valve
- Well Wizard control box
- Air compressor
- PVC pump pipe, discharge port, and appropriate fittings
- Disposable Teflon bailers or equivalent
- Nylon rope
- Peristaltic pump

- Poly tubing
- Multi-parameter water quality probe with flow-through cell (pH, temperature, specific
- Conductance, dissolved oxygen (DO), oxidation reduction potential (ORP)
- Turbidity meter
- Field test kits for Fe^{2+}, Alkalinity and Sulfide
- Photo ionization detector (PID)
- Aluminum foil
- Calibration fluids
- Plastic squeeze or spray bottle filled with de-ionized water
- Paper towels
- Calculator
- Field logbook and data sheets (DQCR, SCFS, COC)
- Waterproof and permanent marker
- Appropriate containers for holding purged water
- Discharge hose
- Well completion information sheet
- Appropriate decontamination equipment (wash/rinse buckets, brushes, etc.)
- Plastic bags
- Cooler with ice
- Clear label tape and strapping tape
- Self-adhesive sample labels.

Sample bottles with preservatives added will be obtained from the analytical laboratory. Several extra sample bottles will be obtained in case of breakage or other problems.

6.2.2 Sampling Procedure

This section gives the step-by-step procedures for collecting groundwater samples in the field. Observations made during sample collection should be recorded in the field logbook and field data sheet as specified in Section 6.2.4 of this SOP.

6.2.2.1 Equipment Decontamination

Before any purging or sampling begins, all well probes, bailers, and other sampling devices will be decontaminated. Mobile decontamination supplies will be provided so tat equipment can be decontaminated in the field. Each piece of non-dedicated purging or sampling equipment will be decontaminated before sampling operations and between each well. The procedures presented in SOP No. 10, Equipment and Personnel Decontamination, will be followed for decontamination of field equipment and for personnel decontamination.

6.2.2.2 Instrument Calibration

Electronic equipment used during sampling includes a multi-parameter water quality probe, data logger, a turbidity meter and a water level measurement probe. Before going into the field, the sampler will verify that these instruments are operating properly. The multi-parameter probe and turbidity meter require calibration checks prior to use every day and must be recalibrated at the end of each week. Calibration times and readings will be recorded in a field logbook to be kept by the field sampler. Specific instructions for calibrating the instruments are given in the manufacturers' instruction manuals.

6.2.2.3 Natural Attenuation (NA) Parameters

Purge water will be analyzed in the field for water quality parameters including specific conductance, pH, temperature, turbidity, DO, oxidation-reduction potential, and Fe^{2+}, alkalinity and sulfide. In the Fall round of sampling, groundwater samples will also be submitted to an off-site laboratory and analyzed for other geochemical water quality parameters including Alkalinity, Chloride, Nitrate/Nitrite, Phosphate, Sulfate, Sulfide, Carbon Dioxide, Total Organic Carbon, Metals, and Ethane, Ethene, and Methane.

6.2.2.4 Well Purging

The purpose of well purging is to obtain representative, aquifer-quality water from the geologic formation being sampled while minimizing disturbance to the collected samples. Many of the existing wells are equipped with dedicated sampling pumps, which will be used when purging and sampling. Where no dedicated sampling pumps are available, a portable sampling pump, Grundfos® or equivalent will be used. Low-flow purging techniques will be attempted in each well to minimize turbidity. To accomplish this, the wells will be purged at the lowest practical pumping rates. These low pumping rates will cause minimal drawdown, thus inducing laminar flow from the aquifer through the screen and to the pump. This technique does not require purging the entire water column. The goal of low flow purging and sampling is to maintain less than 0.3 foot of drawdown at pumping rates not to exceed 500 ml/mm.

Where recharge is insufficient for this method (i.e., more than 0.3 ft of drawdown occurs during purging), the well will be purged until three to five well volumes have been removed and field parameters have stabilized within ±10 percent between consecutive readings. If the well is evacuated to dryness, the well will be sampled after sufficient recovery has occurred.

The following procedures will be performed at each well:

- The well will be approached from upwind, the well cap unlocked and removed, and the air quality monitored in the casing and breathing zone with a photoionization detector (PID) according to SOP No. 8. Air quality measurements will be recorded in the field logbook.

- The condition of the outer well casing, concrete well pad, and any unusual conditions of the area around the well will be noted in the field logbook.

- The depth of static water level will be measured (to nearest 0.01 foot) according to SOP No. 9. Depth to water will be recorded from a measuring point on the well casing. The measuring point should be identified, and time indicated in the field logbook.

- If low-flow pumping is used, the bottom of the well is not to be measured until all sampling is complete.

- The volume of water to be purged will be calculated in the event that drawdown exceeds 0.3 foot and the low-flow methods are not possible. (See Section 5.4.3 for calculation of volumes.)

- Where no dedicated sampling equipment is installed, a pump will be slowly lowered into the well to minimize the disturbance of the stagnant water column above the screened interval. The pump should be placed at, or slightly above, the midpoint of the screened interval.

- The in-line water quality probe will be attached to the pump discharge line.

- The water level probe will be lowered into the well to determine the drawdown rate.

- The pump will be turned on at the lowest feasible pumping rate. The wells will be purged at pumping rates between 100 and 500 ml/min, not to exceed 500 ml/mm, depending on well condition.

- The depth to groundwater will be monitored during purging. The pump flow rate will be adjusted as required to stabilize the drawdown.

- If drawdown does not exceed 0.3 foot during purging, field parameters of pH, temperature, specific conductance, turbidity, DO, and redox will be monitored to determine when aquifer-quality water is being pumped. Field parameters will be measured at the start of purging and then every 2 to 3 minutes. Field parameters will be monitored using the in-line flow-through cell attached to the pump discharge. Purging will continue until all field parameters have stabilized according to the following:

— pH	+ 0.2 units
— Temperature	+ 10%
— Specific conductivity	+ 10%
— Dissolved Oxygen	± 10%
— Redox	+ 10%
— Turbidity	± 10% (or clear and free of fines)

  Upon stabilization of field parameters, the well will be sampled. Purge water will be containerized as IDW.

- If drawdown does exceed 0.3 ft during purging, three to five volumes of water will be purged and containerized as IDW. Field parameters of pH, temperature, specific conductance, turbidity, DO, and redox will be monitored. Theses measurements will be recorded at a minimum of one set of readings per well casing volume purged to determine whether the water chemistry has stabilized. If the chemistry is not stable, purging will continue, measuring field parameters after each one-half well volume.

- If the well is pumped dry during purging, it will be assumed that the purpose of removing three to five well volumes of water has been accomplished, that is, removing all stagnant water which had prolonged contact with the well casing or air.

- Once the well has been pumped dry, samples will be collected using a disposable Teflon® bailer, to minimize turbidity of the samples. Before samples are collect a complete set of water quality parameters must be measured from water that has recharged in to the well.

- If recovery is very slow, samples may be obtained as soon as a sufficient amount of water recharges into the well.

6.2.2.5 Sample Collection

There are three sample collection scenarios that will be used at IAAAP. Each scenario and the appropriate procedures are outlined here within.

Air Bladder Pump

The following sampling procedure is to be used when sampling from an air bladder pump (Well Wizard®):

- The pump will be adjusted to its lowest pumping rate for sample collection.
- Identification labels for sample containers will be filled out for each well.
- Any in-line water quality measurement equipment (e.g., flow-through cell) will be disconnected during sample collection..
- Samples for chemical analysis will be collected from the discharge port attached to the pump.
- The individual sample bottles will be filled in the order given below:

  — Metals and Radionuclide
  — VOCs
  — SVOCs, pesticides and PCBs, and herbicides
  — Explosives (Method 8330)
  — Ferrous Iron (Fe2+)
  — All natural attenuation (NA) parameters in the following order:
    1. Total Organic Carbon
    2. Nitrate/Nitrite and Phosphate
    3. Sulfide and Sulfate
    4. Alkalinity and Chloride

- Fill sample containers for metals, semivolatiles, explosives, and NA parameters almost full.

- VOC sample vials should be completely filled so the water forms a convex meniscus at the top, then capped so that no air space exists in the vial. Turn the vial over and tap it to check for bubbles in the vial, which indicate air space. If air bubbles are observed in the sample vial, repeat the procedure until no air bubbles appear.

- Time of sampling will be recorded.

- Samples will be identified, handled, and documented as described in SOP No. 7.

- The well cap will be replaced and locked.

- Field documentation will be completed, including the chain-of-custody.

Submersed Pump

The following sampling procedure is to be used when sampling from a submersed pump (Grundfos® or equivalent):

- The pump will be adjusted to its lowest pumping rate for sample collection.

- Identification labels for sample containers will be filled out for each well.

- Any in-line water quality measurement equipment (e.g., flow-through cell) will be disconnected during sample collection..

- Samples for chemical analysis will be collected from the discharge port attached to the pump.

- The individual sample bottles will be filled in the same order as shown above.

- Fill sample containers for metals, semivolatiles, explosives, and NA parameters almost fill.

- VOC sample vials should be completely filled so the water forms a convex meniscus at the top, then capped so that no air space exists in the vial. Turn the vial over and tap it to check for bubbles in the vial, which indicate air space. If air bubbles are observed in the sample vial, repeat the procedure until no air bubbles appear.

- Time of sampling will be recorded.

- Samples will be identified, handled, and documented as described in SOP No. 7.

- The well cap will be replaced and locked.

- Field documentation will be completed, including the chain-of-custody.

Disposable Bailer

The following sampling procedure is to be used when sampling from a Disposable Bailer (Teflon® or equivalent):

- Identification labels for sample bottles will be filled out for each well.
- A new disposable bailer will be used at each well.
- The protective plastic around the bailer will be removed at the top only, and new nylon rope will be tied to the securing hole.
- Just prior to sample collection the protective plastic will be removed. If VOC samples are required they will be collected from a new bailer filling.
- The bailer will be lowered **slowly and gently** into contact with the water in the well. The disposable bailer will be lowered to the same depth, which just fills the bailer, in the well each time.
- The bailer will be retrieved **smoothly** and the water will be **slowly** drained into the sample containers through the bailer's bottom discharge control device.
- The individual sample bottles will be filled in the same order as shown above. If VOC samples are required, they will be collected from a new bailer filling.
- Fill sample containers for metals, semivolatiles, explosives, and NA parameters almost fill.
- VOC sample vials should be completely filled so the water forms a convex meniscus at the top, then capped so that no air space exists in the vial. Turn the vial over and tap it to check for bubbles in the vial, which indicate air space. If air bubbles are observed in the sample vial, repeat the procedure until no air bubbles appear.
- Time of sampling will be recorded.
- Samples will be identified, handled, and documented as described in SOP No. 7.
- The well cap will be replaced and locked.
- Field documentation will be completed, including the chain-of-custody.

6.2.2.6 Field Quality Assurance/Quality Control Procedures and Samples

The well sampling order will be dependent on expected levels of contamination in each well, if known, and will be determined prior to sampling. Sampling will progress from the least contaminated well to the most contaminated well. QA/QC samples will be collected during groundwater sampling.

Field QA/QC samples are designed to help identify potential sources of external sample contamination and evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analyses.

Field Blanks

Field blanks are QC samples that check for potential external contamination of samples and will consist of trip blanks. The sample collection coordinator or the project QA/QC coordinator will designate trip blanks. The trip blanks will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory with the other samples.

A trip blank serves as a check on sample contamination originating from the container or sample transport. One trip blank will be sent with each cooler containing water samples for VOC analyses.

Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the groundwater sampling a duplicate sample will be collected at the same time as the initial sample. The initial sample bottles for a particular parameter or set of parameters will be filled first, then the duplicate sample bottles for the same parameter(s), and so on until all necessary sample bottles for both the initial sample and the duplicate sample have been filled. The duplicate groundwater sample will be handled in the same manner as the primary sample. The duplicate sample will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory on the day it is collected. Duplicate samples will be collected for all parameters. Duplicate samples will be blind to the laboratory.

Matrix Spikes and Matrix Spike Duplicates

Matrix spikes (MSs) and matrix spike duplicates (MSDs) are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain-of-custody form and on the bottle. It may be necessary to increase the sample volume for samples where the designation is to be made.

6.2.3 Sample Identification, Handling, and Documentation

Samples will be identified, handled, and recorded as described in this SOP and in SOP No. 7.

6.2.4 Documentation

Each field activity must be documented to facilitate a timely and accurate reconstruction of events in the field (see SOP No. 7). Sample Collection field Sheets will be completed for all groundwater samples submitted for chemical analysis (Figure 1).

6.2.4.1 Sample Collection Field Sheet

A sample collection field sheet for groundwater samples (Figure 1) will be completed at each sampling location. The data sheet will be completely filled in. If items on the sheet do not apply to a specific location, the item will be labeled as not applicable (N/A). The information on the data sheet includes the following:

- Site name
- Well number
- Date and time of sampling
- Person performing sampling
- Water level (BTOC)
- Well depth (BTOC)
- Volume of water purged before sampling
- Pump placement depth or sample collection depth (BTOC)
- Specific conductance, temperature, pH, DO, Redox, and turbidity during evacuation (note number of well volumes)
- Number of samples taken
- Sample identification number
- Preservation of samples
- Record of any QC samples from site
- Headspace analysis (if taken)
- Any irregularities or problems which may have a bearing on sampling quality

6.2.4.2 Field Notes

Field notes shall be kept in a bound field logbook. The following information will be recorded using waterproof ink:

- Names of personnel
- Weather conditions
- Location and well number
- Date and time of sampling
- Condition of the well
- Decontamination information
- Initial static water level and total well depth
- Pump placement depth or sample collection depth (BTOC)
- Calculations (e.g., calculation of purged volume)
- Analyses that will be performed by the laboratory
- Equipment calibration information

6.2.5 Well Volume Calculations

The following equation shall be used to calculate the volume of water to be removed during well evacuation:

For 2-inch wells:

Evacuation Volume (gal) =

[Total Well Depth (ft) - Water Level Depth (ft)] x 0.16 gal/ft = gallons/l well casing volume

For 4-inch wells:

Evacuation Volume (gal)=

[(Total Well Depth (ft) - Water Level Depth (It)] x 0.66 gal/ft = gallons/l well casing volume

Multiply the volume of one well casing volume by three (3) to obtain the minimum volume of water to be evacuated.

Standard Operating Procedure No. 7
Sample Identification, Handling, and Documentation

SOP NO. 7 Sample Identification, Handling, and Documentation

7.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for sample handling, documentation, and tracking at the Iowa Army Ammunition Plant (IAAAP). This procedure is intended to be used together with Field Sampling and Analysis Plan (FSAP) and other SOPs. Applicable SOPs are listed below:

- SOP No. 1 - Surface Soil Sampling
- SOP No. 2 - Subsurface Drilling and Soil Sampling
- SOP No. *5* - Surface and Seep Water Sampling
- SOP No. 6 - Monitoring Well Groundwater Sampling

7.2 SAMPLE IDENTIFICATION

Samples collected during site activities will have discrete sample identification numbers. These numbers are necessary to identify and track each of the many samples collected for analysis during the life of this project. In addition, the sample identification numbers will be used in the database to identify and retrieve the analytical results received from the laboratory.

Each sample is identified by a unique code that indicates the site number, sample location number, sample method and matrix identifier, and sample depth. The sample locations will be the boring or well number. Sample matrix identifiers include the following:

- SS — Surface Soil
- SB - Subsurface Soil
- GW - Groundwater Sample (from a monitoring well)
- SW - Surface Water
- SP - Seep Water
- RN - Rinsate
- TB-Trip Blank

An example of the sample identification code for a subsurface soil sample collected from Boring 101 at Line 800 from a depth of 5 feet will be: 800-B101-SB-05

Where 800 indicates the Site Number (Line 800), B101 indicates the Boring Number, SB indicates the sampling method and sample matrix, and 05 indicates the sample depth.

Groundwater samples will be identified by the monitoring well number only (i.e., JAW-604, G-27, 800-MW-26). If well designations are duplicated throughout the facility, a site name and date will be added to the identification number to delineate the samples.

MS/MSD samples will be given the same sample ID as the analytical sample, but will have "MS/MSD" written on the label. Duplicate samples will be blind samples to the laboratory and will be given a unique sample ID.

The sampling locations, sample type, and sample sequence identifiers will be established prior to field activities for each sample to be collected. On-site personnel will obtain assistance in defining any special sampling requirements from the Project Manager.

7.3 SAMPLE LABELING

Sample labels will be filled out as completely as possible by a designated member of the sampling team prior to beginning field sampling activities each day. All sample labels will be filled out using waterproof ink. At a minimum, each label will contain the following information:

- Sampler's company affiliation
- Site location
- Sample identification code (i.e., 800-B101-SB-OS)
- Date and time of sample collection
- Analyses required
- Method of preservation (if any) used
- Sample matrix (i.e., soil, groundwater, surface water)
- Sampler's signature or initials

An example of a completed sample label is shown in Figure 1.

7.4 SAMPLE HANDLING

This section discusses proper sample containers, preservatives, and handling and shipping procedures. The FSAP summarizes the information contained in this section and the QAPP includes the sample holding times for each analyte.

7.4.1 Sample Containers

Certified, commercially clean sample containers will be obtained from the contract analytical lab. The contract laboratory will label the bottles to indicate the type of sample to be collected. Required preservatives will be prepared and placed in the bottles at the laboratory prior to shipment to the site. Appropriate sample containers for the specific analyses required will be listed in future FSAP addenda.

7.4.2 Sample Preservation

Sample preservation efforts will commence at the time of sample collection and will continue until analyses are performed. Samples will be stored on ice at 4°C in an insulated cooler immediately following collection. The ice will be double bagged in plastic storage bags. Additional sample preservation requirements will be given in future ESAP addenda.

7.4.3 Sample Handling and Shipping

The sample containers will be wiped clean of all sample residue and then wrapped in protective packing material (bubble wrap) and taped. Samples will then be placed right side up in a cooler with ice (double bagged using plastic bags). Additional protective packing material will be used around the upright samples as necessary. A chain-of-custody (COC) form will accompany each cooler. The COC will be put in a plastic bag and will be attached to the inside lid of the cooler. The cooler lid will be taped closed with a custody seal for delivery to the laboratory. Samples will be hand delivered or shipped by overnight express carrier for delivery to the analytical laboratory. All samples must be shipped for laboratory receipt and analyses within specific holding times. This may require daily shipment of samples with short holding times. The temperature of all coolers will be measured upon receipt at the laboratory.

7.4.4 Holding Times and Analyses

The holding time is specified as the maximum allowable time between sample collection and analysis and/or extraction, based on the analyte of interest and stability factors, and preservative (if any) used. Allowable holding times will be presented in Section 4, Quality Assurance Project Plan (QAPP). Chemical constituents that will be analyzed and other parameters to be measured during field investigations at IAAAP will be identified in FSAP addenda.

7.5 SAMPLE DOCUMENTATION

This section describes documentation required in the field notes, on the Sample Collection Field Sheets (SCFS), on the Daily Quality Control Reports (DQCR), and on the sample COC forms.

7.5.1 Field Notes

Documentation of observations and data acquired in the field will provide information on the acquisition of samples and also provide a permanent record of field activities. The observations and data will be recorded using pens with permanent waterproof ink in a permanently bound weatherproof field logbook containing consecutively numbered pages

The information in the field logbook will include the following as a minimum. Additional information is included in the FSAP.

- Project name
- Location of sample

- Sampler's printed name and signature
- Date and time of sample collection
- Sample identification code
- Description of samples (matrix sampled)
- Sample depth (if applicable)
- Number and volume of samples
- Sampling methods or reference to the appropriate SOP
- Sample handling, including filtration and preservation, as appropriate for separate sample aliquots
- Analytes of interest
- Field observations
- Results of any field measurements, such as depth to water, pH, temperature, specific conductance, turbidity, DO, and redox
- Personnel present
- Level of personal protective equipment used during sampling

Changes or deletions in the field logbook should be lined out with a single strike mark, initialed, and remain legible. Sufficient information should be recorded to allow the sampling event to be reconstructed without relying on the sampler's memory.

Each page in the field books will be signed by the person making the entry at the end of the day, as well as on the bottom of each page. Anyone making entries in another person's field book will sign and date those entries.

7.5.1.1 Sample Collection Field Sheet

A SCFS for soil, surface water, and groundwater samples (Figures 2A, 2B, and 2C) will be completed at each sampling location. The data sheet will be completely filled in. If items on the sheet do not apply to a specific location, the item will be labeled as not applicable (N/A). The information on the data sheet includes the following:

- Sample location number
- Date and time of sampling
- Person performing sampling
- Type of sample
- Number of samples taken
- Sample identification number
- Preservation of samples
- Record of any QC samples from site
- Any irregularities or problems which may have a bearing on sampling quality

7.5.2 Daily Quality Control Report

Each sampling crew will also maintain DQCRs to supplement the information recorded in the field logbook. A blank DQCR is shown on Figure 3. DQCRs will be maintained by members of the field sampling team and cross-checked for completeness at the end of each day by the sampling team members and/or Field Manager. They will be signed and dated by individuals making entries and initials by the reviewer upon completion. Copies of the DQCR will be forwarded to the Quality Assurance Officer for review. The DQCR will include the following information:

- Project name
- Project Number
- Personnel on site
- Visitor on site
- Subcontractors on site
- Equipment on site
- Weather conditions
- Field work performed
- QC and health and safety activities
- Problem, down time, and standby time

7.5.3 Sample Chain-Of-Custody

During field sampling activities, traceability of the sample must be maintained from the time that the samples are collected until laboratory data are issued. Initial information concerning collection of the samples will be recorded in the field logbook as described above. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. An example COC form is shown on Figure 4. The COC is a paginated three-part carbonless form.

The sampler will be responsible for initiating and filling out the COC form. The sampler will sign the COC when the sampler relinquishes the samples to anyone else. One COC form will be completed for each cooler of samples collected daily. The COC will contain the following information:

- Sampler's signature and affiliation
- Project number
- Date and time of collection
- Sample identification number
- Sample type
- Analyses requested
- Number of containers
- Signature of persons relinquishing custody, dates, and times
- Signature of persons accepting custody, dates, and times
- Method of shipment
- Shipping air bill number (if appropriate)

The person responsible for delivery of the samples to the laboratory will sign the COC form, retain the last copy of the three-part COC form, document the method of shipment, and send the original and the second copy of the COC form with the samples. Upon receipt at the laboratory, the person receiving the samples will sign the COC form and return the second copy to the Project Manager. Copies of the COC forms documenting custody changes and all custody documentation will be received and kept in the central files. The original COC forms will remain with the samples until final disposition of the samples by the laboratory. The analytical laboratory will dispose of the samples in an appropriate manner 60 to 90 days after data reporting. After sample disposal, a copy of the original COC will be sent to the Project Manager by the analytical laboratory to be incorporated into the central files.

7.6 PHOTOGRAPHIC DOCUMENTATION

Photographs will be taken during sampling events to properly document field activities. Photos will be taken of all field activities including: drilling, well installation, well development, slug testing, sample collection, decontamination procedures, and site/well conditions. The description of the photos and the order they were taken in will be recorded in the field logbook or in a photo log. The exposed film will be numbered and recorded. A camera pass is required at the IAAAP facility. Photographs of the production facilities are strictly prohibited. See SOP No. 12, Permits and Clearances for the appropriate procedures.

FIGURE 2A
SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME ______________________ PROJECT NO. ______________

SAMPLE NO. ______________________ WELL NO. ______________

DATE/TIME COLLECTED ______________________ PERSONNEL ______________

SAMPLE METHOD AND DEPTH ______________________ ______________

SAMPLE MEDIA (Circle 1): Soil Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes No SPLIT SAMPLE NUMBER ______________

FIELD DUPLICATE (Circle 1): Yes No DUPLICATE SAMPLE NUMBER ______________

Sample Container	Preservative	Analysis Requested

DESCRIPTION:

DEPTH: DESCRIPTION:

Comments ______________________

FIGURE 4

URS Corporation

101 South 108 Avenue, Omaha, NE 68154 (402) 334-8181 Fax (402) 334-1984

CHAIN OF CUSTODY RECORD

Project Name	Project No.	Analytical Parameters	Remarks
Project Location	Project Manager		
Sampler(s)			

Sample		Type		Sample Identification	Matrix	Containers		Analytical Parameters					Remarks
Date	Time	Comp.	Grab			No.	Type						

Signatures	Date	Time	Shipping Details	Special Instructions
Relinquished by:				
Received by:			Airbill No.	
Relinquished by:			Lab Address	
Received for Laboratory by:				

COC.xls White copy - Laboratory Yellow copy - Laboratory Pink copy - URS

Standard Operating Procedure No.8
Headspace Analysis

8.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for performing headspace analysis of soil and water samples in the field at the Iowa Army Ammunition Plant and gives the description of equipment and procedures for field screening of soil and water samples. These procedures described are sufficiently detailed to allow field personnel to properly collect and perform headspace analysis. Field procedures for headspace analysis were developed in accordance with USACE Omaha District Geology Scope of Services, and are detailed in this SOP. Sample locations and frequency of collection will be presented in future Field Sampling and Analysis Plan (FSAP) addenda.

Applicable SOPs are listed below:

- SOP No. 1 - Surface Soil Sampling
- SOP No. 2 - Subsurface Drilling, Soil Sampling, and Logging
- SOP No. *5* - Surface and Seep Water Sampling
- SOP No. 6 - Monitoring Well Groundwater Sampling

8.2 HEADSPACE ANALYSIS

8.2.1 Equipment List

The following equipment is required for headspace analysis:

- Clean glass sample containers
- Paper towels
- Aluminum foil
- Photoionization detector (PID)
- Field logbook
- Waterproof and permanent marking pens
- Daily Quality Control Report (DQCR) form

8.2.2 Field Screening Procedures

A portion of selected soil samples and selected water sample collected will be placed in the appropriate clean glass sample container for headspace analysis. The container should be filled approximately one-half full. The mouth of the container will be covered with aluminum foil, tightly capped, and the sample matrix will be allowed to equilibrate with the headspace for 30 minutes. Care must be taken in the selection of soils with respect to consistency and sample placement in the container in order to achieve comparability and consistency. The disposition of the sample in the container will be recorded in the field logbook.

The sample headspace in the container shall be analyzed with a PID by removing the lid and inserting the instrument probe through the foil liner. Care must be taken in the selection of appropriate foil, placement of the foil on the container, and removal of the lid so as not to compromise the integrity of the seal. If the seal has been compromised, this will be recorded appropriately or a new sample taken if possible.

8.2.3 Organic Vapor Analyzer Selection

The selection of the appropriate organic vapor analyzer (OVA) shall be based on contaminants of concern and/or ambient conditions at the respective site. The lamp selected for the OVA, where applicable, will be based on the relative ionization potentials of the expected volatile contaminants. The selected instrument will be recorded on the DQCR and in the field logbook. It is anticipated that a PD detector will be used for most or all of the work at IAAAP.

8.2.4 Calibration

The instrument(s) selected for use in accordance with data quality objectives and site requirements shall be calibrated according to the manufacturer’s recommendations and specifications. These procedures will be attached to this SOP where applicable.

8.2.5 Documentation

All procedures, field conditions, and results will be recorded on the DQCR, sample collection field sheet (SCFS), and in the field logbook. The record will include a description of the material being screened as well as site conditions such as humidity and the equilibration time and temperature.

Standard Operating Procedure No.9
Water Level Measurement

9.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for measuring water levels in wells at the Iowa Army Ammunition Plant (IAAAP). These procedures described are sufficiently detailed to allow field personnel to properly measure water levels. Field procedures for measuring water levels were developed in accordance with USACE Omaha District Geology Scope of Services, and are detailed in this SOP. The well locations and frequency of measurement will be presented in Field Sampling and Analysis Plan (FSAP) addendum. This procedure is intended to be used together with the FSAP and other SOPs. Applicable SOPs are listed below:

- SOP No. 2 - Subsurface Drilling, Soil Sampling, and Logging
- SOP No. 3 - Monitoring Well Installation and Development
- SOP No. 4 - Hydraulic Conductivity Testing (Slug Test Method)
- SOP No. 6 - Monitoring Well Groundwater Sampling
- SOP No. 10 - Equipment and Personnel Decontamination

9.2 WATER LEVEL MEASUREMENT PROCEDURE

9.2.1 Equipment List

The equipment necessary to measure water levels includes:

- Water level probe with 0.01-foot increments
- Photoionization detector (PID)
- Two 5-gal buckets (with lids) or equivalent for decontamination
- Decontamination brushes
- Alconox soap
- De-ionized or distilled water
- Potable water
- Spray bottle
- Field data sheets
- Field logbook
- Appropriate health and safety equipment

9.2.2 Measurement Procedure

Appropriate health and safety equipment, as described in the Health and Safety Plan (HSP) will be used during well opening, water level measurement, and decontamination. The following procedures will be completed when measuring water levels:

- The water level probe will be decontaminated prior to use in each monitoring well. Decontamination procedures are discussed in SOP No. 10.

- The well will be approached from upwind, the well cap unlocked and removed, and the air quality monitored in the casing and breathing zone with a PID according to SOP No. 8. Air quality measurements will be recorded in the field logbook.

- Observations regarding the condition of the well, including the well pad, and surface or protective casing, will be documented in the field logbook.

- The static water level and the total well depth will be measured using an electronic water level meter. The total depth of the well will not be measured prior to groundwater sampling using low-flow purge techniques. The measuring point for all the wells will be the top of PVC or steel monitoring well casing. For standardization of measurements, all well readings will be referenced to the north rim of the monitoring well riser pipe or to a marked reference point on the casing rim.

- The appropriate measurement will be made with the probe, recorded on in the field logbook, and then immediately rechecked before the probe is removed from the well.

- Information including the depths measured, time and date of measurement, and any unusual problems encountered will be documented in the field logbook. If measurements are taken over a several-day period, the date of each measurement will be clearly indicated in the logbook. Section 9.2.4 of this SOP describes the required documentation.

- Care will be taken to verify the readings during each water level measurement period. Any significant changes in water level will be noted by comparing the most recent measurement with past measurements.

- After any measurement is taken, the water level probe will be decontaminated as described in Section 9.2.3 of this SOP

- During water level rounds, if dedicated sampling equipment is restricting the water level probe from reaching the water surface in the well, an alternate well will be measured. In no case will any of the dedicated sampling equipment, below the water level be removed. This will disturb the water in the well, which may cause problems when sampling the well using low-flow techniques.

9.2.3 Decontamination

The water level indicator must be decontaminated before use, between wells, and at the conclusion of measurements. The probe will be decontaminated according to the procedure for decontamination of sampling equipment described in SOP No. 10. Probe decontamination will be completed at the wells. Wash and rinse water will be handled as specified by the Field Manager.

9.2.4 Documentation

Documentation will be completed in the field logbook, during each measuring event. The logbook will include date, time, well number, total well depth, water level, static water elevation, decontamination procedures, calibration procedures, monitoring procedures, and other observations during water level measurement. The logbook will be filled out using legible handwriting, and will be signed and dated by the person completing the page.

The measured depth to water will be compared in the field to historic water levels (where available) to make sure the measured water level is reasonable. Large variations or discrepancies will be noted and the water level checked again to verify accuracy.

9.3 CALIBRATION

The length of the water level measurement probe cord will be calibrated at least once per month or more often as needed to ensure the desired accuracy during water level measuring events. The calibration check consists of laying out 100 feet of steel tape next to 100 feet of the probe cord. Note any measurement discrepancies between the two at 1-foot intervals. The probe cord will be rechecked if there is a possibility that it was stretched or damaged during water level measurements.

The procedures followed during calibration and verification of equipment will be documented in the field logbook along with any calculations. If a correction is required, the probe will be tagged to indicate the correction.

Standard Operating Procedure No. 10
Equipment and Personnel Decontamination

SOP NO. 10 Equipment and Personnel Decontamination

10.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for decontamination at the Iowa Army Ammunition Plant (IAAAP). These procedures described are sufficiently detailed to allow field personnel to properly decontaminate equipment and personnel. Field procedures for decontamination were developed in accordance with USACE Omaha District Chemistry Scope of Services and USACE Omaha District Geology Scope of Services, and are detailed in this SOP. This procedure is intended to be used together with Field Sampling and Analysis Plan (FSAP) and the other SOPs. Applicable SOPs are listed below:

- No. 1 - Surface Soil Sampling
- No. 2 - Subsurface Drilling, Soil Sampling, and Logging
- No. 3 - Monitoring Well Installation and Development
- No. 5 - Surface and Seep Water Sampling
- No. 6 - Monitoring Well Groundwater Sampling
- No. 9 - Water Level Measurement

Site and/or Sample Cross-Contamination

The overall objective of multimedia sampling programs is to obtain samples that accurately depict the chemical, physical, and/or biological conditions at the sampling site. Extraneous contaminants can be brought onto the sampling location and/or introduced into the medium of interest during the sampling program (e.g. using sampling equipment that is not properly or fully decontaminated). Trace quantities of contaminants can consequently be captured in a sample and lead to false positive analytical results and, ultimately, to an incorrect assessment of the contaminant conditions associated with the site. Decontamination of sampling equipment (e.g., all non-disposable equipment that will come in direct contact with samples) and field support equipment (e.g., drill rigs, vehicles) is, therefore, required prior to, between, and after uses at IAAAP to ensure that sampling cross-contamination is prevented, and that on-site contaminants are not carried off-site.

10.2 EQUIPMENT DECONTAMINATION PROCEDURES

10.2.1 Equipment List

The following is a list of equipment that may be needed to perform decontamination:

- Brushes
- Wash tubs
- Buckets

- Scrapers, flat bladed
- Hot water high-pressure sprayer
- Sponges or paper towels
- Alconox detergent (or equivalent)
- Potable tap water
- Laboratory-grade de-ionized water
- Garden-type water sprayers
- Appropriate Health and Safety equipment (i.e., tyvek, nitrile gloves, safety glasses, etc.)
- Appropriate IDW containers

10.2.2 Decontamination

10.22.1 Personnel

Decontamination consists of removing contaminated clothing and washing the skin to remove contaminants. How extensive the decontamination process must be depends primarily on the types of contaminants and the nature of on-site activities planned. As the toxicity of the contaminants and the magnitude of potential contamination of personnel is increased, the decontamination process becomes increasingly more extensive and thorough.

A temporary personnel decontamination line will be set up around each exclusion zone. If contamination is not encountered, a dry decontamination station may be established which consists of discarding of disposable personal protective equipment (PPE).

If real-time monitoring instruments indicate that contamination has been encountered, (i.e., action levels are exceeded requiring an upgrade from initial PPE levels), a complete personnel decontamination station will be established.

The temporary decontamination line should provide space to wash and rinse boots, gloves, and all sampling or measuring equipment prior to placing the equipment into a vehicle. A container should be available to dispose of used disposable items such as gloves, tape, or Tyvek (if used).

The decontamination procedure for field personnel will include:

1. Glove and boot wash in an Alconox solution
2. Glove and boot rinse
3. Duct tape removal
4. Outer glove removal
5. Coverall removal
6. Respirator removal (if used)
7. Inner glove removal

10.2.2.2 Responsible Authority

Decontamination operations at each hazardous waste site shall be supervised by the Site Safety and Health Officer (SSHO). The SSHO is responsible for ensuring that all personnel follow decontamination procedures and that all contaminated equipment is adequately decontaminated. The SSHO is also responsible for maintaining the decontamination zone and managing the wastes generated from the decontamination process.

Site activities should be conducted with the general goal of preventing the contamination of people and equipment. Using remote sampling techniques, bagging monitoring instruments, avoiding contact with obvious contamination, and employing dust suppression methods that would reduce the probability of becoming contaminated and, therefore, reduce the need and extent of decontamination. However, some type of decontamination will always be required on site. A sample personnel decontamination set-up guideline and a sample decontamination equipment and supplies list are included in Section 6, Health and Safety Plan (HSP).

OSHA requires that proper PPE must be worn when operating steam or pressure washing equipment. A rainsuit, boots, hard hat, and a face shield are recommended to be worn. All personnel must be kept out of the path of steam or water spray.

10.2.2.3 Sampling Equipment

The following steps will be used to decontaminate sampling equipment:

- Personnel will dress in suitable safety equipment to reduce personal exposure as required by the HSP.

- Gross contamination on equipment will be scraped off at the sampling or construction site.

- Equipment that cannot be damaged by water will be placed in a wash tub containing Alconox or low-sudsing non-phosphate detergent along with potable water and scrubbed with a bristle brush or similar utensil. Equipment will be rinsed with tap water in a second wash tub followed by a deionized water rinse.

- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water and rinsed with deionized water. Care will be taken to prevent equipment damage.

Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting to prevent contact with contaminated soil. If the equipment is not used immediately after decontamination, the equipment will be covered or wrapped in plastic sheeting, foil, or heavy-duty trash bags to minimize potential contact with contaminants.

10.2.2.4 Drilling and Heavy Equipment

Drilling rigs and excavating equipment will be decontaminated at the decontamination station located near the staging area. Mobile decontamination trailers may be used to decontaminate heavy equipment at each site. The following steps will be used to decontaminate drilling and heavy equipment:

- Personnel will dress in suitable PPE to reduce personal exposure as required by the HSP.

- Equipment showing gross contamination or having caked-on drill cuttings will be scraped with a flat-bladed scraper at the sampling or construction site.

- Equipment that cannot be damaged by water, such as drill rigs, augers, drill bits, and shovels, will be washed with a hot water, high-pressure sprayer then rinsed with potable water. Care will be taken to adequately clean the insides of the hollow-stem augers.

Following decontamination, drilling equipment will be placed on the clean drill rig and moved to a clean area. If the equipment is not used immediately, it should be stored in a designated clean area.

10.2.2.5 Equipment Leaving the Site

Vehicles used for activities in non-contaminated areas will be cleaned on an as-needed basis using soap and water on the outside and vacuuming the inside. On-site cleaning will be required for very dirty vehicles leaving the area. Construction equipment such as trucks, drilling rigs, trailers, etc., will be pressure washed before the equipment is removed from the site to limit exposure of off-site personnel to potential contaminants.

10.2.2.6 Decontamination solutions

A decontamination solution should be capable of removing, or converting to a harmless substance, the contaminant of concern without harming the object being decontaminated. The preferred solution is a mixture of detergent and water, which is a relatively safe option compared to chemical decontaminants. A solution recommended for decontaminating boot covers and gloves consists of 1 to 1.5 tablespoons of Alconox per gallon of warm water. Skin surfaces should be decontaminated by washing with hand soap and water. The decontamination solution must be changed when it no longer foams or when it becomes extremely dirty. Rinse water must be changed when it becomes discolored, begins to foam, or when the decontamination solution cannot be removed.

10.2.2.7 Wastewater

Liquid wastewater from decontamination will be containerized as IDW, and stored for later disposal as described in Section 7, IDW Transportation and Disposal Plan.

10.2.3 Emergency Decontamination

Hazardous waste facilities should also have in place emergency decontamination procedures, in order to prevent the loss of life or severe injury to site personnel. In the case of threat to life, decontamination should be delayed until the victim is stabilized; however, decontamination should always be performed first, when practical, if it can be done without interfering with essential lifesaving techniques or first aid, or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe injury or loss of life. During an emergency, provisions must also be made for protecting medical personnel and disposing of contaminated clothing or equipment.

10.2.4 Documentation

Sampling personnel will be responsible for documenting the decontamination of sampling and drilling equipment. The documentation will be recorded with waterproof ink in the sampler's field logbook with consecutively numbered pages. The information entered in the field logbook concerning decontamination should include the following:

- Date and start and end times
- Decontamination observations
- Weather conditions
- IDW handling

Standard Operating Procedure No. 11
Boring Abandonment

11.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for abandoning borings at the Iowa Army Ammunition Plant (IAAAP) and gives descriptions of equipment and field procedures necessary to abandon borings. These procedures described are sufficiently detailed to allow field personnel to properly abandon a boring. Field procedures for boring abandonment were developed in accordance with USACE Omaha District Geology Scope of Services, and are detailed in this SOP. Applicable SOPs are listed below:

Applicable SOPs are listed below:

- SOP No. 1 - Surface Soil Sampling
- SOP No. 2 - Subsurface Drilling, Soil Sampling, and Logging

11.2 BORING ABANDONMENT PROCEDURES

11.2.1 Equipment List

The following is an equipment list for boring abandonment:

- Portland cement (type I or II) and powdered bentonite for grouting
- Bentonite chips
- Potable water
- Drill rig or portable grout station
- Logbook
- Boring log sheets
- Waterproof and permanent marking pens
- Tremie pipe
- Appropriate health and safety equipment

11.2.2 Abandonment Procedures

Following completion of the borings each boring must be abandoned and plugged to provide a low-permeability zone that would retard movement of water through the boring backfill.

Where water was not encountered and the boring sidewalls are stable the boring may be backfilled using hydrated bentonite chips. The dry bentonite chips are poured into the boring from the ground surface filling the boring in 1-foot lifts. Hydration of the bentonite chips with 1 gallon of water is necessary for each lift of bentonite chips.

Where water was encountered in the boring and where the boring sidewalls are unstable the boring must be backfilled with a fluid cement/bentonite grout pumped into the boring. The grout will consist of a mixture that is blended to produce a thick, lump-free, cement/bentonite grout. The grout will be prepared in an above-ground rigid container by mixing the bentonite powder with potable water. Mix the grout until free of any clumps of powdered material. Pump the grout mixture into the base of the boring using drill rods or tremie pipe placed through the center of the augers. Initially place the drill rods or tremie pipe 3 feet above the bottom of the boring. Pump grout into the boring maintaining a positive head of grout within the central core of the augers at all times. Pull the augers and the tremie pipe or drill rods incrementally until the boring is grouted to the ground surface. After the grout has set for 24 hours check the boring for settlement. Add grout as required to refill the boring.

11.2.3 Pavement Repair

Where borings penetrate surface pavements, walkways or sidewalks, it will be necessary to patch the pavement surface following backfilling. Concrete pavements should be filled with 3,000 psi concrete mix. Asphaltic concrete pavements should be filled with asphaltic concrete patch mix and thoroughly compacted by ramming. The surface of any patch should be leveled upon completion. In freezing weather the concrete mix must be protected with tarps or blankets to keep from freezing for 48 hours after placement.

11.2.4 Documentation

Observations and data acquired in the field during boring abandonment will be recorded to provide a permanent record. These observations will be recorded with waterproof black ink in a bound weatherproof field logbook with consecutively numbered pages.

A boring log/diagram will be completed for each boring with observations and procedures recorded in the field logbook. A description of the well abandonment procedures, including drilling and the placement of well abandonment material, will be included in the field logbook. A description of drilling equipment and quality control procedures will be documented. A note will be placed on the boring log that the boring was abandoned and backfilled with hydrated bentonite chips or grouted with a cement/bentonite mixture to the ground surface or the pavement subgrade. The type of material used to patch the pavement surface will also be noted on the boring log and the field logbook.

Standard Operating Procedure No. 12
Permits and Clearances

12.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for obtaining permits and clearances at the Iowa Army Ammunition Plant (IAAAP). Permits and clearances are required for plant security, and for underground utility clearance (drilling, hand augering, excavating, etc.).

12.2 GENERAL REQUIREMENTS

URS and its subcontractors will adhere to the IAAAP security regulations while working at the facility. The Project Manager will inform each employee and subcontractor of the security requirements and ensure that the regulations are strictly maintained. The Project Manager will submit a list of the URS and subcontractor personnel anticipated to work on-site.

12.2.1 Citizenship

Personnel working in restricted security areas will be U.S. citizens. Proof of U.S. Citizenship will be shown before entering any restricted security area. If required, URS will obtain and submit fingerprints of URS and subcontractor personnel working on-site.

12.2.2 Identification Badges

All URS and subcontractor field personnel will obtain construction identification badges with photographs from American Ordnance (AO) Security in coordination with the Plant Protection Division. The identification badge will be displayed while working at the facility. The Project Field Manager will ensure the badges are returned to the AO Security upon completion of the work. Badges will be valid from date of issue through 31 December 2004. They will be exchanged at that time if work is to continue.

URS personnel and subcontractors will display their identification badges to gain access to the facility general area and those limited areas specifically authorized on the face of the badge. URS understands that any employee possessing a badge is bound by the Security Regulations of the Plant. The Plant Protection Division and/or AO Security may deny issuance or revoke any badge from an individual not complying with these rules.

12.2.3 Law Check

The Project Manager will ensure that each employee and all subcontractor personnel on-site have a law check performed and will request subcontractors to have law checks performed for its field staff The Project Manager will send the form to the employee’s local law enforcement agency to determine whether the employee has a police record. If any employee has a police record, it will be forwarded to the Plant’s security officials for review. Upon review, the security officials may deny issuance of a badge for that employee.

12.2.4 Facility Access

Vehicle "Visitor" placards will not be issued. The construction badges will designate areas of access for the individuals and their vehicles. Vehicles must be visibly identified by a company name (i.e., URS). All vehicles will be subject to search when exiting through access gates of the general plant areas.

URS personnel and subcontractors will access the facility area through Vehicle Gates Number 4 and 5. Material delivered via commercial trucks will enter the facility through Gate No. 3 during the hours of 0700 to 1730 on Monday through Thursday. Special arrangements can be made to accommodate off-time deliveries. The plant gates and their primary uses and operating times are outlined in the following list:

- Gate 1 is a specially designated construction gate used only in the event of facility labor dispute. If a labor dispute occurs, all URS employees and subcontractor personnel must use Gate No. I to access the facility (currently, this gate is not utilized).

- Gate 2, the east gate, is currently not utilized.

- Gate 3, the commercial gate, is open Monday through Thursday from 7:00 a.m. to 5:30 p.m.

- Gate 4, the main gate, is open 24 hours daily.

- Gate 5, the south gate, is open Monday through Thursday from 5:45 a.m. to 7:45 a.m. and from 3:45 p.m. to 6:00 p.m.

12.2.5 Camera Pass

URS or subcontractor personnel will obtain a camera pass from AO Security prior to entering IAAAP with a camera. Photographs taken within the installation will include only project sites and operations. No photographs will be taken of production facilities.

12.2.6 Permits and Licenses

URS will comply with the IAAAP requirements of an IAAAP Safety Work Permit. An IAAAP Safety Work Permit will be issued by the IAAAP (AO) Safety Manager after the site safety initiation briefing. If hot work is anticipated, this permit can be modified to include it.

12.3 UTILITY CLEARANCES

Digging permits will be obtained for all subsurface drilling activities prior to initiating the work. URS will notify the facility of on-site subsurface work one week in advance. Digging permits will be obtained through the appropriate U.S. Army representative. When any intrusive work is being performed in the vicinity of utility and/or communication cables/lines, Civil Engineering and/or Communication monitoring personnel, as required, will be present. No work shall start if the required monitoring personnel are not present. No mechanical digging shall be performed within 5 feet on each side of utilities and/or communication line(s) until they are physically exposed by hand digging. If a utility and/or communication line is damaged, the designated representative of the U.S. Army shall be notified immediately for further directions.

An underground utility search will be conducted for all off-site investigations, borings, and monitoring well locations. The underground utility search will be coordinated with the State/County.

12.4 OTHER PERMITS AND LICENSES

All field personnel, including subcontractors will be OSHA 40-hour trained. One member from the field team will have the 8-hour site supervisor training. One member of each field sampling team will have First Aid and CPR training. All drilling will be done by a State of Iowa Licensed Driller. All surveying will be done by a State of Iowa Licensed Land Surveyor.

Standard Operating Procedure No. 13
Direct-Push Well Installation, Sampling, and Injection

13.1 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for direct-push soil sampling, groundwater sampling and injection well installation and injection at the Iowa Army Ammunition Plant (IAAAP). These procedures give descriptions of equipment, field procedures, and documentation procedures implemented for the collection of direct-push soil and groundwater samples. The procedures described here are sufficiently detailed to allow field personnel to properly collect soil and groundwater samples, as well as install injection wells using direct-push technology. Field procedures were developed in accordance with IAC 567 Chapter 49 (IDNR 1998), USACE EM 1110 (USACE 1998) and USACE Omaha District Geology Scope of Services, and are detailed in this SOP. Specific soil and groundwater sampling location will be presented in future Field Sampling and Analysis Plan (FSAP) addenda.

These procedures are intended to be used together with FSAP and other appropriate SOPs. Health and safety procedures and equipment for the investigation are detailed in the IAAAP Health and Safety Plan (HSP). Applicable SOPs are listed below:

- No. 2 Subsurface Drilling, Soil Sampling, and Logging
- No. 7 Sample Identification, Handling, and Documentation
- No. 8 Headspace Analysis
- No. 10 Equipment and Personnel Decontamination
- No. 11 Boring Abandonment
- No. 12 Permits and Clearances

Reference Standards

Wherever IAC 567 Chapter 49 (IDNR 1998) is sited in this document, it will mean the IDNR Iowa Administrative Code 567 Chapter 49, for nonpublic water wells. Wherever USACE EM 1110 (USACE 1998) is sited in this document, it will mean the United States Army Corps of Engineers, Engineering Manual 1110-1-4000, for monitoring well design, and documentation at hazardous, toxic, and radioactive waste sites. Wherever an ASTM designation is cited in this document, it will mean the American Society for the Testing and Materials Standard Specification of that designation appearing in the “1994 Annual Book of ASTM Standards”, published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania. “EM 1110-2-1906” refers to the United states Department of the Army, “Engineering Design, Laboratory Soil Testing,” 30 December 1970.

General Approach

A multi-phase injection and monitoring approach is planned to be utilized to address groundwater concerns at the IAAAP. A treatability test and subsequent applications will be used to gather the required data necessary to design and implement an in situ-based remedial action for target compounds in groundwater at the IAAAP. It is recognized that the design, guidance, and procedures used for future in situ bioremediation activities can change as new data and information are collected. As such, the procedures presented herein may be modified based on the most recent data and information.

The planned phases of an in situ bioremediation effort, whether they are for a treatability study, pilot test, or full scale application, are likely to be comprised of the following activities, unless modified by additional information.

Phase 1

Step 1A – Install injection and/or monitoring network in the treatment and monitoring area. In some locations, existing wells may be used for injection and/or monitoring purposes. In these cases, injection and/or monitoring wells may not need to be installed.

Step 1B – Sample monitoring network in treatment area, including existing and/or newly installed wells to establish baseline (pre-injection) aquifer conditions.

Step 1C – Inject selected amendment into target zone of aquifer into the selected injection well(s) for the purpose of stimulating anaerobic biodegradation of target compounds.

Step 1D – Monitor REDOX potentials periodically (typically biweekly unless another frequency is determined to be appropriate) in monitoring points and injection points to determine aquifer REDOX values and effects of injectate.

Step 1E – *Decision Point*: If REDOX potentials are greater than -50 mV after 4 weeks of monitoring (this value and duration may change as additional data is collected), inject the same amendment as in Step 1C. Vary the injection scheme (number of injection points, distance from monitoring well, injectate concentration) as needed based on REDOX monitoring results to lower REDOX over as much of the treatability area as possible. Continue to monitor REDOX on a biweekly basis for 4 weeks (depending on additional data).

If REDOX potentials are less than -50 mV, collect groundwater analytical samples and monitored natural attenuation (MNA) parameters to monitor degradation of target compounds.

Phase 2

Phase 2A – *Decision Point*: If groundwater analytical results from Step 1E do not demonstrate a 25% or greater reduction in target compound concentrations as compared with pre-injection results, evaluate whether reinjection of the same amendment augmented with a slower release carbon source would be beneficial. Also consider reinjection of same fast release carbon source as initially used (perhaps with closer injection spacing or higher injectate concentration), particularly if redox is near -50 mV and target compound concentration reduction is near, but less than 25%. If groundwater analytical data from Step 1E demonstrates greater than 25% reduction in target compound concentrations, evaluate reinjection based on trends in REDOX. If REDOX appears to have stabilized, reinject same carbon source as used in Step 1E to drive aquifer to more reducing state. Vary number of injection points, distance from monitoring well, and injectate concentration, as needed, based on REDOX monitoring results. If REDOX appears to be steadily declining, continue to monitor its progress and resample when REDOX is at its lowest.

Phase 2B – Repeat Steps 1C, 1D, and 1E.

13.2 PROCEDURES FOR DIRECT-PUSH WELL INSTALLATION

Monitoring well installation will be accomplished by using a direct-push well installation technology by the six main tasks listed below. These procedures will be accomplished according to the general procedures outlined in the Geoprobe® Standard Operating Procedure Technical Bulletin No. 992500. These tasks are:

- Driving the probe rods to the required depth;
- Deploying the screen and riser pipe;
- Installing a sand/grout barrier;
- Installing a bentonite seal above the screen (if required);
- Grouting the well annulus (if required); and
- Installing surface protection (if required).

After the proper depth has been reached, a 1-inch diameter, schedule 40 PVC screen and riser pipe will be properly assembled, inserted into the borehole, and installed. Well construction diagrams will be completed. After installation, measuring points on the direct-push wells will be surveyed to a common datum.

Each direct-push well will be developed by purging. Development will be continued until the water is clear or at least five well volumes are removed.

13.3 PROCEDURES FOR DIRECT-PUSH SAMPLING

Direct-push sampling will be used to collect continuous or discrete soil samples and discrete groundwater samples. Direct push will also be used to install small diameter wells to be used for injection and groundwater sampling. Direct-push technology involves the use of probing tools that are advanced using a combination of static weight of the carrier vehicle and hydraulic hammer percussion. Continuous soil samples will be collected with a Dual Tube Soil Sampler. Discrete soil samples will be collected with a Macro-Core® Sampler (closed-piston system) or equivalent.

Discrete groundwater samples will be collected with a Screen Point Sampler or equivalent. Sample collection methods will be determined by site specific geological conditions. If other sampling equipment and techniques are used, an SOP of the specific methods to be used will be obtained from the subcontractor and inserted as attachments to this SOP.

13.3.1 Equipment List

The following equipment will be needed to complete direct-push soil and groundwater sampling:

- Direct-push rig with appropriate drilling and sampling tools (stainless-steel drive rods, piston sampler, liners, stainless steel split soon, mini-bailer)
- Photoionization detector (PID)
- Stainless steel or Teflon® mini-bailer
- Peristaltic pump and poly tubing
- Weighted tape measure with 0.1-foot increments
- Surveyor's stakes and flags
- Aluminum foil and headspace jars
- Field books/field sheets
- Stainless-steel knife, bowl and spoon
- Sample bottles provided by the laboratory
- Sample bottle labels
- Label tape (clear)
- Paper towels
- Camera and film
- Waterproof and permanent marking pens
- Plastic sheeting
- Trash bags
- Appropriate health and safety equipment, as specified in the HASP
- Appropriate decontamination supplies, as specified in SOP No. 10
- Ice chest with ice

13.3.2 Decontamination

Before drilling or sampling begins, the drilling and sampling equipment will be decontaminated according to the procedures contained in SOP No. 10. Drilling and sampling equipment will be decontaminated between boring and sampling locations. Sampling equipment will also be decontaminated between collection of samples from different depths at the same location.

13.3.3 Direct-Push Soil Sampling Procedures

The following procedures apply once the direct-push boring has been advanced to the appropriate depth. The methods and equipment used to advance the rods will be determined based on-site conditions.

13.3.3.1 Collecting Soil Analytical Samples

Analytical soil samples will be collected using continuous sampling methods or a piston-type sampler. Volatile organic compound (VOC) soil samples will be collected once the sampler is opened. Once VOC samples have been collected, the remaining soil will be composited. If required, semi-volatile organic compound (SVOC) samples will be collected first from the composited soil, with any remaining parameters collected after that. Other sample containers for analytical parameters will be specified in future FSAP addenda.

Once the soil sampler has been retrieved:

- Don a clean pair of nitrile gloves.

- Collect any required VOC sample. This should be done immediately upon opening the sampler.

- Scan the length of the sample with the PID and record the readings, measure the recovery, and scrape off any soil smear zone from the recovered sample with a stainless-steel knife. If the soil is not cohesive or if the smear zone cannot be easily removed, an attempt will be made to remove soil from the portion of the sample that has not come in contact with the sampler.

- Composite the remaining soil by thoroughly mixing the soil from the split spoon sampler in a clean stainless-steel bowl with a stainless-steel spoon. Once the soil has been composited, fill the appropriate containers for SVOCs. The remaining bottles will then be filled with the composited soil for any remaining parameters. The required analyses and appropriate volume of containers of soil will be presented in the future FSAP addenda.

- Complete the description of the recovered sample according to the Unified Soil Classification System.

- Label, store, transport, and document the samples (depending on the use of the sample) according to SOP No. 7.

- If no other samples will be collected, the boring will be abandoned using hydrated bentonite pellets or a cement/bentonite mixture according to SOP No. 11.

13.3.3.2 Collecting Geotechnical Soil Samples

Soil samples for geotechnical analysis will be collected using a split spoon, dual wall, or piston sampler equipped with brass or plastic liners. The liners will be labeled using the sample numbering scheme used for sample identification listed in SOP No. 7.

- Don a clean pair of nitrile gloves.

- Remove the liner from the sampler.

- Cut the liner into the desired lengths and seal the ends with endcaps. Secure the end caps with electrical tape and label accordingly.

- If no other samples will be collected, the boring will be abandoned using hydrated bentonite pellets or a cement/bentonite mixture according to SOP No. 11.

13.3.4 Direct-Push Groundwater Sampling Procedures

Once the borehole has been advanced to the desired sampling depth, the rods will be retracted to separate the disposable drive point from the drive rods, which will allow groundwater to enter the drive rods.

Once sufficient water has entered the rods:

- Don a clean pair of nitrile gloves.
- Lower the mini-bailer into the rods and fill the appropriate containers for VOC analysis.
- Collect all remaining parameters using a peristaltic pump. Prior to sampling using the peristaltic pump, at least one tubing volume should be purged.
- Label, store, transport, and document the samples (depending on the use of the sample) according to SOP No. 7.
- If no other samples will be collected, the boring will be abandoned using hydrated bentonite pellets or a cement/bentonite mixture according to SOP No. 11.

13.3.4.1 Groundwater Sample Filtration

Groundwater samples collected using direct-push sampling methods will be filtered at the laboratory. Filtration will be done only for metals, using a filter with an approximate 20- to 30-micron pore size. The samples will be preserved immediately after filtration.

13.3.5 Small Diameter Injection Well Installation

Small diameter injection wells will be installed using the soil borings created by the direct-push equipment. The wells will be installed in accordance with SOP No. 3, and will be 1-inch diameter wells constructed of schedule 40 PVC. The screen will be a 0.01 inch slotted PVC or continuous wire wrapped screen. The screen length will be determined in the field based on the hydrogeologic and geologic conditions encountered during soil boring. These wells will be used for adding amendments to the soil to encourage biodegradation of contaminants in the vicinity of the wells. These wells will also be used for groundwater sampling as described in SOP No. 6.

13.3.6 Field Quality Assurance Quality Control Procedures and Samples

Field quality assurance/quality control (QA/QC) samples are designed to help identify potential sources of external sample contamination and evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analyses.

13.3.6.1 Field Blanks

Field blanks are QC samples that check for potential external contamination of samples. No field blanks will be collected for soil samples. For groundwater samples, however, trip blanks will accompany all VOC samples. The sample collection coordinator or the project QA/QC coordinator will designate trip blanks. The trip blanks will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory with the other samples.

A trip blank serves as a check on sample contamination originating from the container or sample transport. One trip blank will be sent with each cooler containing water samples for volatile organic analyses.

13.3.6.2 Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the direct-push soil and groundwater sampling, duplicate samples will be collected at the same time as the initial samples. The initial sample bottles for a particular parameter or set of parameters will be filled first, then the duplicate sample bottles for the same parameter(s), and so on until all necessary sample bottles for both the initial sample and the duplicate sample have been filled. The duplicate samples will be handled in the same manner as the primary samples. The duplicate samples will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory on the day they are collected. Duplicate samples will be collected for all parameters. For soil samples, following collection of VOC samples, the remaining soil in the sampler will be composited and containerized for nonvolatile analyses. Duplicate samples are sent blind to the laboratory.

13.3.6.3 Matrix Spikes and Matrix Spike Duplicates

Matrix spikes (MS) and matrix spike duplicates (MSD) are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain-of-custody form and on the bottles. It may be necessary to increase the sample volume for samples where this designation is to be made.

13.3.7 Sample Identification and Handling

Samples will be identified, handled and recorded as described in this SOP and SOP No. 7. The parameters for analysis and preservation will be presented in future FSAP addenda.

13.3.8 Documentation

Each field activity must be properly documented to facilitate a timely and accurate reconstruction of events in the field (see SOP No. 7). Sample Collection Field Sheets will be completed for all analytical samples submitted for chemical analysis (Figures 1 and 2).

13.3.9 Field Logbook

The most important aspect of documentation is thorough, organized and accurate record keeping. All information pertinent to the investigation and not documented on the boring log will be recorded in a bound logbook with consecutively numbered pages. All entries in logbooks will be made in waterproof ink and corrections will consist of line-out deletions that are initialed and dated. Entries in the logbook will include the following, as applicable:

- Project name and number
- Sampler's name
- Date and time of sample collection
- Sample number, location, and depth
- Sampling method
- Observations at the sampling site
- Unusual conditions
- Information concerning drilling/direct-push decisions
- Decontamination observations
- Weather conditions
- Names and addresses of field contacts
- Names and responsibilities of field crew members
- Names and titles of any site visitors
- Location, description, and log of photographs (if taken)
- References for all maps and photographs
- Information concerning sampling changes, scheduling modifications, and change orders
- Summary of daily tasks (including costs) and documentation on any cost or scope of work changes required by field conditions
- Signature and date by personnel responsible for observations

Field investigation situations vary widely. No general rules can include each type of information that must be entered in a logbook for a particular site. A site-specific logging procedure will be developed to include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks will be kept in the field team member's possession or in a secure place during the investigation. Following the investigation, the logbooks will become a part of the final project file.

13.3.10 Boring Logs

Boring logs will be completed for each boring by qualified personnel (geologist, geological engineer, or geotechnical engineer). The boring log form is shown on Figure 3.

Boring logs will include the following information:

- Boring location
- Boring identification

- Drilling/direct-push agency
- Drilling/direct-push equipment and method
- Date started and completed
- Completion depth
- Logger
- Depth groundwater was encountered during drilling/direct push
- Depth to groundwater at the completion of drilling/direct push
- Description of materials encountered by depth including soil or rock type, moisture content, color and Unified Soil Classification
- Samples collected for laboratory analysis by depth of sample below surface, sample type and identification number, and sample interval
- Sample recovery
- Field screening results for soil headspace, breathing zone, and borehole with PID
- Origin of the lithologies (fill, loess, glacial till, glacial outwash, alluvium or colluvium, etc.)
- Other remarks or observations

13.4 PROCEDURES FOR INJECTION FOR DIRECT-PUSH POINTS

An injection pump designed for the placement of the selected amendments will be used to place the amendments into the subsurface at the selected depths at the well locations. The pump will be gravity-fed from an amendment reservoir. The pre-set pressure relief value will be set to deliver no more than the top end of the pressure range identified in the Work Plan. The amendments will be injected using a pressure activated injection probe (or equivalent) with the lateral injection ports set at the specific depths identified in the Work Plan. After injection activities the pump, injection probe, and tubing will be cleaned in accordance with the specified procedure provided by the pump manufacturer to remove materials out of the pump, probe, and injection tubing.

Specific injection procedures are:

1) Prior to handling material to be injected, familiarize yourself with all safety and health risks associated with the specific compound, including, but not limited to the safe dilution percentages and the handling procedures. Wear appropriate Personal Protective Equipment (PPE). If you are not familiar with the safety and health risks, do not handle any compound.

2) Using a Direct-Push Rig, advance injection tooling to the bottom of the desired injection zone.

3) Once target depth has been reached, install injection cap, attach exterior rod grip handle, and connect injection hose to the injection tooling.

4) Prepare the amendment in the delivery system to insure a steady and consistent injection flow.

5) Activate injection pump and begin the injection process. Simultaneously retract the injection tooling as needed. Adjust the retraction rate of the injection tooling to match the flow rate of

the pump. This is to ensure even vertical distribution of the amendment into the desired injection zone or zones.

6) Once the desired amount of injection amendment has been injected, shut down the pump, and continue to retract the injection tooling.

7) Once the injection tooling has been removed from the borehole, backfill the boring with appropriate backfilling material, and patch the surface to match existing surface material.

FIGURE 1
SOIL SAMPLE COLLECTION FIELD SHEET

SITE NAME ______________________ PROJECT NO. ______________

SAMPLE NO. ______________________ WELL NO. ______________

DATE/TIME COLLECTED ______________________ PERSONNEL ______________

SAMPLE METHOD AND DEPTH ______________________ ______________

SAMPLE MEDIA (Circle 1): Soil Sediment Sludge MS/MSD

SAMPLE SPLIT (Circle 1): Yes No SPLIT SAMPLE NUMBER ______________

FIELD DUPLICATE (Circle 1): Yes No DUPLICATE SAMPLE NUMBER ______________

Sample Container	Preservative	Analysis Requested

DESCRIPTION:

DEPTH: DESCRIPTION:

____

____

____

____

____

____

____

Comments ____

FIGURE 2
WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

PROJ. NAME ______ PROJECT NO. ______

SITE NAME ______ WELL NO. ______

DATE/TIME COLLECTED ______ PERSONNEL ______

SAMPLE METHOD ______

SAMPLE MEDIA:	Groundwater			
SAMPLE QA SPLIT:	YES	NO	SPLIT SAMPLE NO.	
SAMPLE QC DUPLICATE:	YES	NO	DUPLICATE SAMPLE NO.	
MS/MSD REQUESTED	YES	NO	MS/MSD SAMPLE NO.	

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested

WELL PURGING DATA

Date		Well Depth (ft. BTOC)	
Time Started		Depth to Water (ft BTOC)	
Time Completed		Water Column Length	
PID Measurements		Volume of Water in Well (liters)	
Background		Purge Rate (liters/min)	
Breathing Zone		Level of Drawdown (ft. BTOC)	
Well Head		Amount Purged (liters)	

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU's)	Water Level	Purge Rate

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe		
Water Quality Meter		

GENERAL COMMENTS

Ferrous Iron =

YSI 600 XL Multi-Parameter Probe Unit #

Field Parameters Measured =

Pump Placement Depth =

Well Diameter =

Screen Interval =

Turbidity of Sample =

FIGURE 3

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT	HOLE NUMBER
1. COMPANY NAME	2. DRILLING SUBCONTRACTOR	SHEET OF SHEETS

3. PROJECT	4 LOCATION
5. NAME OF DRILLER	6. MANUFACTURE'S DESIGNATION OF DRILL
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION
	9. SURFACE ELEVATION
	10. DATE STARTED / 11. DATE
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
21. TOTAL CORE RECOVERY %					
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR	

LOCATION SKETCH/COMMENTS SCALE:

PROJECT	HOLE

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

FIGURE 3

HTRW DRILLING LOG

PROJECT	INSPECTOR	HOLE NO
		SHEET OF SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	1.0						
	2.0						
	3.0						
	4.0						
	5.0						
	6.0						
	7.0						
	8.0						

PROJECT	HOLE NO

APPENDIX D
Amendments to Original Work Plan

The following changes were made to the Draft-Final (Revision 1) Work Plan due to issues encountered during field activities associated with the work plan and under consultation with the EPA and Army representatives.

- Additional samples at Line 3A Pond

- Addition of perchlorate to groundwater and surface water samples at the Incendiary Disposal Area and the Possible Demolition Site.

The rationale and details of each change were outlined in a letter work plan from Army to EPA prior to commencement of the new field activities. Copies of the letter work plans are included in this Appendix.

DEPARTMENT OF THE ARMY
IOWA ARMY AMMUNITION PLANT
17571 STATE HIGHWAY 79
MIDDLETOWN, IOWA 52638-5000

REPLY TO
ATTENTION OF

November 22, 2005

Installation Management Division

Mr. Scott Marquess
U. S. Environmental Protection Agency
Region VII
901 North 5th St.
Kansas City, Kansas 66101

Dear Mr. Marquess:

Reference Federal Facility Agreement (FFA) under CERCLA section 120, Administrative Docket Number: VII-F-90-0029 between the U.S. Environmental Protection Agency (EPA) and the U.S. Army for Iowa Army Ammunition Plant (IAAAP). Also reference Army work plan letter dated November 7, 2005 concerning additional sampling for Supplemental Remedial Investigation for Operable Unit 4 at 3A Pond.

We have included adjusted maps and tables in accordance with discussions held between the Parties on November 15, 2005. The field work will be conducted November 28 through December 1, 2005 in accordance with the Draft Final Work Plan for the Supplemental Remedial Investigation Operable Unit 4 (Tetra Tech, 2004). This letter delineates the rationale, sampling plan with location and analytical parameters, and the required personal protective equipment (PPE) not identified in the referenced work plan.

RATIONALE

Further vertical and horizontal delineation is needed around proposed sample pair, 3AP-TTSB-001 (soil boring) and 3AP-TTW-002 (groundwater). On September 9, 2005 Tetra Tech was collecting a DPT groundwater sample at Line 3A Pond when an odor was encountered at approximately 9 feet below ground surface (bgs) at sampling location 3AP-TTTW-002 (see attached figure). The odor was described by personnel as a "strong chemical odor" and encountered from a depth of 9 feet to 18 feet bgs. All drilling and sampling work was stopped at 18 feet bgs and the area was cleared of all Tetra Tech and subcontract personnel.

Soil and groundwater samples collected at the Line 3A Pond disposal pit and leach field during late August/early September 2005 sampling did not exceed the ROD Remediation Goals or the EPA Region 9 Preliminary Remediation Goals with the exception of 3AP-TTTW-001. The groundwater sample, 3AP-TTW-001, was collected at approximately 29 feet below ground surface and exceeded EPA Region 9 Preliminary Remediation Goals for aluminum, arsenic, iron, manganese, vanadium and benzene. The nearest soil sample, 3AP-TTSB-001, was collected at two depth intervals, 2 to 4 feet and 4 to 6 feet. No odors were encountered during the collection of this soil sample and results reported non-detect for explosives. Metals were detected in 3AP-

TTSB-001 but exhibited no exceedences of the aforementioned comparison criteria. Soil samples collected at the Leach Field, 3AP-TTSB-001 through 3AP-TTSB-003, were not collected beyond a six foot depth and were only analyzed for explosives and metals. However, soil samples collected at the Disposal Pit were collected to a total depth of eight feet and analyzed for explosives, metals, semi- volatile organic compounds (SVOC) and volatile organic compounds (VOC); there were detections of chloroform, acetone and 1, 2-dichloropropane at the 6 to 8 foot interval but not at concentrations above screening criteria. Based on the analytical results, soil boring logs and field observations the contamination of concern is likely to be a SVOC or VOC occurring within the soil vadose zone and the groundwater below the leach field. Furthermore, the odor encountered at 3AP-TTTW-002 started at 9 feet bgs and extended to a depth of 18 feet bgs before work was terminated.

SAMPLING PLAN

The soil vadose zone, starting at approximately 8 to 10 feet bgs, and groundwater will be the primary focus of additional sampling efforts at the Line 3A Pond.

The additional samples at Line 3A Pond will be collected to help identify the contaminant of concern and its vertical/horizontal extent in the vicinity of the Leach Field. All samples will be sent to Accutest in Orlando Florida for chemical analysis.

A total of 6 soil samples and 7 groundwater samples will be collected and sent to Accutest during the sampling effort at Line 3A Pond (see attached figure). At each proposed sampling location soil will be collected at 2-foot intervals beginning at 6 feet bgs. Field personnel will take and record a PID reading and field observation for each soil interval at each sampling location. The interval most likely to have the highest levels of contaminants will be determined based on highest PID reading, detectable odor and visible soil characterization. A sample from this interval will be collected and analyzed for SVOCs and VOCs. Sampling intervals will continue until bedrock is reached or PID readings reach background. A direct push groundwater sample will be collected at each proposed sampling location and analyzed for SVOCs and VOCs. Additionally a groundwater sample will be collected at the 3AP-TTTW-002 sampling location and sent to the laboratory for explosives, metals, SVOC and VOC analysis. Line 3A Pond sampling locations and required analyses are detailed on the attached table and figure.

PERSONAL PROTECTIVE EQUIPMENT

All field personnel and subcontractors will be required to wear personal protective equipment (PPE) during the sampling effort. Based on the results of the previous sampling event at the Line 3A Pond and the known presence of an odor starting at 9 feet bgs, a full face respirator with an organic vapor cartridge (black), tyvek suits and butyl rubber gloves will be required for PPE. An evacuation route upwind of the sampling location will be established before sampling commences and the area will be monitored with a PID to ensure the safety of sampling personnel.

Copies of this letter and the enclosure have been sent to:

TechLaw Inc., Mr. Bryan Rundell, 6400 Glenwood St., Suite 212, Overland Park, KS 66202
USAEC, ATTN: SFIM-AEC-CDN (Mr. Andrew Maly), 5179 Hoadley Road, Aberdeen Proving Grounds, MD 21010
U.S. Army Center for Health Promotion and Preventive Medicine, ATTN: Lia Gaizick, 5158 Blackhawk Road Bldg: E1675, Aberdeen Proving Ground, MD 21010

Copies of this letter have been sent to:

U.S. Army Corps of Engineers, CEMVS-PM, ATTN: Ms. Cotner, 8945 Latty Avenue, Berkeley, MO 63134
U.S. Army Corps of Engineers, ATTN: CENWO-PM-HB, ATTN: K. Howe, 106 South 15th Street, Omaha, NE 68102-4978
Tetra Tech Inc, ATTN: Mr. Rick Arnseth, Suite A-600, 800 Oak Ridge Turnpike, Oak Ridge, TN 37830
Iowa Department of Natural Resources, ATTN: Dan Cook, Wallace State Office Building, 900 East Grand Ave., Des Moines, IA 50319
Iowa Department of Public Health, ATTN: Don Flater/Dan McGhee, Lucas State Office, Building, 321 East 12th Street, Des Moines, IA 50319-0075
U.S. Fish and Wildlife, ATTN: Mike Coffey, 4469 48TH Avenue Court, Rock Island, IL 61201
American Ordnance, IAAAP, 17575 Highway 79, Middletown, IA 52638-9701
Joint Munitions Command, ATTN: AFSC-OFC-GC (Mr. Jackson), 1 Rock Island Arsenal, Rock Island, IL 61299-5500
IMA, Northwest Region, ATTN: SFIM-NW Mr. Gary Badtram, 1 Rock Island Arsenal, Rock Island, IL 61299-7190

If you have any questions, please contact Mr. Rodger D. Allison, rallison@aollc.biz, Installation Management Division, 319-753-7130.

Sincerely,

Leon D. Baxter
Installation Management Division

Enclosure

Line 3A Pond
Additional Sampling Rationale

Sample Name	Type	Method	Rationale	Soil at 2 foot intervals until bedroock						Groundwater
				6 - 8 feet	10-12 feet	12-14 feet	14-16 feet	16-18 feet	Soil Sample with highest PID Reading to Accutest	
3AP-TTSB-201	Soil	DPT	Characterize/Delineate Odor at Line 3A Pond	PID Reading	PID Reading	PID Reading	PID Reading	PID Reading	VOC	
3AP-TTSB-202	Soil	DPT	Characterize/Delineate Odor at Line 3A Pond	PID Reading	PID Reading	PID Reading	PID Reading	PID Reading	VOC	
3AP-TTSB-203	Soil	DPT	Characterize/Delineate Odor at Line 3A Pond	PID Reading	PID Reading	PID Reading	PID Reading	PID Reading	VOC	
3AP-TTSB-204	Soil	DPT	Characterize/Delineate Odor at Line 3A Pond	PID Reading	PID Reading	PID Reading	PID Reading	PID Reading	VOC	
3AP-TTSB-205	Soil	DPT	Characterize/Delineate Odor at Line 3A Pond	PID Reading	PID Reading	PID Reading	PID Reading	PID Reading	VOC	
3AP-TTSB-206	Soil	DPT	Characterize/Delineate Odor at Line 3A Pond	PID Reading	PID Reading	PID Reading	PID Reading	PID Reading	VOC	
3AP-TTTW-102	Groundwater	DPT	Characterize/Delineate Odor at Line 3A Pond							explosives, VOC, field parameters[1]
3AP-TTTW-202	Groundwater	DPT	Characterize/Delineate Odor at Line 3A Pond							explosives, VOC, field parameters[1]
3AP-TTTW-203	Groundwater	DPT	Characterize/Delineate Odor at Line 3A Pond							explosives, VOC, field parameters[1]
3AP-TTTW-204	Groundwater	DPT	Characterize/Delineate Odor at Line 3A Pond							explosives, VOC, field parameters[1]
3AP-TTTW-205	Groundwater	DPT	Characterize/Delineate Odor at Line 3A Pond							explosives, VOC, field parameters[1]
3AP-TTTW-206	Groundwater	DPT	Characterize/Delineate Odor at Line 3A Pond							explosives, VOC, field parameters[1]
3AP-TTTW-207	Groundwater	DPT	Characterize/Delineate Odor at Line 3A Pond							explosives, VOC, field parameters[1]

Notes:

1 Field parameters will be collected with a multimeter where sufficient groundwater can be collected.

GIS FILENAME: IAAAP_Samantha.map
DATE: 11/22/2005
SOURCE:
OPERATOR: Samantha.Groves

COORDINATE SYSTEM:
State Plane - Iowa South
(NAD 83, meters)
VERTICAL REFERENCE DATUM:
NAVD88

LEGEND

Proposed Sample Locations
Soil
Groundwater

Line 3A Pond Soil Data
Non-Detect
Detect
Above ROD RG/EPA PRG

Line 3A Pond Groundwater Data
Non Detect
Detect
Above ROD RG/EPA PRG

Historical Outlines
Areas
Lines

MKM Sampling Grids

Topographic Contours
major contours
minor contours

Surface Water

Potentiometric Surface

Railroads

Process Lines
Building
Ruin

Building doors
Areas
Lines

Bunkers
Pipe Discharges
Tanks
Septic Systems and Drainfields
Freon Tanks
Transformer Pads
Excavations

LINE 3A POND LETTER WORKPLAN
IOWA ARMY AMMUNITION PLANT
MIDDLETOWN, IOWA

Tetra Tech, Inc.

OAK RIDGE, TENNESSEE

Figure 1
Line 3A Pond
Round 2 Proposed
Sampling Locations

DEPARTMENT OF THE ARMY
IOWA ARMY AMMUNITION PLANT
17571 STATE HIGHWAY 79
MIDDLETOWN, IOWA 52638-5000

REPLY TO
ATTENTION OF

March 7, 2006

Installation Management Division

Mr. Scott Marquess
U. S. Environmental Protection Agency
Region VII
901 North 5th St.
Kansas City, Kansas 66101

Dear Mr. Marquess:

Reference Federal Facility Agreement (FFA) under CERCLA section 120, Administrative Docket Number: VII-F-90-0029 between the U.S. Environmental Protection Agency (EPA) and the U.S. Army for Iowa Army Ammunition Plant (IAAAP).

The Army proposes to amend the approach for sampling related to the *Draft Final Work Plan for Supplemental Remedial Investigation OU-4* at the Iowa Army Ammunition Plant to include perchlorates. This letter delineates the rationale and sampling plan with analytical parameters.

RATIONALE

Groundwater and surface water samples collected in accordance with the work plan were not analyzed for perchlorate. The two sites that have the potential for perchlorate contamination are the Incendiary Disposal Area and the Possible Demolition Site. At the Incendiary Disposal Area, bedrock was encountered before groundwater and thus no groundwater samples were collected at this site. One groundwater sample was collected at the Possible Demolition Site but not analyzed for perchlorate. Three surface water sampling locations were sampled in association with each site but were not analyzed for perchlorate.

CHANGES IN SCOPE AND SAMPLING PLAN

All work will be performed in accordance with the *Draft Final Work Plan for Supplemental Remedial Investigation OU-4* (Tetra Tech, 2005) and the Facility Wide Work Plan (URS, 2002).

At the Incendiary Disposal Area, another direct push point will be placed in the vicinity of the previous proposed sampling location. If this point yields groundwater, a sample will be collected for perchlorate in addition to the previously proposed analytes (total and dissolved metals and explosives). At the Possible Demolition Site, a groundwater sample will be collected from a direct push boring adjacent to the location of the previous boring. Groundwater at this location will be analyzed for perchlorate only.

Both sites have three associated surface water sampling locations (upgradient, midgradient and downgradient). Each of these will be sampled and analyzed for perchlorate only.

Perchlorate analyses will be performed using U.S. EPA Drinking Water Method 314.

Copies of this letter have been sent to:

TechLaw Inc., Mr. Bryan Rundell, 6400 Glenwood St., Suite 212, Overland Park, KS 66202
USAEC, ATTN: SFIM-AEC-CDN (Mr. Andrew Maly), 5179 Hoadley Road, Aberdeen Proving Grounds, MD 21010
U.S. Army Center for Health Promotion and Preventive Medicine, ATTN: Larry Tannenbaum, MCHB-TS-REH, BLDG 1675, APG-EA, MD 21010-5403
U.S. Army Corps of Engineers, CEMVS-PM, ATTN: Ms. Cotner, 8945 Latty Avenue, Berkeley, MO 63134
U.S. Army Corps of Engineers, ATTN: CENWO-PM-HB, ATTN: K. Howe, 106 South 15th Street, Omaha, NE 68102-4978
Tetra Tech Inc, ATTN: Mr. Rick Arnseth, Suite A-600, 800 Oak Ridge Turnpike, Oak Ridge, TN 37830
Iowa Department of Natural Resources, ATTN: Dan Cook, Wallace State Office Building, 900 East Grand Ave., Des Moines, IA 50319
Iowa Department of Public Health, ATTN: Don Flater/Dan McGhee, Lucas State Office, Building, 321 East 12th Street, Des Moines, IA 50319-0075
U.S. Fish and Wildlife, ATTN: Mike Coffey, 4469 48TH Avenue Court, Rock Island, IL 61201
American Ordnance, IAAAP, 17575 Highway 79, Middletown, IA 52638-9701
Joint Munitions Command, ATTN: AFSC-OFC-GC (Mr. Jackson), 1 Rock Island Arsenal, Rock Island, IL 61299-5500
IMA, Northwest Region, ATTN: SFIM-NW Mr. Gary Badtram, 1 Rock Island Arsenal, Rock Island, IL 61299-7190

If you have any questions, please contact Mr. Rodger D. Allison, rallison@aollc.biz, Installation Management Division, 319-753-7130.

Sincerely,

Leon D. Baxter
Installation Management Division

RESPONSE TO USACHPPM COMMENTS

Comment Response Matrix
Draft Final Supplemental Remedial Investigation Work Plan for OU4 August 2005

Commenter: USACHPPM – Lia Gaizick

Comments dated: September 2, 2005

Comment No.	Page/Reference	Comment	Response
		General Comments	
1		Please note that USACHPPM has not been included in the internal Army phase of the document review process. USACHPPM provided comments on an earlier version of the subject document (October 2004 draft) and did not receive a response to our comments. The October 2004 version of the document was revised based on USEPA Region 7 comments and dated February 2005. We received a copy of the February 2005 version with a memo indicating that the document was to be considered final on March 18, 2005. Therefore, we did not initiate further comment. Since that time it appears that EPA has initiated "informal dispute" on the February 2005 version of the document. The subject document is a resolution to that dispute and has already been sent to USEPA Region 7. However, we feel there are significant issues that Army should have considered before the document was offered to EPA as a resolution (see comments below).	Noted. The subject Work Plan has undergone subsequent revisions during the informal dispute. The latest version of the document (May 2006) incorporates the results of those discussions.
2		We acknowledge that "PRGs" can be used to screen sites to determine whether further evaluation is appropriate. However, the "PRGs" should be appropriate to the potential receptors evaluated for each site (i.e., residential values should be used for residential receptors and vegetation numbers for vegetation). If industrial PRGs are used to screen sites that do not have industrial workers as a potential receptor then the text should have some discussion as to the relevance of the PRGs for that site. This might include a discussion of background concentrations of the chemicals. Additionally, the presentation of how the comparison	PRGs and other screening criteria were used to focus the evaluation of data and to identify any data gaps (e.g., extent of contamination). As stated in Section 1.3, "Generally, the lowest applicable standard was used for comparison, with the exception of metals in soil, in which the higher of the background o0r LOAEL derived CC was used."

Comment Response Matrix
Draft Final Supplemental Remedial Investigation Work Plan for OU4 August 2005

Commenter: USACHPPM – Lia Gaizick

Comments dated: September 2, 2005

Comment No.	Page/Reference	Comment	Response
2 (con't.)		criteria aided in the decision making for more sampling is not transparent. Tables 4-1 through 4-3 provide rationale that appears to be unrelated to comparison criteria procedures, and the summary and conclusions sections provided in Section 3 appear incomplete. Figures 3-1 through 3-12 attempt to provide a summary by presenting information on sample point locations where values are above the CCs, Region 9 RGs, etc., but they are difficult to understand and are not helpful as shown. The figures are not chemical specific so it is not apparent what they are intended to convey. A flowchart or table showing what consideration (line of evidence) was given for each media at each site would be more transparent. For instance, for surface water and sediment it appears that upstream and downstream concentrations were compared to the criteria and were used to decide if more sampling was necessary. Additionally, for surface water and sediment, background concentrations were also used in the comparison of media data. The document should be more transparent as to how upstream, downstream, and background concentrations figure into the information to determine if more sampling is necessary. Also, the procedure for comparison for metals in surface soil is questionable. The text indicates that "…where analyte concentrations were lower than established RGs, the range of background metals soil concentrations were used. Finally if metals concentrations were below OU-1 RGs and background soil concentrations, the lower of the USEPA Region 9 PRGs for industrial soils or the CCs was used." Why is there further comparison if the analyte	The rationales for additional samples presented in Table 4-1 through 4-3 are related to the identified data gaps (often delineation of contamination). Text was added as indicated above to clarify the use of background soil values. The authors recognize that soil cleanup values for metals will never drop below background values.

Comment Response Matrix
Draft Final Supplemental Remedial Investigation Work Plan for OU4 August 2005

Commenter: USACHPPM – Lia Gaizick

Comments dated: September 2, 2005

Comment No.	Page/Reference	Comment	Response
		concentration is below background? The Army does not recommend cleanups below background concentrations.	
3.		During discussions concerning the Baseline Ecological Risk Assessment, USACHPPM cautioned the use and calculation of critical concentrations (CC), stressing that these values would be misinterpreted. The application of the CCs in this document is the type of issue USACHPPM was particularly concerned about. The subject document discusses that when analyte concentrations in the media are lower than human health RGs, a comparison of surface soil data to the lower of either the CCs or Region 9 industrial soil PRGs is made to determine if data gaps exist (see comment 2 above). The CCs for both soil and water/sediment are based on the Indiana bat. For the soil CCs the assumption is made that bats eat 100% terrestrial invertebrates and for water/sediment it is assumed that the same bat species eat 100% aquatic invertebrates. The potential receptors (see MKM 2004) at several sites do not include mammalian wildlife (i.e., Incendiary Disposal Area), yet the numbers for the Indiana bat are used as comparison criteria and show exceedances. In this instance CCs are ecological irrelevant to this site because the only receptor of concern is vegetation. The bat CC has no relation to vegetation. It is a back calculation with a Hazard Quotient of 1 and a specified toxicity value to arrive at the dose of a contaminant the bat would receive by ingesting terrestrial invertebrates. The dose to the bat is then converted to a concentration of the contaminant in invertebrates that is then converted to a concentration in soil that would result in the calculated invertebrate concentration (see MWH 2004, section 6.1.3.1).	We recognized the potential for misuse of the CC calculation. This precipitated a >1 yr. discussion with EPA to arrive at an alternative method for deriving ecological cleanup standards for the Indiana Bat. The focus on the Indiana Bat is relevant to all sites at the IAAAP because of its presence, either nesting or feeding, throughout the installation. Subsequent discussions with EPA, U.S. Fish and Wildlife Service, and the Army yielded a relatively new compilation of data on invertebrate compiled by USACHPPM for use in an uptake model. That new data, combined with the use of area averaged soil concentrations is the established method for risk calculations for the soil/Indiana Bat.

Comment Response Matrix

Draft Final Supplemental Remedial Investigation Work Plan for OU4 August 2005

Commenter: USACHPPM – Lia Gaizick

Comments dated: September 2, 2005

Comment No.	Page/Reference	Comment	Response
4.		Section 3 of this document, Site-Specific Backgrounds, does not contain conceptual site model information for each of the sites, to include contaminant of potential concern information, migration pathways, and potential receptors. In the October 2004 version of the document, this information was contained in Appendix A –Draft Final Soil Data Collection Work Plan, MKM July 2004. The Appendix is not provided in this version of the report. If the information is not provided in an appendix it should be provided in Section 3. This will help provide the reviewers and decision makers with a transparent line of evidence for why there is a need for further sampling (based on applicable migration pathways and potential receptors). If the Draft Final Soil Data Collection Work Plan, MKM July 2004 is not a final document, this Work Plan should not be submitted until that document becomes final.	The MKM Work Plan was finalized and is thus included by reference in this Supplemental Investigation Work Plan.
5.		In the Comment Response Matrix submitted with this document, EPA provides a specific comment on the Incendiary Disposal Area in which they specifically ask about perchlorate sampling. The response to that comment does not appear sufficient. Item 6 of the 2004 DA guidance on perchlorate indicates that if there is suspected perchlorate contamination Army shall plan and program to sample and assess perchlorate. From the response given it does not appear that Army intents to address perchlorate. Perchlorate has been found in ground water at the installation, so further information should have been provided in the Army's response to explain whether or not it is possible that perchlorate may be found at the site and any other sites in this OU.	Perchlorate sampling at the Incendiary Disposal Area and the Possible Demolition Site were added after discussions with EPA.

Comment Response Matrix
Draft Final Supplemental Remedial Investigation Work Plan for OU4 August 2005

Commenter: USACHPPM – Lia Gaizick

Comments dated: September 2, 2005

Comment No.	Page/Reference	Comment	Response
		Specific Comments	
1	Pg. 1-3. Sect.1.2, 5th bullet on the page	This indicates that surface water data are compared to the BERA CCs for aquatic receptors. The values shown in the table are based on the back calculation of an HQ of 1 for the Indiana bat, assuming that 100% of the bat's diet is aquatic insects. The Indiana bat CCs are the more conservative values presented for ecological receptors in the BERA (MWH 2004). How do these values relate to the management goals for the OU-4? This is particularly of interest for two reasons: 1) in addition to using the bat to evaluate surface water, the surface soil data is compared to CCs for the Indiana bat –assuming the bat's diet is 100% *terrestrial invertebrates*, and 2) bats hibernate and insects are only available for part of the year (short exposure duration). Depending on the management goal, national ambient water quality criteria would be a more appropriate screen to determine if more surface water sampling is necessary. Additionally, from other sections of this document it appears that upstream concentrations are also compared to analytical concentrations, but this is not discussed under this bullet point. Recommendation: Provide justification for using the CC for the bat for aquatic receptors. Bat values are used for both aquatic and terrestrial CCs, but the bat's diet can't be both 100% aquatic and 100% terrestrial insects. Although the bat CC are the most conservative values provided in the BERA (MWH 2004), justification should be included to explain why CCs for the bat are being used to evaluate both aquatic and terrestrial media, especially in areas	The screening criteria described were used as an initial screen to focus the data evaluation and thus were conservative (i.e., use of a threatened and endangered species as the receptor). Subsequent discussions of the data provide comparisons to upstream concentrations prior to determining whether a data gap exists.

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Commenter: USACHPPM – Lia Gaizick

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Comment No.	Page/Reference	Comment	Response
1 (con't.)		where potential exposure pathways to the bat may not exist. The CCs are based on a hazard quotient calculation that has many uncertainties and no site-specific data concerning actual concentrations of chemicals in the bats diet. Additionally, discuss how upstream and downstream concentrations were used to evaluate the analytical data from the MKM and historical sampling.	
2	Pg. 1-3, Sect.1.2, last sentence on the page	This states that "*The CCs established for surface soil, sediment and surface water in the BERA are based on the Lowest Observed Adverse Effects Level (LOAEL), which should not result in unacceptable levels of risk to ecological receptors (MWH 2004).*" This statement is incorrect as written. The CC values corresponding to LOAEL-based HQs are used to estimate COPEC concentrations that might pose ecological concern. Exposure to media concentrations *below* the LOAEL CC *should not result in unacceptable levels* of risk to ecological receptors. Additionally, no rationale is provided to explain that the CCs chosen were for the Indiana bat, which is a special status species at IAAAP and is the most conservative CC. <u>Recommendation:</u> Please correct the statement as indicated above.	The text has not changed. The understanding of a LOEAL-based CC is that concentrations below that should not result in unacceptable levels of risk.
3	Pg. 3-5, Sect. 3.1.3, last paragraph on the page	This discusses the two types of phosphorus that may have been used at the site. This information may be more helpful in a previous section (3.1.2) where phosphorus is first discussed. <u>Recommendation:</u> Consider moving the paragraph to the end of the soil subsection in section 3.1.2.	No change.

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Comment No.	Page/Reference	Comment	Response
4	Pg 3-6, Sect.3.2.1, Site Background, 1st paragraph	The text states that "Sludge from the sewage disposal plant was deposited on the landfill once or twice a year…". Is the landfill included in IAAP-015? Or is the landfill a separate AOC? Recommendation: If the landfill is a separate AOC consider specifying that in the text and whether or not it is included in OU-4.	The Old Flyash Waste Pile is occasionally referred to as a landfill. The use of the term landfill here may be confusing but refers to the waste pile.
5	Pg. 3-8, Sect. 3.2.2, 4th paragraph	The text indicates that "…surface water contained RDX above comparison criteria (Table 3-7)". However, for Site 5, Table 3-7 shows the Fall 2003 value as 2.96 and the "PRG" as 12900. This is not an exceedance of the criteria. Recommendation: Please recheck Table 3-7 and the text in section 3.2.2.	The value in Table 3-7 is correct for aquatic ecological risk but the text statement was base on a more conservative human drinking water value of 2 ppb.
6	Pg. 3-9, Sect. 3.2.2	This section discusses results of the groundwater sampling. However, no mention is made of the boron exceedance that is later discussed in section 4.3. A discussion of the boron exceedance should be included in this section. Recommendation: Please include a discussion of the boron sampling results.	The boron result was discussed in the referenced MKM report and presented in Table 3-8. The historical boron result will be discussed in the RI Report.
7	Pg.3-23, Sect. 3.7.1	After reading this section it is not clear that the Line 3A Pond that was excavated and backfilled with clean fill according to JAYCOR (1996), was located in the area where MKM sampling was conducted. The third paragraph of this section states that Tetra Tech found that "the Line 3A pond was determined to be a leach field associated with building 3A-01 and a raw chemical	Subsequent document and historical photo examination yielded more information on the nature and location of the "Pond", As built locations for the disposal pit and associated leach field were added to the figures and sampling was restricted to these previously unexamined areas.

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Commenter: USACHPPM – Lia Gaizick

Comments dated: September 2, 2005

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7 (con't)		disposal pit". From the Figures provided (3-9, 3-10, and 4-5) no previous sampling occurred at the leach field or at the raw chemical disposal pit. However, it is not clear if where previous sampling occurred is actually where excavation occurred. Recommendation: Consider referring to this new area to be sampled as Line 3A leach field and disposal pit, rather than the Line 3A "Pond". Since historic soil samples do not exceed comparison criteria the request for further sampling at this site might be misinterpreted. It is only the leach field and disposal pit that are not completely characterized and not the area previously sampled.	
8	Pg. 3-24, Sect. 3.7.2	See general comment 2. MKM (2004) indicates the potential receptors associated with this site are homeowners and vegetation downstream along the Skunk River. Industrial PRGs are not appropriate to apply to residential scenarios. Additionally, the second paragraph states that "No analytes were detected above comparison criteria" in the 3 ft bgs samples. However, arsenic did exceed the criteria in sample 41SA0201 (see Table 3-24). Recommendation: Further discussion should be included to explain why industrial PRGs are used for this site and how that factored into the decision for the need for further sampling. Also, consider adding a discussion concerning the arsenic exceedance and its relation to the high arsenic concentrations in background at the site.	Although the area in sot used by the current Line 3A operations, and despite MKMs assertions that the only receptors are off-site residential and vegetation, the site is still on the facility property and poses a possible exposure threat to on-site industrial workers for soil. The arsenic exceedance reference will be corrected in the RI Report.

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Commenter: USACHPPM – Lia Gaizick

Comments dated: September 2, 2005

Comment No.	Page/Reference	Comment	Response
9	Tables 3-1 through 3-27	The fourth column in the tables is titled "RG" in some tables and "PRG" in other tables. This is an inaccurate label and would be better as "criteria" or something similar. RG implies a risk based number. Critical concentrations are not risk based numbers and should not be labeled as RGs. Recommendation: Please change the label from "RG" or "PRG" to "criteria" or "comparison criteria".	RGs are here used to refer to the soil cleanup goals established in the OU-1 ROD. RGs were used for soil and sediment comparisons. Groundwater and surface water were compared to PRGs.
10	Pg. 4-5, Sect. 4.6	The first sentence refers the reader to section 3.6.2. However, this is the incorrect section, it should be 3.7.2. A short summary statement that explains that previous sampling had not correctly identified the "pond" should be included to remind the reader why more sampling is necessary. Additionally, it does not appear that any surface soil samples will be taken during the proposed sampling (see Table 4-1). If no surface soil samples were taken from that area before, it is not clear why surface soil samples are not being analyzed now. Additionally, if there is no concern for surface soil then CC should not have been used as comparison criteria at the "pond". Recommendation: Please correct the section reference (the same mistake is made in section 4.7) and add some summary text as described above. Additionally, address the lack of surface soil sampling.	The reference is mistaken and should be Sect. 3.7.2. Surface samples were not collected because closure of the "Pond" included excavation of near surface materials (see Sect. 3.7.2).
11	Pg. 4-7, Sect. 4.8	The second to last bullet discusses a human health risk screening. How will that be conducted? It also discusses the possibility of performing a baseline human health risk assessment. However, there is no mention of an ecological component.	Human health risk screening will be conducted in accordance with standard EPA guidance. Screening for risk will be guided by prior risk assessments for OU-1 and the BERA.

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Commenter: USACHPPM – Lia Gaizick

Comments dated: September 2, 2005

Comment No.	**Page/Reference**	**Comment**	**Response**
11 (cont)		Recommendation: Some information should be provided as to what is meant by a screening of chemical analytes (i.e., what numbers will the analyte concentrations be screened against?). Additionally, based on the MWH (2004) BERA it does not appear that there is an ecological concern at the Line 3A "Pond" or the Construction Debris Landfill. However, this work plan does not directly address ecological issues at the other sites and should include some summary statement about ecological concerns as well.	

RESPONSE TO USEPA COMMENTS

Comment Response Matrix

Draft Final (Revision 1) OU-4 Supplemental RI Work Plan August 2005

Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
		General Comments	
1	General	A plan and schedule under the Federal Facility Agreement (FFA) should be established to address ordnance-related concerns at the IAAP. This work should logically be addressed under the OU4 schedule, as OU4 includes "any other unacceptable risks that may be identified and not addressed in either OU1 or OU3".	UXO have not been located during previous investigations or remedial activities at IAAAP sites. Three OU-4 sites, the Central Test Area, the Incendiary Disposal Area, and the Possible Demolition Site have been identified as having the potential for UXO based on historical site activities. Army funding has been scheduled for UXO identification activities for FY06/FY07. Once funding becomes available, the Army will be able to identify a schedule for UXO related activities. MKM has recently performed geophysical surveys to identify magnetic anomalies for potential UXO avoidance/personnel health and safety. It is unclear if including UXO concerns under OU-4 would be prudent given its funding constraints/timeline. Including UXO concerns in OU-4 may unnecessarily slow down the completion of other environmental activities at OU-4.
2	Page 4-7	On Page 4-7 you mention that a Baseline Human Health Risk Assessment will be conducted if contamination is present above screening levels. EPA will expect that if a BLRA is conducted, it be submitted concurrent with the RI Report.	If a BLRA is conducted, it will be submitted concurrent with the Supplemental RI report for OU-4.
3	General Comment 1	Please see EPA letter of 2/25/05 providing comments on the Draft MKM Soil Data Collection Report. The issues identified in that letter have not yet been resolved, and are relevant to the nature of additional sampling that will be conducted at the OU4 sites. Additional summary comments are included below relative to each area.	All outstanding technical issues related to inadequacies in the MKM Soil Data Collection Report are addressed in Tetra Tech's revised RI work plan.
4	General Comment 3	EPA does not disagree that if no significant soil contamination is present at depth, groundwater contamination is unlikely. However, the ability to obtain	We agree that obtaining representative soil samples can be difficult, particularly at sites where there are potential widespread site impacts (such as PDS or InDA). However, at

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Draft Final (Revision 1) OU-4 Supplemental RI Work Plan August 2005

Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
		adequate numbers of representative subsurface soil samples is questionable. Please note that the JAYCOR RI concludes repeatedly that "…no contamination is present in soils at depths greater than 2-3 feet below the surface, thus no groundwater contamination would be present". Given the extensive groundwater contamination at the IAAP, it is clear that this is an inaccurate conclusion. In order to reach any reliable conclusions about groundwater contamination, several groundwater samples should be obtained from each area of concern.	sites of known and relatively limited size (such as the 3A Pond), demonstrating the lack of significant soil contamination at depth should be a representative indicator of the lack of groundwater contamination. While groundwater contamination appears to be extensive at IAAAP, it is in fact confined to small areas at individual sites, which in most cases have demonstrated subsurface soil contamination or documented sources to groundwater (such as redwater/pinkwater impoundments, belowground sumps, etc). More research is needed to determine if there are sites where no soil contamination is present at depth but groundwater contamination is present. It should be noted that the EWI, which has documented limited soil contamination, has demonstrated no groundwater contamination in the downgradient till and bedrock monitoring wells. Only surface soils have been sampled to any extent at the majority of OU-4 sites. Thus it is unknown if subsurface soils, and potentially groundwater, at these sites are impacted. Tetra Tech verbally agreed to sample groundwater beneath the Line 3A Pond and resample groundwater at the FAWP during a technical team meeting at EPA Region 7. In addition to Line 3A Pond, sites with relatively broad potential source areas, which include the InDA, PDS, CTA, and CDL, groundwater will be sampled.
5	General Comment 4	The "Draft MEC Density Survey Report" referenced in the response has not been submitted to EPA. The response is incomplete.	The MEC Density Survey Report was submitted to the EPA in June 2005.

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Draft Final (Revision 1) OU-4 Supplemental RI Work Plan August 2005

Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
		Specific Comments	
6	Specific Comment 1	EPA suggested that it would be appropriate to address all IAAP sub-sites in the OU4 Record of Decision, since OU4 is the last IAAP OU. The Army suggests that collating all IAAP sites should occur in a separate document. It is not evident that such an approach is most efficient, but suggest that you provide details of such a proposal.	The Army is willing to entertain the notion of including historically written off, closed, and non-contaminated sites not included in the OU-3 or OU-1 RODs. This is provided that review and approval of the OU-4 ROD would not be unnecessarily delayed by the inclusion of various sites that were closed and written off over the last 20+ years of the IAAAP installation restoration program. The Army and EPA should discuss and agree on the specific sites to be included in the OU-4 ROD, preferably during the execution of the OU-4 RI.
7	Specific Comment 3	Please note that surface water sampling was only excluded from the initial MKM work only due to contractual/scoping issues experienced by the Army, with the understanding that such sampling would be performed as part of this more comprehensive RI. Sampling should be conducted accordingly.	The necessity for surface water sampling will be determined by the presence of surface soil contamination at individual sites that could erode and impact local surface water quality, unless otherwise agreed to. Specifically, if surface soil contamination exists in samples proximal to surface water bodies, the FFA parties would visit the site and examine surface features for potential pathways for runoff and incorporation into local waterways. The parties would collaboratively agree in the field on the number and locations of surface water samples needed for each site. This is a considerably more defensible technical approach to locating proposed samples than selecting them from site maps. Surface water samples are proposed for 4 sites as noted in Table 4-3 of the revised document.

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Draft Final (Revision 1) OU-4 Supplemental RI Work Plan August 2005

Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
8	Specific Comment 4	We strongly disagree with your assessment of the Fly Ash Waste Pile site, based on our observation in the winter of 2004. Fly ash material was observed to be sloughing into Brush Creek, contradicting the statement that fly ash has limited, if any contact with the Creek. The response to this comment is clearly inaccurate. Please clarify whether Tetra Tech has actually assessed this site. We suggest a joint visit to the site by the FFA parties.	As discussed in prior meetings between the EPA Region 7 and Tetra Tech, the fly ash is sloughing into the creek as is commonly observed with any soil placed on a slope at an angle greater than its angle of repose. However, the impact of the sloughed material to Brush Creek surface water or sediment quality is not established. Actions designed to prevent sloughing will be based on preventing impacts to Brush Creek surface water and sediment quality. More site reconnaissance and collection of photos would be appropriate to determine the extent of sloughing into Brush Creek, especially following rainfall events.
9	Specific Comment 5	Please clarify whether you are intending to delineate the extent of Mercury contamination.	Mercury is one of the metals that will be sampled.
10	Specific Comment 6	Obtaining samples for VOCs by composite methods is unacceptable and was discussed among the FFA parties prior to the MKM sampling. Please evaluate soils for VOCs using proper sample collection techniques.	Samples collected for VOC analyses were not composited by MKM. This confusion has been clarified in the MKM draft-final report submittal to the EPA. Therefore, no further VOC analyses at the EWI are warranted.
11	Specific Comment 7	The Army should provide the video of activities at the Construction Debris Landfill as indicated.	MKM will provide this, as comment 7 states.
12	Specific Comment 10	Please further describe/clarify the confusion regarding sample depths as noted in the response.	In earlier revisions of the OU-4 Work Plan, inadequate information was provided by MKM regarding actual in-field sampling techniques, including depths for individual samples, which in some cases was different from their work plan. What appeared to be at-depth shallow samples in some of their proposed descriptions (e.g. the PDS) were surface grab samples, and what appeared to be surface/shallow soil samples at some sites were at-depth samples (e.g., the InDA). Upon Tetra Tech's receipt and subsequent review of the Soil Data Collection report, such sampling details were clarified.

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Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
13	Specific Comment 11	Please conduct surface water sampling, as noted previously.	As agreed, three surface water samples will be collected in Brush Creek at and downstream of the Fly Ash Waste Pile area that is sloughing into the creek.
14	Specific Comment 12	Please conduct groundwater sampling, as noted previously.	As agreed, groundwater samples will be collected from hydropunches or temporary wells when conducting subsurface soil investigations. Groundwater samples to be collected are listed in Table 4-2 of the revised document.
15	Specific Comment 13	Please see comment 8 above. Your assessment of the site is inaccurate.	Please see response to Comment 8 above.
16	Specific Comment 14	Please see comment 4 above.	Because of the widespread nature of potential sources and the potential for missing subsurface contamination, downgradient GW samples will be collected from hydropunches or temporary wells when conducting subsurface soil investigation. Samples will be analyzed for explosives and total/dissolved metals. It should be noted that high total metals concentrations are expected owing to turbidity typically encountered in hydropunch samples. Should dissolved metals be detected above background, a metals issue in GW will be considered.
17	Specific Comment 16	The nature of the Construction Debris Landfill site should be clarified. The Work Plan repeats assertions from the JAYCOR RI, stating that the site encompasses only 3 acres. Others who have assessed the site estimate its extent to be closer to 10 acres. The representativeness of any sampling is questionable if the nature of the site is not more clearly defined. The adequacy of any groundwater monitoring network should be assessed.	Further evaluation of site (recon/photos) and further review of historical aerial photos are warranted to determine actual extent of site. The historical records review for this site by Shaw does not confirm or disprove the 10 acre size, nor does it describe likely areas of contamination. Thus, it cannot be determined at this time if the existing well network (including the piezometers) is adequate. The adequacy of the well network at the site will be addressed during the RI.
18	Specific Comment 18	Please see comment 5 above.	The MEC report was submitted to the EPA prior to the previous revision which was submitted in June 2005.
19	Specific Comment 20	Please see comment 1 above.	Please see response to General Comment 1 above.

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Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
20	Specific Comment 25	The QAPP should be modified to provide the appropriate information.	Tetra Tech will review the Facility-Wide Work Plan QAAP to ensure the appropriate information is included and revise/addend as needed.
		Document Specific Comments	
	Incendiary Disposal Area	1. Given that "incendiaries" may have been disposed here, perchlorates are a potential contaminant and should be evaluated. 2. Please provide specifics of any ATSDR reports that discuss phosphorus toxicity. 3. The Work Plan concludes that numerous surface water detections are "likely" within the range of background. This conclusion does not appear to be adequately supported. Surface water samples should be collected. 4. Groundwater samples should be collected at the site.	1. Perchlorates were added to sampling scheme as a late change. This change is discussed in Appendix D. 2. This is discussed in more detail in revisions to the report. 3. Surface water samples have already been agreed to. 4. There is no indication of subsurface contamination in the subsurface samples collected. However, because of the potentially widespread nature of source material, downgradient groundwater sampling will be conducted.(1 hydropunch/temporary well sample). The same conclusion for dissolved versus total metals holds true here as with the PDS.

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Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
	Fly Ash Waste Pile	1. Given conditions at the site (fly ash disposal, solid waste disposal, unstable/unsafe conditions), we suggest that a removal action be considered. 2. Explosives are a contaminant of concern at the site and should be evaluated. 3. The assessment of site conditions presented in the Work Plan is inaccurate. Please note that the photos included in Appendix B are from 1999, and may not be reflective of current conditions. 4. The extent of fly ash material should be established. 5. Regular surface water monitoring should be conducted at the site.	1. The work currently is for an RI and not an FS. A work plan could be prepared for a TCRA or non-TCRA if conditions warrant. 2. Explosives will be evaluated in soil, GW and SW, but the MKM samples will not be re-sampled only for explosives. 3. Additional site reconnaissance (including invasive investigation for fly ash depth on slope) will be conducted. 4. See response above. 5. The necessity and nature of long-term surface water monitoring is not understood. As indicated in response to comment 8 and 13 above, impacts to Brush Creek resulting from sloughing fly ash must first be established. If impacts are discovered, action will be taken to eliminate the impacts (e.g. slope stabilization).
	Possible Demolition Site	1. Surface water and groundwater samples should be collected at the site. 2. Perchlorate should be considered as a potential contaminant of concern.	1. Surface water sampling was proposed in earlier versions of the OU-4 WP. Groundwater samples will be collected from hydropunches/temporary wells. 2. Perchlorate was added as a late change in the scope. The details of the change are noted in Appendix D.

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Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
	Inert Disposal Area	1. No additional comments.	
	Explosive Waste Incinerator	1. Surface water samples should be collected. 2. See previous comments regarding VOC sample collection methods.	1. There is no indication for VOCs contamination in surface water at the site, which would be rainwater in the ditch. There is no significant sediment contamination, thus surface water contamination is not expected. 2. MKM has addressed this in their response.
	Construction Debris Landfill	1. See comments above regarding the site. The extent of the site should be defined/mapped. 2. This site is a landfill site and should be treated as such. A removal action should be considered for this site. Representative surface water and groundwater sampling should be conducted. 3. The presence of buried ash in the subsurface (approximately 15' below grade) is reason for the Army to re-evaluate presumed uses of this site.	1. Agreed. Reconnaissance of the site will be conducted as part of pre-sampling activities. 2. Landfill is more of a misnomer for the site. Not sure that a removal action is necessary, given the lack of contamination observed and what was determined to be placed at the CDL in the HRR (construction debris). If a removal action is deemed necessary, this will be addressed in a feasibility study. 3. The buried ash will be investigated further, as already indicated in WP.
	Line 3A Pond	1. Please see comments in 2/25/05 letter. It appears that the MKM Work Plan was not followed, and previous samples were inappropriately located relative to the location of the former pond. Additional work on this site is needed.	1. Agreed. Soil and groundwater samples will be collected from the appropriate locations at the leach field/chemical pit observed from historical drawings and the 1957 aerial photo.

Comment Response Matrix

Draft Final (Revision 1) OU-4 Supplemental RI Work Plan August 2005

Commenter: Scott Marquess, EPA

Comments dated: April 4, 2005

Comment No.	Page/Reference	Comment	Response
	Central Test Area	1. Samples have not been collected from areas where high levels of anomalies were detected. Additional sampling is proposed, however, the sampling is of limited density. It is unclear that the extent of contamination will be adequately defined with the additional sampling. Defining the contaminant extent is a key objective that should be met.	1. Agree samples could be denser. Overlaying the geophysical map on the proposed sampling map may be good idea to show we are getting good coverage on the anomalies. Please note that magnetic anomalies detected by MKM will be avoided for health and safety concerns over the potential for UXO. Therefore, grid densification will be performed and added to the proposed soil sample map in the work plan but where the sample point does not coincide with a magnetic anomaly.
		2. The Work Plan reports detections from the MKM event, but does not provide specific data. Quantitative data should be provided. Nitrobenzene detections were reported which may merit further evaluation.	2. Specific analytical results were provided in the MKM Soil Data Collection report, and the reviewer is referred to this report for further information.
		3. Groundwater at the site should be sampled.	3. Groundwater sampling will be performed down-gradient of known or suspected contaminant releases using small diameter wells installed with filter packs. As noted above, areas with magnetic anomalies will be avoided for health and safety concerns over the potential for UXO.

RESOLUTION OF DISPUTE

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
INSTALLATIONS AND ENVIRONMENT
110 ARMY PENTAGON
WASHINGTON DC 20310-0110

DEC 21 2005

Mr. John B. Askew
Regional Administrator
U.S.E.P.A. Region VII
901 North 5th Street
Kansas City, Kansas 66101

Dear Mr. Askew:

This letter is to acknowledge the Army's receipt and acceptance of the Statement of Dispute Resolution regarding the Operable Unit 4, pursuant to the Federal Facilities Agreement for the Iowa Army Ammunition Plant (AAP). The signed statement is enclosed.

I want to express my gratitude for the hard work and cooperative attitude your staff displayed in working with the Army to craft the resolution to this dispute. I appreciate the EPA's willingness to ensure that concepts important to both our agencies could be preserved in this settlement.

Please let me know if issues arise in the conduct of the Iowa AAP cleanup program where this office can be of assistance. I can be reached at (703) 697-2014.

Regards,

Tad Davis

Addison D. Davis, IV
Deputy Assistant Secretary of the Army
(Environment, Safety and Occupational Health)

Iowa Army Ammunition Plant
EPA CERCLA FFA Dispute of March 28, 2005
Re: Operable Unit 4 (OU4) Work Plan for Supplemental Remedial Investigation
Statement of Dispute Resolution

This agreement represents the written decision that memorializes the resolution of a dispute under Section XI of the Federal Facility Agreement (FFA), Docket Number VII-F-90-0029, effective December 1990, entered into by the U.S. Army and the U.S. Environmental Protection Agency (EPA).

The agreement resolving EPA's dispute of the Draft Final Operable Unit 4 (OU4) Work Plan for Supplemental Remedial Investigation (RI) follows:

1. The parties agree to establish a new operable unit, subject to the FFA, to be called operable unit 5 (OU5). This OU5 is a munitions response area and includes 5 munitions response sites (MRS): the West Burn Pad Site (MRS-OU5A), Line 6 (MRS-OU5B), Central Test Area (MRS-OU5C), Possible Demolition Site (MRS-OU5D), and Incendiary Disposal Area (MRS-OU5E). All munitions and explosives of concern (MEC) and munition constituent (MC) contamination associated with these sites will be addressed under OU5.

2. The Army is conducting Preliminary Assessment/Site Inspection (PA/SI) work at the above OU5 sites under its Military Munitions Response Program (MMRP). The parties will participate in a scoping meeting to discuss upcoming OU5 SI work in February 2007. The Army may conduct sampling under the SI at the OU5 areas and will report the results of any SI sampling in a Remedial Investigation Work Plan, which is described below.

3. The Army agrees to submit to EPA a Draft RI Work Plan for OU5 by September 30, 2007.

4. The Army agrees to submit to EPA a Draft RI Report for OU5 by September 30, 2008.

5. The RI Work Plan and RI Report are primary documents, subject to the terms and conditions of the IAAP FFA. The Army will submit the Draft Final RI Work Plan and Draft Final RI Report to EPA consistent with the requirements established in the FFA. The purpose of the RI is to sufficiently define the nature and extent of contamination associated with MEC and MC at the OU5 areas in order to determine risk and support selection of a remedy. The nature and extent of contamination and risks for contaminated soils associated with the above types of releases (including soils considered "reactive" and "non-reactive") shall also be defined in the RI Report.

6. Included in the Draft RI Report, the Army will propose a schedule subject to the FFA for the submittal of the following OU5 documents – Feasibility Study, a Proposed Plan, Record of Decision, Remedial Design, Remedial Action Work Plan, and Remedial Action Completion Report. These documents are all primary documents subject to the IAAP FFA.

7. The Army submitted to EPA the Draft Final Supplemental Remedial Investigation Report for OU4 on August 29, 2006. The Draft Final OU4 Supplemental RI Report excludes elements that are outlined in this dispute. EPA will either accept or dispute the Draft Final OU4 Supplemental RI Report, consistent with provisions of the FFA, within 30 days of the execution of this Dispute Resolution. Schedules for the submittal of subsequent OU4 draft primary documents under the FFA (FS, Proposed Plan, ROD) shall be adjusted as follows:

Document	Submittal Deadline
Draft Feasibility Study	4/24/07
Draft Proposed Plan	10/22/07
Draft Record of Decision	5/27/08

8. The parties agree that access controls should be in place to prevent human exposures to MEC and/or MC at the OU5 MRS. The Army will take the following actions to control potential exposures to MEC and MC at the OU5 MRS until the final remedy is implemented at these sites-

A. Within 30 days of the resolution of the dispute, the Army will provide documentation of the visitor, contractor, hunter, and personnel safety program which informs them of the location and restrictions associated with each of the OU5 MRS. This documentation will include copies of educational materials to be provided to visitors to IAAP who could reasonably be anticipated to come in contact with the OU5 MRS. EPA will review the documentation and respond to the Army within 30 days of receipt of the documentation. If EPA believes that additional measures are necessary, EPA and the Army will discuss the contents of the documentation and try to reach consensus on what additional measures, if any, may be appropriate. The Army agrees to give full consideration to any changes to the documentation suggested by EPA.

B. Within 90 days of the resolution of this dispute, the Army will begin to provide the educational materials to all visitors, contractors, hunters or other personnel who could reasonably be anticipated to come in contact with the OU5 MRS.

C. Within 90 days of the resolution of the dispute, the Army will install signage at each of the OU5 MRS warning people of potential ordnance-related hazards and discouraging access.

D. Within 90 days of the completion of the OU5 RI Report, the Army will install a fence around the perimeter of the Possible Demolition Site and Incendiary Disposal Area OU5 MRS to prevent access to ordnance-related hazards unless the Army presents information in the OU5 RI report demonstrating that the fencing is not necessary.

9. CERCLA response actions at the Firing Site would be addressed under the FFA with the Formerly Used Sites Remedial Action Program (FUSRAP) at IAAP. FUSRAP will primarily be addressing the presence of depleted uranium (DU) at the Firing Site resulting from past testing operations conducted by the Atomic Energy Commission. The Firing Site is an operational testing range currently being used by the Army to test military munitions. DU rounds are no longer tested at the Firing Site by the Army. Any additional response actions at the Firing Site beyond those which will be addressed by FUSRAP will be addressed when

the range ceases to be operational unless releases from the Firing Site require an immediate response to protect human health or the environment. If such a condition is determined to exist, response actions will be implemented consistent with provisions of the FFA.

10. The Demolition Area is considered an active area by the Army and is the subject of a RCRA permit application. It is EPA's intent that the RCRA permit involving the Demolition Area be issued in Fiscal Year 2008. Any necessary response actions involving the Demolition Area will be addressed consistent with the provisions of the forthcoming RCRA permit. This approach for addressing the Demolition Area will be enforceable under the terms of the RCRA permit, and would be considered equivalent to managing the site under the FFA.

11. The Deactivation Furnace Area has been grouped by the Army with the Demolition Area for site management purposes at IAAP. The Deactivation Furnace Area will be addressed pursuant to the existing Record of Decision for OU1.

12. The West Burn Pads Area South of the Road (WPBS) is included in the IAAP FUSRAP FFA. The Army has included the WBPS in their MMRP. The Army will include the WBPS in their MMRP SI and document findings and conclusions from that effort in the RI Work Plan outlined in Item #3 above.

William Rice for
John B. Askew
Regional Administrator
EPA, Region 7

12/20/06
Date

Addison D. Davis, IV
Deputy Assistant Secretary of the Army
Environment, Safety, and Occupational Health

DEC 21 2006
Date