RAS 14584

STAFF EXHIBIT 17

FIELD SAMPLING PLAN ADDENDUM 3

Depleted Uranium Impact Area Site Characterization: Other Monitoring Equipment Installation, Other Monitoring (Precipitation, Cave, and Stream/Spring Gauges), and Electrical Imaging Survey Jefferson Proving Ground, Madison, Indiana

FINAL

Prepared for:

U.S. Department of Army
Installation Support Management Activity
5183 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5424

U.S. NUCLEAR REGULATORY COMMISSION
In the Matter of US Army (Jefferson Proving Ground)
Docket No. 40-8838-MLA Official Exhibit No. 17
OFFERED by Applicant/Licensee Intervenor ______
NRC Staff Other ______
IDENTIFIED on ______ Witness/Panel ______
Action Taken: ADMITTED REJECTED WITHDRAWN
Reporter/Clerk ______

DOCKETED
USNRC
October 25, 2007 (2:00pm)
OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF
Docket No. 40-8838-ML

TEMPLATE = SECY-027

SECY-02

STAFF EXHIBIT 17

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and

U.S. Army Corps of Engineers
Louisville District
600 Dr. Martin Luther King, Jr. Place
Louisville, Kentucky 40202-2230

Submitted by:

From Science to Solutions

Science Applications International Corporation
11251 Roger Bacon Drive
Reston, Virginia 20190

Contract No. W912QR-04-D-0019
Delivery Order No. 0012

July 2006

FIELD SAMPLING PLAN ADDENDUM 3

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Jefferson Proving Ground, Madison, Indiana

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FIELD SAMPLING PLAN ADDENDUM 3
Depleted Uranium Impact Area
Site Characterization: Other Monitoring Equipment Installation, Other Monitoring (Precipitation, Cave, and Stream/Spring Gauges), and Electrical Imaging Survey
Jefferson Proving Ground, Madison, Indiana

Contract No. W912QR-04-D-0019
Delivery Order No. 0012

Nuclear Regulatory Commission License SUB-1435

July 2006

Final

Name / Title	Telephone	Date
Joseph N. Skibinski Project Manager	(703) 810-8994	7/7/06
Joseph E. Peters Quality Assurance Officer	(703) 318-4763	7/7/06
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Harold W. Anagnostopoulos Radiation Safety Officer/Radiation Protection Officer	(314) 770-3059	7/7/06
Seth T. Stephenson Field Manager	(765) 278-3520	7/7/06

The approved Field Sampling Plan (FSP) Addendum 3 will be provided to subcontractors (i.e., UXO support) at the time of subcontract execution.

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CERTIFICATION 4

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has prepared this Field Sampling Plan (FSP) Addendum 3 for performing site characterization at Jefferson Proving Ground's Depleted Uranium Impact Area, located in Madison, Indiana. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan (QCP). During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

Joseph N. Skibinski
Project Manager
Science Applications International Corporation

7/7/06
Date

Joseph E. Peters
Quality Assurance Officer
Science Applications International Corporation

7/7/06
Date

Corinne M. Shia
Independent Technical Review Team Leader
Alion Science and Technology Corporation

7/7/06
Date

Significant concerns and explanation of the resolutions are documented within the project file.

As noted above, all concerns resulting from independent technical review of the project have been considered.

Lisa D. Jones-Bateman
Vice President
Science Applications International Corporation

7/7/06
Date

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APPENDICES

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LIST OF ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
CHP	Certified Health Physicist
CSP	Certified Safety Professional
DO	Delivery Order
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DU	Depleted Uranium
EI	Electrical Imaging
EMR	Electromagnetic Radiation
EOD	Explosive Ordnance Disposal
FSP	Field Sampling Plan
GP	Geophysical Procedure
GPS	Global Positioning System
HASP	Health and Safety Plan
HPT	Health Physics Technician
IDW	Investigation-derived Waste
JPG	Jefferson Proving Ground
NGB	National Guard Bureau
NOAA	National Oceanic and Atmospheric Administration
QA	Quality Assurance
QC	Quality Control
RF	Radio Frequency
SAIC	Science Applications International Corporation
SOP	Standard Operating Procedure
SOW	Statement of Work
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	Unexploded Ordnance
VT	Variable Time

1. INTRODUCTION

This document is the third Addendum to the previous Field Sampling Plan (FSP) (SAIC 2005a) prepared for the Depleted Uranium (DU) Impact Area Site Characterization Project for Jefferson Proving Ground (JPG), Madison, Indiana. Science Applications International Corporation (SAIC) has prepared this Addendum in accordance with the statement of work (SOW) requirements under the U.S. Army Corps of Engineers (USACE) Contract No. W912QR-04-D-0019, Delivery Order (DO) No. 0012.

This FSP Addendum documents and describes specific activities and details of the JPG DU Impact Area other monitoring equipment installation (cave streams and streams) and electrical imaging (EI) tasks that were not addressed in the FSP or have been modified from the information presented in the original FSP. The other equipment installation task includes the installation of gauging stations, calibration, maintenance, and data collection at the installed gauging stations. With this understanding, this Addendum follows the same format and relevant sections of the FSP are referenced. This document is to be used in conjunction with the existing FSP, not as a replacement. The information provided in this plan was developed for use by SAIC in support of JPG's site characterization program to assist with the installation of surface water gauging stations and the calibration of, maintenance of, and data collection from the installed gauging stations, as well as the completion of the EI survey. SAIC assumes no liability for the use of this information for any other purpose than as stated in this Addendum or the FSP.

Surface water stage data will be collected at 10 automatic gauging stations and 1 manual station and, following completion of calibration, the stage data will be used to calculate surface water flows and estimate recharge to the aquifer. Additional details concerning the scope and objectives of the other monitoring equipment installation were presented in Section 6.4 of the FSP (SAIC 2005a) and Section 2 of this Addendum.

An EI survey will be completed across previously identified fracture traces (SAIC 2006) and will be used to refine the locations of the potential preferred groundwater flow pathways and to further characterize the subsurface features. Approximately 39,000 linear feet of traverse are planned on being completed with this geophysical method. Additional details concerning the scope and objectives of the EI survey were presented in Section 6.1 of the FSP (SAIC 2005a) and Section 3 of this Addendum.

Section 4 provides information on investigation-derived waste (IDW), Section 5 discusses data use, Section 6 describes radiological responsibility and licensing, and the references used in preparing this report are provided in Section 7. The following appendices provide supporting documentation:

- *Appendix A. Work Instruction for the Installation of Other Monitoring Equipment*—This appendix describes field procedures for installing cave stream and stream gauging stations, collecting manual flow measurements, and data recorder downloading and collection methodology at the JPG DU Impact Area and surrounding area.
- *Appendix B. Work Instruction for Conducting the JPG Electrical Imaging Survey*—This appendix describes the specific field procedures for conducting the EI survey at JPG, considering the presence of unexploded ordnance (UXO) and radioactive materials.
- *Appendix C. SAIC Internal Geophysics SOPs*—This appendix presents the SAIC geophysical SOPs that will be used during the completion of the EI survey and consist of GP-011 Surface Electrical Imaging, GP-001 Geophysical Project Management, GP-006 Field Activities Documentation, and GP-007 Field Mapping with GPS (global positioning system). These internal SAIC SOPs present the procedures for performing geophysical investigations and maintain a desired level of quality assurance/quality control (QA/QC).

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2. MONITORING EQUIPMENT INSTALLATION AND MONITORING PLAN

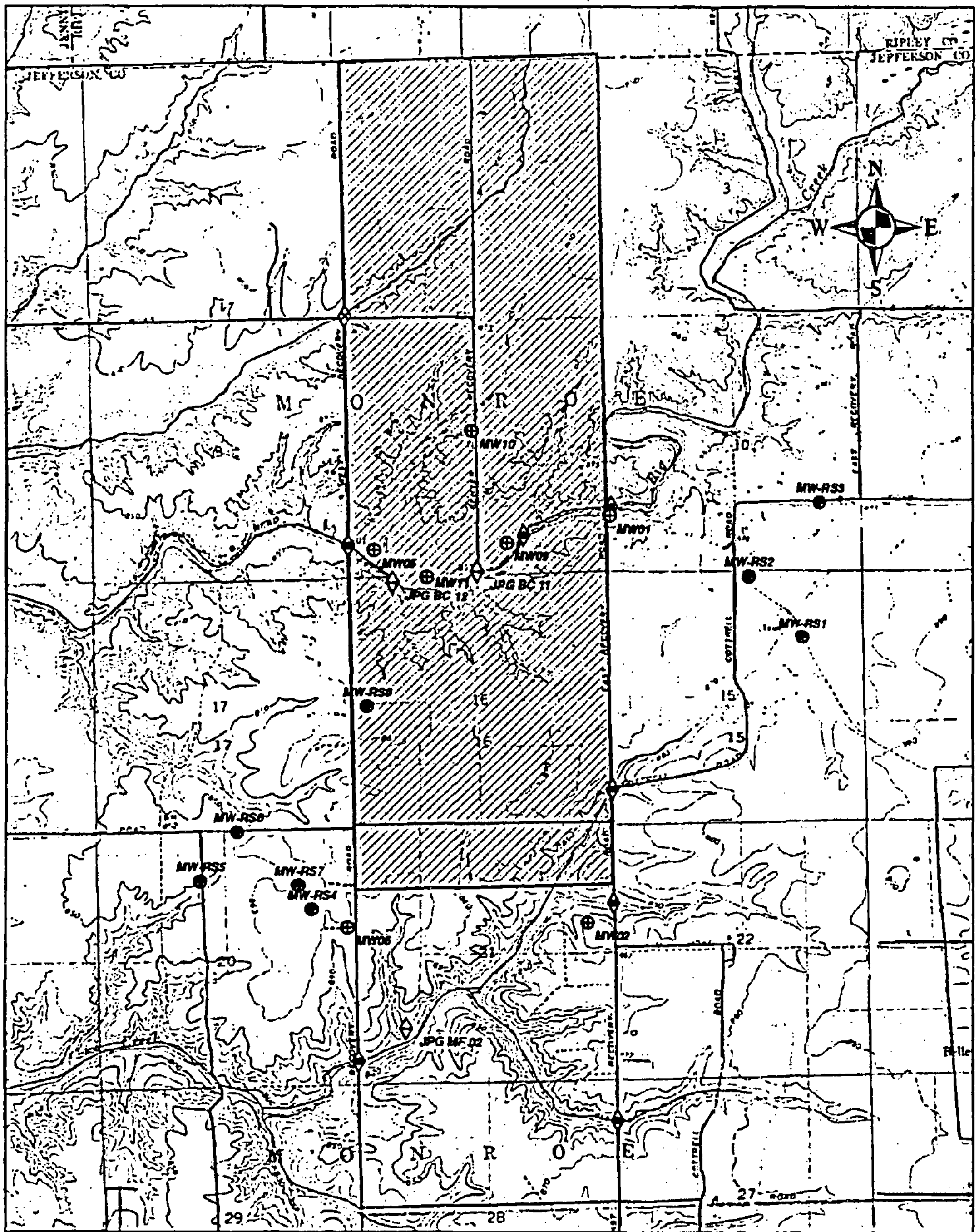
This section summarizes the cave stream and stream gauging station installation, calibration, and data collection activities to be conducted at JPG starting with the installation of the gauging stations in September 2005. This work will be conducted in accordance with the work instructions specified in Appendix A of this FSP Addendum. The timing of the installation activities is partially dependent of precipitation and flow conditions at the site. It is preferred to install the gauging stations when surface water flows are not high for both safety and ease of installation. The objective of this task is to collect surface water stage measurements that will be used to calculate and monitor surface water flows and flow from selected cave streams. This flow data will be used to estimate recharge to the aquifer. Precipitation data will not be collected with the installation of an automated weather station as stated in the FSP (SAIC 2005a), but will be downloaded from the following website http://www.fs.fed.us/raws/. The data are provided through the National Oceanic and Atmospheric Administration (NOAA) Cooperative Institute for Regional Prediction and are from an existing automated weather station maintained by the U.S. Fish and Wildlife Service (USFWS) on the eastern side of the JPG facility. Mesowest, associated with the University of Utah, manages the data for this (and other) weather stations.

Seven stream stage gauging stations (three on Big Creek and four on Middle Creek) and three cave spring stage gauging stations will be constructed and electronic data loggers will be installed in the JPG DU Impact Area (Figure 2-1). The construction of each stage gauging station location will be unique and adjusted to the actual site conditions at the individual locations. A stilling well will be constructed at each location and the cave stream gauges also are anticipated to include a weir. Six of the stream gauge stilling wells will be secured to bridge pillars or culverts, when present in an orientation that is usable. The remaining stream gauge will be built into the bank of Big Creek immediately east of the DU Impact Area and it is anticipated that an excavation approximately 10 feet long, 1 foot wide, and 5 feet deep (true dimensions will be determined in the field) will be completed for this installation. A backhoe may be used for this excavation if site conditions are appropriate. The cave spring gauges will be built into the banks of the springs emanating from the caves and it is anticipated that an excavation approximately 5 feet long, 1 foot wide, and 2 feet deep (true dimensions will be determined in the field) will be completed for this installation. An additional location at the intersection of Morgan Road and the Big Creek tributary immediately north of the main channel of the creek will have a staff gauge installed where periodic manual measurements will be collected.

Each of the automatic gauging stations will have an electronic data recorder and pressure transducer installed that will continuously and automatically record water levels (or stage) within the stilling wells. Each gauging station will be calibrated by manually measuring stream or spring/cave stream flows using a Gurley® flow meter or equivalent initially following installation and during each monthly download event during the first year of monitoring and during each quarterly download event during the second year of monitoring. The manual flow measurement procedure is detailed in Appendix A. Each of the stage gauging station recorders will be operated for a minimum of two hydrologic years.

Because the entire DU Impact Area is located north of the firing line where the potential to encounter UXO is likely, anomaly avoidance procedures will be followed[1]. This includes the scanning of work areas by visual and instrument surveys conducted by a qualified UXO contractor supervised by one of SAIC's qualified UXO specialists (i.e., graduate of U.S. Department of Defense [DOD] Explosive Ordnance Disposal [EOD] School in Indian Head, Maryland). The surveyed areas will be marked. Non-UXO personnel will operate only within the designated UXO-free areas. All other field work in

[1] SAIC will not be completing any UXO clearance activities as part of this investigation. Anomaly avoidance activities using a magnetic locator will be completed by SAIC's Senior UXO Supervisor. The avoidance activities will identify and mark areas where UXO possibly exists and safe work areas where UXO is not present.



Legend

- ⊕ Monitoring Well Locations
- ● Range Monitoring Well Locations
- Proposed Manual Stream Gauging Station
- Proposed Continuous Stream Gauging Station
- Proposed Cave Stream Gauging Station
- Streams
- Roads
- DU Impact Area

0 1,000 2,000 4,000

SCALE IN FEET

Jefferson Proving Ground
Madison, Indiana

Proposed Approximate Surface Water Gauging Station Locations

PAE 04/07/06

Revisions:

From Science to Solutions

FIGURE 2-1

Note: Proposed stream guage locations subject to adjustment based on field observations nonscanned areas where UXO reasonably may be exposed at the surface and within excavated areas will be subject to continuous surveillance by qualified UXO personnel. Additional procedures for work in UXO areas are included in Appendix D of the Health and Safety Plan (HASP) Addendum (SAIC 2005e).

Following the anomaly avoidance activities, establishing ingress/egress routes and work areas, and completion of the excavation activities by the qualified UXO contractor, SAIC personnel will install the stilling wells, weirs, and electronic data recorders.

Between gauge locations, the excavation and installation equipment will be decontaminated by dry methods consisting of scraping and removing the loose soil and material clinging to the equipment. Equipment used during this task will include hand excavation equipment (e.g., shovels, picks, and digging bars), a backhoe, miscellaneous construction hand tools, and a flow meter. The health physics technician (HPT) will survey the equipment and additional decontamination will be completed if the equipment is determined to be contaminated with depleted uranium (DU). Additional decontamination, if warranted, may consist of a water and Alconox® wash with a water rinse. All equipment will be surveyed by a HPT for radioactivity and will receive an unconditional release prior to allowing it to leave the site.

SAIC personnel, as well as subcontracted UXO personnel, are required to comply with all of the policies and procedures specified in this FSP Addendum, associated plans (SAIC 2005a, b, c, d, and e), and other referenced documents. The following summarizes the roles and responsibilities of the SAIC personnel responsible for conducting the monitoring equipment installation and monitoring.

- Mr. Joseph N. Skibinski is SAIC's JPG Project Manager. He is responsible for all activities conducted at JPG, including the cave stream and stream gauging station installation, calibration, and data collection activities, and all external coordination.
- Mr. Todd D. Eaby is SAIC's Hydrogeology and Multimedia Sampling and Analysis Lead for the cave stream and stream gauging station installation, calibration, and data collection activities. He is responsible for developing the plans associated with the surface water gauging events and will be present at JPG during the installations of the gauging stations. While present at JPG, he will be the primary point of contact for SAIC.
- Mr. Seth T. Stephenson will serve as the Field Manager, provide anomaly avoidance support, and will oversee subcontracted UXO personnel. He is a graduate of the EOD School in Indian Head, Maryland, and has served as the UXO Team Member and UXO Supervisor on surveys and removal actions at DOD sites. When Mr. Eaby is not present at JPG, he will be the primary point of contact for SAIC and will be responsible for ensuring work activities are conducted in accordance with the procedures and policies specified in the HASP Addendum and other related project plans.
- Mr. Randy C. Hansen will serve as the Health and Safety Officer. He is a certified safety professional (CSP) and has supervised the environmental radiation protection program on remedial action projects involving radiological contamination. He has experience supporting field operations at JPG.
- Mr. Harold W. Anagnostopoulos will serve as the Radiation Safety Officer. He is a certified health physicist (CHP) in SAIC's St. Louis office who specializes in environmental compliance, occupational safety, and radiation protection.
- Mr. Joseph E. Peters will be the QC Manager for all of SAIC's work at JPG. He will ensure that data collection is accomplished following the established procedures specified in the project plans and in compliance with established SAIC procedures. He is the QC Manager for USACE, National Guard Bureau (NGB), and U.S. Department of Energy (DOE) contracts and has extensive experience in working with laboratories and validating chemical and radiological data.

SAIC is proposing to install all of the gauging stations in September 2006. It is anticipated that all of the gauging station installations will be completed in a two week period. The timing of the installation activities is partially dependent of precipitation and flow conditions at the site. It is preferable to install the gauging stations when surface water flows are not high for both safety and ease of installation. Immediately following installation, the first manual flow measurements will be collected for calibration purposes using a portable flow meter. Gauging station data downloads and manual measurements will be scheduled following the completion of the installations and will be completed monthly for the first year. During the first year, each data collection event will include the downloading of electronic data recorders at 10 locations and manual flow measurements at a total of 11 locations. These events are anticipated to start in October 2006 and will be completed quarterly following the completion of the first year of data collection. During the second year, the data collection events will include the downloading of electronic data recorders at 10 locations, manual flow measurements at a total of 10 locations, and the recording of the stage as visually observed at the installed staff gauge on the tributary of Big Creek.

3. ELECTRICAL IMAGING SURVEY PLAN

This section summarizes the EI survey to be conducted at JPG scheduled to be completed in July through September 2006. The survey is planned to be completed during the summer to avoid frozen ground conditions, which inhibit electrical connection of the electrodes with the soil. The objective of this task is to refine the locations of potential preferred groundwater flow pathways and to further characterize the subsurface features. The results of this study will be used to assist in the selection of proposed monitoring well pair locations and refinement of the conceptual site model.

The SAIC geophysical procedures (GPs) for project management (GP-001), field activities documentation (GP-006), field mapping with GPS (GP-007), and surface EI (GP-011) will be used in conjunction with the work instruction for conducting the JPG EI (Appendix B). GP-011 was included as Appendix A to the FSP (SAIC 2005a) and included in this Addendum to provide the field team with a complete set of procedures for executing the identified work.

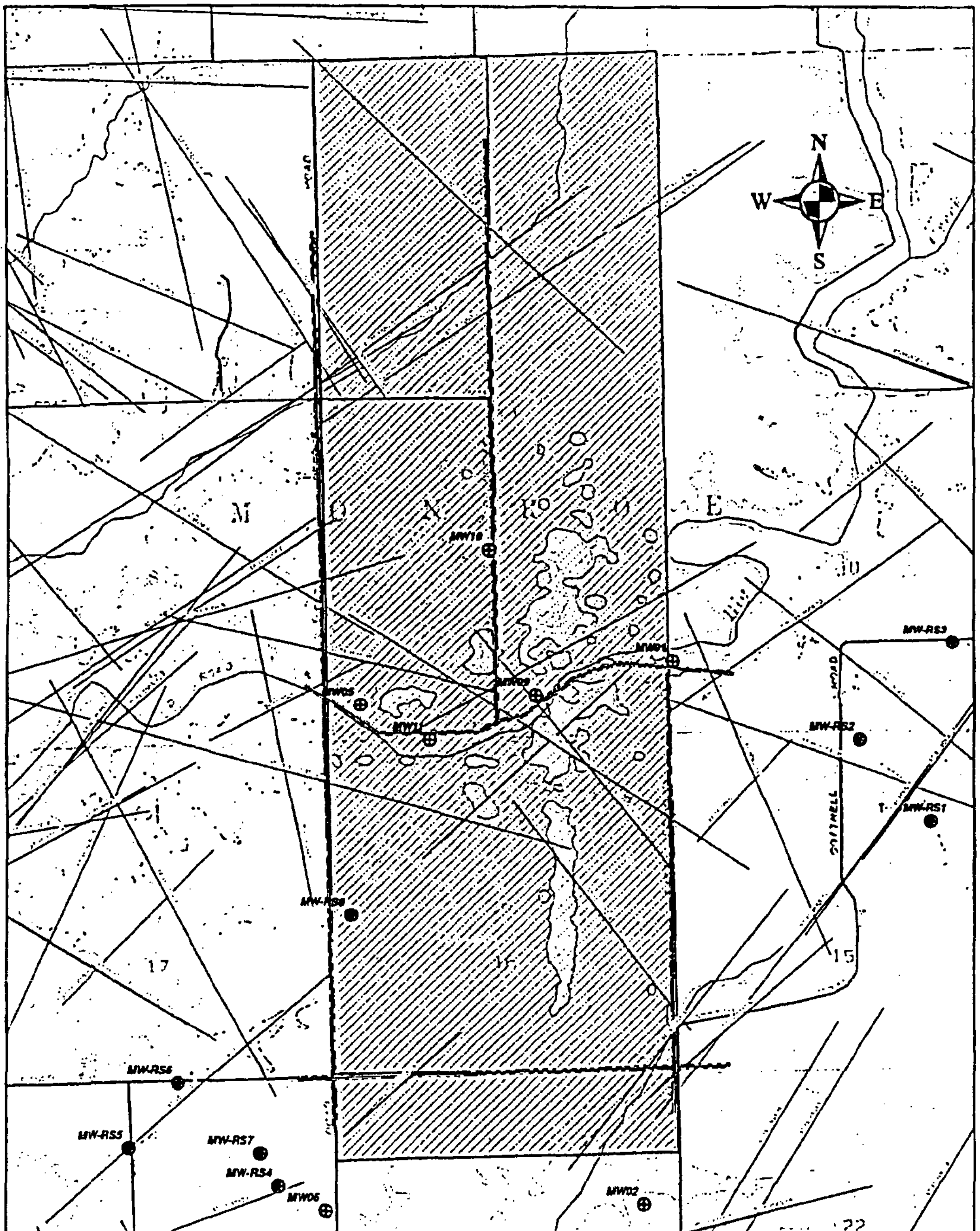
EI is a geophysical technique that measures the electrical properties of the subsurface. Specifically, the resistivity of the subsurface earth materials is measured along profiles. This is facilitated by placing electrodes attached along a cable along a traverse at a specified spacing and collecting resistivity measurements. For the purpose of this investigation and to provide the resolution and depth of investigation desired, a SuperSting® automatic, multi-electrode system with an electrode spacing of 4 meters, up to an 84-electrode array, and a dipole-dipole array configuration will be used. This should provide a maximum investigation depth of approximately 150 feet, but will be partially dependent on actual site conditions. Depending on the actual site conditions the field crew, with consultation of the senior geophysicist, may employ the use of additional electrodes to achieve the depth and/or resolution desired for the purpose of the investigation. The data collection method and array configuration consisting of "electrode rolls" in which the trailing electrodes and cables are moved to the leading edge of the array along the traverse, following data collection along that section of the traverse will facilitate coverage along the entire traverse distance.

The EI survey will include collection of data along approximately 39,000 linear feet of traverse. The traverse locations are illustrated in Figure 3-1 and may be adjusted in the field due to site features that may negatively affect the EI survey results.

Because the entire DU Impact Area is located north of the firing line where the potential to encounter UXO is likely, anomaly avoidance procedures will be followed. This includes the surveying of work areas for anomaly avoidance by visual and instrument surveys conducted by a qualified UXO contractor supervised by one of SAIC's qualified UXO specialists (i.e., graduate of DOD EOD School in Indian Head, Maryland) or by SAIC's Senior UXO Supervisor. The Senior UXO Supervisor will conduct a visual survey of the areas to either side of each transect for UXO that may be present at the surface. The surveyed areas will be marked and communicated to non-UXO personnel. Non-UXO personnel will operate only within the designated surveyed areas determined to be safe for operations. Additional procedures for work in UXO areas are included in Appendix D of the HASP Addendum (SAIC 2005e).

There is a remote possibility that the electricity injected into the soil surrounding Supersting® electrodes could inadvertently trigger a detonation of munitions equipped with variable time (VT) fuzes, which are susceptible to electromagnetic radiation (EMR) in the radio frequency (RF) range. Consequently, SAIC will operate the electrical resistivity test equipment remotely after SAIC personnel have emplaced the testing equipment at the site to address this concern. Additional UXO precautions are presented in Appendix B and HASP Addendum 3 (SAIC 2006e).

Following the completion of anomaly avoidance activities and establishing work areas along the EI traverse, SAIC personnel will install the stainless steel stakes by driving them into the ground along the EI traverse under direct supervision of the SAIC Senior UXO Supervisor.



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Scale in Feet

Legend

- ⊕ Monitoring Well Locations
- ● Range Monitoring Well Locations
- Proposed Electrical Imaging Traverses
- Fracture Traces
- Streams
- Roads
- DU Impact Area
- 14 µR/hr Exposure Rate (1995 SEG Scoping Survey Report)

Jefferson Proving Ground
Madison, Indiana

Fracture Trace Locations and
Proposed Electrical Imaging Traverses

PAE 04/20/06 | SMS 4/21/06

Revisions:

SAIC
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FIGURE 3-1

Between each deployment of electrode arrays, the stainless steel stakes will be decontaminated by dry methods consisting of scraping, knocking, and removing the loose soil and material clinging to the stakes. If the electrode cables get soiled, they may be wiped clean. The HPT will survey the equipment for contamination with DU and additional decontamination may be performed if the equipment is determined to be contaminated with radioactive material. Additional decontamination may consist of a water and Alconox® wash with a water rinse. All equipment will be surveyed by an HPT for radioactivity and will receive an unconditional release prior to allowing it to leave the site.

SAIC personnel are required to comply with all of the policies and procedures specified in this FSP Addendum, associated plans (SAIC 2005a, b, c, d, and e), and other referenced documents. The following summarizes the roles and responsibilities of the SAIC personnel responsible for conducting the electrical imaging survey:

- Mr. Joseph N. Skibinski is SAIC's JPG Project Manager. He is responsible for all activities conducted at JPG, including the EI survey and all external coordination.
- Mr. Todd D. Eaby is SAIC's Hydrogeology and Multimedia Sampling and Analysis Lead for the EI survey. He is responsible for developing the plans associated with the EI survey and will be present at JPG during the start of the survey. While present at JPG, he will be the primary point of contact for SAIC.
- Mr. Seth T. Stephenson will serve as the Field Manager and provide anomaly avoidance support. He is a graduate of the EOD School in Indian Head, Maryland, and has served as the UXO Team Member and Senior UXO Supervisor on surveys and removal actions at DOD sites. When Mr. Eaby is not present at JPG, he will be the primary point of contact for SAIC and will be responsible for ensuring work activities are conducted in accordance with the procedures and policies specified in the HASP Addendum and other related project plans.
- Mr. Randy C. Hansen will serve as the Health and Safety Officer. He is a CSP and has supervised the environmental radiation protection program on remedial action projects involving radiological contamination. He has experience supporting field operations at JPG.
- Mr. Harold W. Anagnostopoulos will serve as the Radiation Safety Officer (Radiation Safety Officer). He is a CHP in SAIC's St. Louis office who specializes in environmental compliance, occupational safety, and radiation protection.
- Mr. Joseph E. Peters will be the QC Manager for all of SAIC's work at JPG. He will ensure that data collection is accomplished following the established procedures specified in the project plans and in compliance with established SAIC procedures. He is the QC Manager for USACE, NGB, and DOE contracts and has extensive experience in working with laboratories and validating chemical and radiological data.
- Mr. Richard A. Hoover is SAIC's senior geophysicist and the project geophysics manager for the EI survey. He will be in contact with the geophysics field crew and will ensure that data collection is accomplished following established procedures specified in the project plans and in compliance with established SAIC procedures. He will be responsible for providing oversight and review of all of the survey data and data processing, and will provide guidance to the project hydrogeologist and geophysics field crew for any modifications to the field procedure due to site conditions to collect the best data to effectively achieve the project objectives. The geophysics manager will be responsible for the interpretation and geophysical reporting.
- Mr. Jeffery J. Warren is SAIC's geophysics field supervisor, one of the EI field crew members, will be responsible for completing all of the applicable field forms and communicating the survey progress, problems, and results to the SAIC project managers.

SAIC is proposing to conduct the EI survey in July through September 2006. It is anticipated that the EI survey will be completed in three 10-day shifts with 4-day breaks between. The timing of the EI survey is partially dependent on weather and soil conditions at the site. It is preferred to complete the EI survey when the soils are not frozen so that good electrical connection between the stainless steel stakes and the soil can be achieved. The EI equipment can not be operated during electrical storms.

4. INVESTIGATION-DERIVED WASTES

Following completion of field work, any radioactive waste generated shall be turned over to the Department of Army for secure storage. No radioactive waste is anticipated.

4.1 MONITORING EQUIPMENT INSTALLATION

IDW generated during the monitoring equipment installation task will consist of decontamination liquids, Tyvek® coveralls, and disposable gloves. Soils and decontamination liquids (if used) generated from equipment decontamination will be disposed of on the ground in the general area from which the materials originated. Any other wastes determined to be radioactive will be turned over to the Army and will be surveyed, packaged, stored, and transported in accordance with applicable regulations.

All excavated soils generated from the excavation/installation of gauging stations will be returned into open portions of the excavation following the completion of the gauging station installation and/or spread on the ground surface at the location of the station. Any materials such as disposable gloves, Tyvek®, paper towels will be surveyed or placed into plastic garbage bags and later surveyed by the HPT to determine if they are radioactive, and disposed of as normal solid waste if determined to not be radioactive. If IDW disposal is determined to be necessary, the Army might handle it themselves or a change order may be requested to include the services of a qualified and experienced licensed radioactive waste broker (e.g., Duratech, Race). Radioactive wastes will be stored temporarily in a secured location, as directed by the Army.

4.2 ELECTRICAL IMAGING SURVEY

IDW generated during the EI survey may consist of decontamination liquids, towels/wipes, and disposable gloves. Soils and decontamination liquids (if used) generated from equipment decontamination will be disposed of on the ground in the general area from which the materials originated. Any other wastes determined to be radioactive will be turned over to the Army and will be surveyed, packaged, stored, and transported in accordance with applicable regulations.

Any materials such as disposable gloves, Tyvek®, and paper towels will be surveyed or placed into plastic garbage bags and later surveyed by the HPT to determine if they are radioactive, and disposed of as normal solid waste if determined to not be radioactive. If IDW disposal is determined to be necessary, the Army might handle it themselves or a change order may be requested to include the services of a qualified and experienced licensed radioactive waste broker (e.g., Duratech, Race). Radioactive wastes will be stored temporarily in a secured location, as directed by the Army.

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5. DATA USE

5.1 MONITORING EQUIPMENT INSTALLATION AND MONITORING REPORT

A surface water and precipitation monitoring report will be prepared that summarizes all data collected at each gauging station during the first year of data collection. The second year of surface water data and flow analysis will be included in a report along with stage gauging results from monitoring wells and will be prepared under a separate task. The reports will include calibration results (rating curves) for each gauging station and the results of the recharge to the aquifer estimates. The data collected will be used to support development of a water budget and the recharge estimates will be completed by using either the U.S. Geological Survey (USGS) computer program PART (hydrograph separation) or RORA (recession curve displacement) (USGS 2005).

5.2 ELECTRICAL IMAGING SURVEY

An EI survey report will be prepared that will summarize all of the EI data collected. The report will include a map illustrating the final EI transect locations, color printouts illustrating the results of the data analysis collected for each transect, important physical features, and surface topography for each transect. Text will be included that describes the results of each transect, interpreted geophysical anomalies, and any physical features that are identified that may have potentially caused interference with the survey.

The results of the EI survey and the fracture trace analysis will be incorporated and used by SAIC in completing a monitoring well location assessment and selection task. Information resulting from these studies will be used with other site data in the formulation and development of potential monitoring well pair locations for a revised monitoring well network for groundwater monitoring and characterization, and will be documented in a separate report completed under a separate task.

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6. RADIOLOGICAL RESPONSIBILITY AND LICENSING

The possession of radioactive materials at JPG is authorized and governed under a radioactive materials license granted by NRC to the Army. The license number is SUB-1435. The current amendment is No. 13, dated April 26, 2006. The license authorizes the possession of up to 80,000 kilograms (approximately 177,000 pounds) of DU metal, alloy, and/or other forms. The material must remain onsite, within the restricted area known as the "Depleted Uranium Impact Area."

The Army has requested that SAIC be responsible for the work that is described in this FSP Addendum, and obtain and utilize a license from NRC that authorizes the contractor to provide radiological services for the Army. SAIC has obtained and will utilize such a license.

The SAIC St. Louis office is authorized to provide certain radiological services to clients under a radioactive materials license granted by NRC to SAIC. The license number is 24-32591-01. License condition number 14 requires that SAIC enter into a written agreement with the Army so that roles, responsibilities, and lines of authority for work at the site are clearly defined. This written agreement will be issued in letter form and must be signed by authorized persons from both SAIC and the Army prior to initiating work under this FSP. Once the agreement is signed, Figure 6-1 will be used to document the true date and time that responsibilities are transferred between the Army and SAIC.

Section 1 – Acceptance by SAIC Under NRC License No. 24-32591-01

Form ID No. (MM-DD-YYYY-XX):	
Task Description and Working location (be very specific):	
Governing Work Document(s) (e.g., Field Sampling Plan, HASP Addenda):	
Client Contacted (print name):	Method of Notification:
☐ Check to confirm that the client has agreed to remit the working area(s) to SAIC	
SAIC Approval to Accept	
SAIC Name (print):	Signature:
Date Accepted:	Time Accepted:
Follow-on Client Approval to Remit	
Client Name (print):	Signature:

Section 2 – Remittance by SAIC to the Army Under NRC License No. SUB-1435

Client Contacted (print name):	Method of Notification:
☐ Check to confirm that the client has agreed to accept the working area(s) from SAIC	
SAIC Approval to Remit	
SAIC Name (print):	Signature:
Date Remitted:	Time Remitted:
Follow-on Client Approval to Accept	
Client Name (print):	Signature:

Figure 6-1. Acceptance and Remittance of Radiological Responsibility at JPG

7. REFERENCES

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APPENDIX A

WORK INSTRUCTION FOR THE INSTALLATION OF OTHER MONITORING EQUIPMENT

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1.0 PURPOSE

The purpose of this work instruction is to define the instructions and requirements necessary for cave stream and stream stage gauging station installation, calibration, and data collection activities performed by and/or assisted by Science Applications International Corporation (SAIC). This work instruction describes the methods and equipment commonly used for installing and constructing stage gauging stations, collecting stream flow measurements, and downloading data from electronic data recorders.

2.0 PREREQUISITES

2.1 JPG Staff Notification

SAIC's Project Manager or Field Manager will notify contacts at the U.S. Fish and Wildlife Service (USFWS) (Dr. Joe Robb at 812-273-0783) and Indiana Air National Guard (ANG) (Jefferson Range) (Lieutenant Colonel Matt Sweeney at 812-689-7295) at least 1 week in advance of installing, calibrating, or collecting data from cave stream and stream gauging stations.

2.2 Health and Safety Work Permit (HSWP) Pre-Briefing

The Senior Health Physics Technician (HPT) will conduct and document the HSWP pre-briefing for all personnel and visitors prior to initiating any activities related to the installation, calibration, and data collection of cave stream and stream stage gauging stations. Additional information concerning the HSWP can be found in Health and Safety Plan (HASP) Addendum 3, Appendix C (SAIC 2006).

2.3 Equipment Check

The Hydrogeology and Multimedia Sampling and Analysis Lead, Field Manager, or designee will ensure the field equipment and expendables required are assembled and available to complete the task.

FIELD EQUIPMENT AND EXPENDABLES CHECKLIST

____ HASP and HASP Addendum 3
____ Field Sampling Plan (FSP) and FSP Addendum 3
____ Pressure transducers and data loggers (for installation)
____ Sand bags/pipe
____ Stop watch
____ Bucket/containers of known volumes
____ Back-up media for data files
____ Data logger communication cable
____ Water level indicator
____ Field logbooks
____ Black indelible pen(s)
____ Nitrile/leather gloves
____ Trash bags
____ Measuring tape
____ Decontamination equipment
____ Waders
____ Safety shoes

____ Safety glasses
____ Cellular telephone/two-way radios
____ Schoenstedt® fluxgate magnetometer (anomaly avoidance)
____ Radiation monitoring equipment
____ Portable flow meter (e.g., Gurley® meter)
____ Hand tools for digging
____ Hand tools for installation (e.g., drill)
____ Generator
____ Digital camera
____ Stilling well and weir materials
____ Alconox
____ First aid kit
____ GPS unit
____ Tyvek
____ Computer.

2.4 Daily Health and Safety Tailgate Briefings

SAIC personnel, subcontractor personnel, and visitors will conduct daily safety tailgate briefings that will address hazards associated with all activities planned for that day. Additional information concerning the daily health and safety tailgate briefings can be found in the HASP (SAIC 2005a).

3.0 REQUIREMENTS

1. Refer to the site- or project-specific HASP (SAIC 2005a) and HASP Addendum 3 (SAIC 2006) for relevant health and safety requirements.
2. All activities related to the installation of gauging stations will be documented in the bound log field books in accordance with the work instructions below and in SAIC FTP 1215.
3. Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in SAIC QAAP 17.1, Records Management.
4. A qualified unexploded ordnance (UXO) subcontractor will be used to provide anomaly avoidance and excavation services at all of the gauging station locations and will work under the direction of SAIC's Senior UXO Supervisor.

4.0 INSTRUCTIONS

The following sections include the instructions for installing and setting up gauge stations at the JPG DU Impact Area. The following sections also include instructions for measuring stream levels and flows and downloading data from automatic data recorders.

4.1 Instructions for the Installation of Continuous Stream Gauging Stations on Existing Bridge Structures

1. Each of the stream gauge station locations will have unique construction and excavation requirements based on the actual conditions at each location and will be determined at the time of the installation. It is anticipated that six of the seven stream gauging stations will have existing bridge structures to which a stilling well can be secured.
2. Where stations will be installed on existing bridge structures, SAIC personnel will take the bridge out of service temporarily by spanning caution tape across the road on both sides of the bridge. The tape will be spread beyond ingress/egress points used by SAIC and subcontractor personnel to install the continuous stream gauges.
3. Personnel from the UXO subcontractor will conduct anomaly avoidance in all ingress/egress routes and work areas for the installation of all gauging stations. Specific procedures are included in Appendices A and D of HASP Addendum 3 (SAIC 2006).
4. Following completion of the anomaly avoidance survey and the establishment of the ingress/egress routes and work areas, the UXO subcontractor will excavate any soil or sediment required for the installation of the stilling wells to be attached to the existing bridge structures. The use of a backhoe to assist in excavation activities at each location will be determined during the installation activities.
5. SAIC personnel will construct the stilling wells that will be secured to the bridge structure. One end will extend into and be open to the stream and the other will extend several feet above the stream bank.
6. SAIC personnel will later install the monitoring and recording equipment (see Work Instructions for the Installation and Setup of Pressure Transducers and Electronic Data Recorders). Each continuous stream gauging station will have a pressure transducer and electronic data recorder (In Situ Level Troll® or equivalent) installed within the stilling well for measurement and collection of stage data.
7. The Hydrogeology and Multimedia Sampling and Analysis Lead or Field Manager will inspect each continuous stream gauging station to ensure the station functions properly. In addition, photographs of the final configurations will be taken so that changes or alterations can be assessed during each visit.

4.2 Instructions for the Installation of Continuous Stream Gauging Stations in Stream Banks

1. It is anticipated that one stream gauge station will be installed directly into the stream bank.
2. Personnel from the UXO subcontractor will conduct anomaly avoidance to establish ingress/egress routes (assume each is 100 feet long and 10 feet wide) and clear a 50-foot-diameter work area for the use of a backhoe, if required.
3. For each station, the UXO subcontractor will excavate a trench on the stream bank that will be used to construct an L-shaped stilling well that will be sealed in concrete. The use of a backhoe to assist in excavation activities at each location will be determined during the installation activities.
4. SAIC personnel will construct the stilling wells and one end will extend into and be open to the stream and the other will extend out of the concrete several feet above the stream bank. It is assumed that the trench will be 10 feet long, 1 foot wide, and 5 feet deep (true dimensions will be determined in the field).
5. SAIC personnel later will install the monitoring and recording equipment (see Work Instructions for the Installation and Setup of Pressure Transducers and Electronic Data Recorders). Each continuous stream gauging station will have a pressure transducer and electronic data recorder

(In Situ Level Troll® or equivalent) installed within the stilling well for measurement and collection of stage data.

6. The Hydrogeology and Multimedia Sampling and Analysis Lead or Field Manager will inspect each continuous stream gauging station to ensure the station functions properly. In addition, photographs of the final configurations will be taken so that changes or alterations can be assessed during each visit.

4.3. Instructions for the Installation of Cave Stream/Spring Gauging Stations

1. Each of the cave stream/spring gauging stations will have unique construction and excavation requirements based on the actual conditions at each location and will be determined at the time of the installation. Generally the stations will consist of a weir and a stilling well.
2. Personnel from the UXO subcontractor will conduct anomaly avoidance to establish ingress/egress routes (assume each is 100 feet long and 10 feet wide), survey 50-foot-diameter work areas, and excavate trenches on cave spring banks. Due to the nature of the ground surface and terrain surrounding the cave stream locations, motorized equipment such as a backhoe is not anticipated to be able to be used.
3. Personnel from the UXO subcontractor will excavate a trench on the cave stream/spring bank that will be used to construct an L-shaped stilling well that will be sealed in concrete. It is assumed that the trenches will be approximately 5 feet long, 1 foot wide, and 2 feet deep (true dimensions will be determined in the field).
4. SAIC personnel will construct the stilling wells and one end will extend into and be open to the stream and the other will extend out of the concrete several feet above the stream bank. It is assumed that the trench will be 10 feet long, 1 foot wide, and 5 feet deep (true dimensions will be determined in the field). In addition a weir may be installed in conjunction with the stilling well depending on the configuration of the stream and the individual location conditions.
5. SAIC personnel later will install the monitoring and recording equipment (see Work Instructions for the Installation and Setup of Pressure Transducers and Electronic Data Recorders). Each cave stream/spring gauging station will have a pressure transducer and electronic data recorder (In Situ Level Troll® or equivalent) installed within the stilling well for measurement and collection of stage data.
6. The Hydrogeology and Multimedia Sampling and Analysis Lead or Field Manager will inspect each cave stream/spring gauging station to ensure the station functions properly. In addition, photographs of the final configurations will be taken so that changes or alterations can be assessed during each visit.

4.4 Instructions for the Installation of Manual/Visual Stream Gauging Station

1. Installation of stream staff gauges for visual or manual measurements only will consist of installing a manufactured graduated staff gauge in the stream. In order to protect the gauge, it will be mounted to existing bridge or culvert structures if present in the proper orientation.
2. Following completion of the anomaly avoidance survey and the establishment of the ingress/egress routes and work areas, the UXO subcontractor will excavate any soil or sediment required for the installation of the graduated staff gauge to be attached to the existing bridge or culvert structures.
3. SAIC personnel then will install the graduated staff gauge.
4. The Hydrogeology and Multimedia Sampling and Analysis Lead or Field Manager will inspect each manual/visual stream gauging station to ensure the station functions properly. In addition,

photographs of the final configurations will be taken so that changes or alterations can be assessed during each visit.

4.5 Instructions for the Installation and Setup of Pressure Transducers and Electronic Data Recorders

1. The pressure transducers and electronic data recorders will be hung in the stilling wells on hooks installed on the inside of the well casing so that locking covers can be installed and secured.
2. The depth to water inside the stilling well will be measured with an electronic water tape and recorded in the field logbook at the time of the start of data recording. Water levels will be collected from the identified reference location on the stilling well casing.
3. The data recorder will be set to collect stage data (water levels in the stilling well) on a linear scale and data points will be collected at a minimum of one every 2 minutes initially and if determined that the rate of data collected is not required, the rate will be adjusted following approval by the Hydrogeology and Multimedia Sampling and Analysis Lead. The test name (data file) will include the gauging station number (location). Data recorder test parameters will be recorded in the field logbook and will include test name, data collection rate, start time, stilling well water level (manual measurement), and data recorder/transducer serial number.
4. The test will be started and sufficient time will be allowed to have several data points collected. Following the collection of several data points, the operation of the data logger will be confirmed by viewing the active test with the computer.
5. After the pressure transducer and the data recorder are installed and data collection is started, manual flow measurements will be performed and recorded in the logbook for use in developing a rating curve for the station.

4.5 Instructions for Measuring Stream Flow at Automatic Stream Gauging Stations

1. Manual flow measurements will be collected at each station following the initial installation of the data logger and prior to downloading the electronic stage data and stopping the data collection.
2. An attempt will be made to perform the manual measurements in a straight section of stream with smooth shorelines with no brush or branches hanging in the water and no large rocks or weeds in the water. Areas with back eddies will be avoided. During the installation activities, an appropriate location for performing the manual measurements will be selected. The manual measurements will be collected from the same location during each measurement event and recorded in the field logbook at the time of the measurement.
3. The manual measurements will be collected using a portable flow meter such as a Gurley® meter or equivalent. All measurements will be recorded in the field logbook. The following steps/protocol will be followed during the collection of the manual flow measurements.
   a) A measuring tape/string will be stretched perpendicularly across the stream channel. The channel then will be divided in 15 to 30 equal segments.
   b) The depth of the water at the mid-point of each segment will be measured and recorded.
   c) The portable flow meter will be placed at 0.6 of the depth of the channel segment to be measured and the average velocity will be measured for each channel segment. If the water is deep, velocity measurements will be collected from 0.2 and 0.8 of the depth and averaged to obtain an average velocity for the channel segment.

4.6 Instructions for Measuring Stream Flow at Cave Stream/Spring Gauging Station

1. The manual measurements at cave streams will be dependent on the flow and the final configuration of the gauging station. It is anticipated that each of the cave stream locations will include a weir. One of the following methods of measuring the flow will be used when a weir has been installed at a gauging station.

   a) The height of the backwater above the weir crest will be measured and can be used to calculate the corresponding discharge through the weir. The following formulas would be used:

      i. Rectangular Weir: $Q = 1/3 (L - 0.2H) H^{2/3}$
      ii. Ninety-degree V-notch weir: $Q = 2.5H5/2$

      where:

      Q is the discharge (cubic feet per second)
      L is the length of the weir crest (feet)
      H is the head of the backwater above the weir crest (feet).

   b) If the construction of the weir is such that a container of known volume can be placed to collect all of the discharge, the timing method can be used. The container of known volume will be placed and the time to fill the container will be measured. This measurement will be used to calculate the discharge through the weir.

2. If a weir is not included in the configuration of the station and the channel is appropriately configured, flow measurements will be collected in the manner described for stream gauging station locations or temporary items such as sandbags will be used to construct a dam with a pipe that will be used for collecting timed volume measurements.

4.7 Instructions for Measuring Stream Levels and Flows at Manual/Visual Stream Gauging Station

1. A staff gauge will be installed at this location and manual measurements will include the visual reading of the water level on the staff gauge. Visual readings will be recorded in the field logbook. Once a rating curve is developed for the staff gauge, only visual readings will be required for acquiring flow measurements at this location.

2. Manual flow measurements are anticipated to be collected by one of two methods based on the configuration of the stream channel, bridge, and/or culvert. and are described below:

   a) Measurements will be collected using a portable flow meter as described in the stream flow measurement section.

   b) Temporary items such as sandbags can be used to construct a dam with a pipe that can be used for collecting timed volume measurements.

   c) If a culvert is present and in a usable orientation that a container of known volume can be positioned to collect all of the water flowing through it, timed volume measurements can be collected.

4.8 Instructions for Downloading Data from Data Loggers

1. The data loggers will be downloaded once every month during the first year and quarterly the second year.
2. The data loggers will be downloaded to a laptop computer and immediately backed up on separate media such as USB drives or disks.
3. The following steps will be completed at each station during the download tasks:
   a) The condition of the gauging station will be evaluated and any damages or changes to the station or surrounding channel, etc. will be noted in the field logbook.
   b) The stilling well will be unlocked and a depth to water will be measured in the stilling well and recorded in the field logbook. Water levels will be collected from the identified reference location on the stilling well casing.
   c) Manual flow measurements will be completed at the gauging station location prior to downloading the data logger.
   d) The laptop will be connected to the data logger using the communication cable and the data will be downloaded and saved as an Excel® file.
   e) Following the transfer of the data file to the laptop and confirmation of the data file and back-up file the data test will be stopped and a new test will be defined. The new test name will include the station number and the date. The minimum data collection frequency will be one measurement on a linear scale every 2 minutes initially and if determined that the rate of data collected is not required, the rate will be adjusted following approval by the Hydrogeology and Multimedia Sampling and Analysis Lead.. Prior to starting the new test, the old test will be deleted from the data logger memory.
   f) Start newly defined test (data collection). Allow several data points to be collected and then confirm operation with computer.
   g) After starting the new test another depth to water measurement in the still well will be collected and recorded in the field logbook. Data recorder test parameters will be recorded in the field logbook and will include test name, data collection rate, start time, stilling well water level (manual measurement), and data recorder/transducer serial number.
4. The stilling well cap will be secured with a lock following the completion of the data download and collection of flow measurements.
5. Before leaving the field, the data files and back-up files will be confirmed.

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APPENDIX B

WORK INSTRUCTION FOR CONDUCTING THE JPG ELECTRICAL IMAGING SURVEY

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1.0 PURPOSE

The purpose of this work instruction is to define the instructions and requirements necessary for completing an electrical imaging (EI) survey by Science Applications International Corporation (SAIC). This procedure describes the methods and equipment commonly used for conducting EI surveys.

2.0 PREREQUISITES

2.1 JPG Staff Notification

SAIC's Project Manager or Field Manager will notify contacts at the U.S. Fish and Wildlife Service (USFWS) (Dr. Joe Robb at 812-273-0783) and Indiana Air National Guard (ANG) (Jefferson Range) (Lieutenant Colonel Matt Sweeney at 812-689-7295) at least 1 week in advance of conducting the EI.

2.2 Health and Safety Work Permit (HSWP) Pre-Briefing

The Senior Health Physics Technician (HPT) will conduct and document the HSWP pre-briefing for all personnel and visitors prior to initiating any EI activities. Additional information concerning the HSWP can be found in Health and Safety Plan (HASP) Addendum 3, Appendix C (SAIC 2006).

2.3 Equipment Check

The Senior Geophysicist, Geophysics Field Supervisor, Field Manager, or designee will ensure the field equipment and expendables listed below are available and function properly.

FIELD EQUIPMENT AND EXPENDABLES CHECKLIST

____ HASP and HASP Addendum
____ Field Sampling Plan (FSP) and FSP Addendum
____ AGI SuperSting® resistivity system main unit
____ AGI SuperSting® multi-electrode cables
____ AGI SuperSting® test box kit and supplies
____ Stainless steel electrodes (84 minimum)
____ Back-up media for data files
____ Two 12-volt marine batteries
____ Battery chargers
____ Two heavy hammers
____ Field logbooks
____ Black indelible pen(s)
____ Nitrile/leather gloves
____ Trash bags
____ Metric measuring tape
____ Decontamination equipment
____ Salt (sodium chloride)
____ Gloves
____ Safety shoes
____ Safety glasses
____ Cellular telephone/two-way radios

____ Schoenstedt® fluxgate magnetometer (anomaly avoidance)
____ Radiation monitoring equipment
____ Water
____ Water jugs
____ Extra rubber bands
____ Laptop computer
____ Digital camera
____ Pin flags and/or wooden stakes/lath
____ Marking paint
____ First aid kit
____ Global positioning system (GPS) unit
____ Surveyors flagging
____ Caution tape
____ Electrical and rubber splicing tape.

2.4 Daily Health and Safety Tailgate Briefings

SAIC personnel, subcontractor personnel, and visitors will conduct daily safety tailgate briefings that will address hazards associated with all activities planned for that day. Additional information concerning the daily health and safety briefings can be found in the HASP (SAIC 2005a).

3.0 REQUIREMENTS

1. Refer to the site- or project-specific HASP (SAIC 2005a) and HASP Addendum 3 (SAIC 2006) for relevant health and safety requirements.
2. All activities related to the installation of gauging stations will be documented in the bound log field books in accordance with the work instructions below and in SAIC FTP 1215.
3. Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management.
4. SAIC's Senior unexploded ordnance (UXO) Supervisor or subcontractor UXO specialist will provide anomaly avoidance services at all of the EI transect locations.

4.0 INSTRUCTIONS

The following sections include the instructions for establishing work areas and setting up and conducting EI tests.

4.1 Instructions for Establishing Work Areas

1. The transect locations are generally along established roadways that are designated as clear for walking and driving. All roadways within 1 mile of the EI survey area will be blocked prior to starting EI activities on a daily basis. This is necessary to prevent vehicles or people from unintentionally entering the areas while the tests are conducted. In addition, SAIC's Field Manager or designee will notify contacts at USFWS (Dr. Joe Robb at 812-273-0783) and Indiana ANG (Jefferson Range) (Lieutenant Colonel Matt Sweeney at 812-689-7295) daily to identify access restrictions (1-mile perimeter) where EI surveys will be conducted.
2. If the transect extends off of the roadways or onto adjacent roadway shoulders, SAIC's Senior UXO Supervisor or personnel from a UXO subcontractor will conduct anomaly avoidance in all

ingress/egress routes and work areas for the EI transects. Specific procedures are included in Appendices A and D of HASP Addendum 3 (SAIC 2006).

3. The surveyed areas will be marked and non-UXO personnel will operate only within the designated work areas. If UXO is determined to be on the surface in areas adjacent to the EI transects, SAIC's Senior UXO Supervisor or personnel from a UXO subcontractor may require the EI transect to be moved or modified or restrict personnel access to that area. All restricted areas will be marked for positive identification by non-UXO personnel.

4.2 Instructions for Equipment Set-up and Test Operation (Data Collection)

1. Following the anomaly avoidance scanning and the establishment of the ingress/egress routes and work areas, the geophysics crew will lay out and construct the array.
2. SAIC's geophysics crew will install the stainless steel electrodes (stakes) at a anticipated 4-meter spacing as measured along the transect. It is anticipated that an array of up to 84 electrodes will be used. If determined that the actual field conditions require a change in the electrode spacing and/or number of electrodes, all changes will be discussed with and approved by the Geophysics Manager, Project Hydrogeologist, and Project Manager.
3. SAIC's geophysics crew will install wooden stakes and/or pin flags to mark the endpoints of each array. The locations of the wooden stakes will be surveyed using GPS to support data analysis, provide positive features for location during proposed well location activities, and in the unlikely event that EI tests need to be re-conducted
4. Following the placement of the electrodes and stakes, the multi-electrode cables will be attached to the horizontal platform on the electrodes using rubber bands. The cables then will be connected to the SuperSting® unit.
5. All personnel will withdraw from the array a minimum distance of 1,000 meters (approximately 1.1 miles) and initiate the quality assurance/quality control (QA/QC) tests and conduct the contact resistance check. Both tests will be initiated remotely by the Geophysics Field Manager. If any abnormally high contact resistance is measured, the personnel will return to the array and soak the earth surrounding the stakes with a salt/water solution to reduce the resistance. If determined that the site conditions (e.g., dry sand or dry silt within or near the surface) are continually producing high contact resistance, the electrode locations may be pre-watered with the salt/water solution and allowed to soak prior to conducting the tests.
6. Following completion of the QA/QC tests and a successful contact resistance check, the geophysics crew will withdraw to the minimum safe withdrawal distance. When the Geophysics Field Manager confirms that all personnel have withdrawn beyond the minimum safe withdrawal distance, the Geophysics Field Manager will remotely initiate the EI test. Personnel may continue working on constructing arrays along other transect(s) if the array is outside the minimum safe withdrawal distance. No personnel will be allowed to enter within the minimum safe withdrawal distance during the test. The Geophysics Field Manager will remotely monitor the test and determine when the test is complete.
7. After remote confirmation that the test for the array is complete, the EI survey data will be downloaded to a laptop computer following the collection of data at each array prior to breakdown of the EI equipment and checked for proper data transfer. If data download immediately following collection is impossible due field logistics, at a minimum the EI data file must be checked within the SuperSting® main unit memory.
8. Following the completion of the data collection and download, the array and all equipment will be moved to continue along the traverse and repeated until the entire transect is surveyed.

9. All of the traverse end locations along with every fourth electrode location will be surveyed using GPS to provide the location of prominent surface features as well as a reasonable and accurate base map of the geophysical survey traverse locations.
10. All electronic field data will be backed up at a minimum of once at the end of each field day.

APPENDIX C

SAIC INTERNAL GEOPHYSICS SOPs

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Geophysical Services
Harrisburg, Pennsylvania
(800) 944-6778
An Employee-Owned Company
www.quality-geophysics.com

Geophysical Procedure
GP-001

GEOPHYSICAL PROJECT MANAGEMENT

January 2000
(Revised August 28, 2003)

Reviewed by:

George R.A. Fields

George R.A. Fields, P.G.
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Senior Geophysicist/Geophysical Program Mgr.

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVES

1.1 Scope

This geophysical procedure provides instructions and establishes requirements for managing and implementing geophysical surveys. This procedure is applicable to all Science Applications International Corporation (SAIC) personnel involved in geophysical proposals and investigations.

Geophysical investigations are used to investigate a variety of problems. Geophysics represents a technical specialty requiring the integration of physics, geology, mathematics, hydrogeology, chemistry, engineering, computer science, electronics and common sense. In order to maintain technical consistency across a diverse organization, and assure data integrity and streamline communications, this geophysical procedure has been developed.

1.2 Objectives

The objective of this geophysical procedure is to provide uniform methods and instructions for preparing and reviewing geophysical work scopes (and budgets) selection of appropriate geophysical methods and techniques, management of digital data, and review and quality assurance/quality control of geophysical data and reports

2.0 DEFINITIONS

Anomaly - An anomaly is a deviation from uniformity in the physical property being measured or which is different in appearance from the survey in general, frequently caused by geological, hydrological, chemical or man-made feature.

3.0 RESPONSIBILITIES

Small geophysical projects may require a field crew of only one-person. In this instance, the field person shall be responsible for performing many of the activities described below under the supervision of a Geophysicist or Senior Geophysicist. For larger projects that encompass many geophysical personnel, or cover an extended period of time it is appropriate to identify and define the additional roles, responsibilities and qualifications of the geophysical manager and field geophysical supervisor.

3.1 Geophysical Manager

The SAIC Geophysical Manager, in concert with the SAIC Project or Program Manager shall be responsible for ensuring that proposed geophysical services, data collection, data processing, data interpretation and reporting are performed by personnel trained and indoctrinated in the content of this procedure and related procedures prior to performing the activity. The geophysical manager will ensure that data collection, processing and interpretation parameters and methods are appropriate to meet the survey objectives as communicated by the SAIC Project or Program Manager. The Geophysical manager shall be responsible for final geophysical data interpretation and geophysical reporting. Furthermore, the Geophysical Manager shall ensure that all geophysical survey activities are documented in accordance with SAIC requirements. The Geophysical Manager will commonly be a Senior Geophysicist on larger, multi-disciplined projects, but may be a Project Geophysicist on smaller, single task projects.

3.2 Field Geophysical Supervisor

For a multi-person survey crew, one of the SAIC geophysical personnel shall be designated as the field supervisor and shall be responsible for ensuring the completion of all applicable forms and for notifying the SAIC Project Manager or designee of site-specific activities, survey progress, problems, and results. The SAIC Field Supervisor shall be responsible for assuring quality geophysical data is collected. The SAIC Field Supervisor shall be a qualified Project Geophysicist, but may be a Staff Geophysicist for smaller, single task projects. The Field Geophysical Supervisor will be responsible for ensuring that geophysical field survey activities are performed in accordance with this geophysical procedure, and the appropriate geophysical method geophysical procedure and the project specific scope of work.

3.3 Geophysical Survey Crew

A geophysical survey field crew shall consist of appropriately trained and qualified personnel. The SAIC Geophysical survey crew shall be responsible for collecting quality geophysical data and documenting all activities in accordance with this geophysical procedure and the appropriate technique specific geophysical procedure.

4.0 QUALIFICATIONS

4.1 Senior Geophysicist

A person with 14 or more years of geophysical work at a level of responsibility that has permitted the development of a broad experience in data collection, data processing, data interpretation and reporting with a variety of instruments. Senior geophysicists will have a working knowledge of the theoretical and practical aspects of multiple geophysical techniques. A Senior Geophysicist will be responsible for all levels of a geophysical project including defining the technical approach to a project, budgeting, survey design, interpretation report review and client interaction.

4.2 Project Geophysicist

A person with 6 or more years of geophysical experience in data collection and processing with a variety of instruments and software packages, and has gained experience in data interpretation and reporting. A Project Geophysicist will have a working knowledge of the practical aspects of geophysical techniques and become aware of theoretical aspects of techniques applied. A Project Geophysicist will be responsible for geophysical data collection, processing and presentation. A Project Geophysicist may interpret and report data under the supervision of a Senior Geophysicist.

4.3 Staff Geophysicist

A person with 3 or more years of geophysical experience in data collection and processing with a variety of instruments and software packages, and is gaining experience in data interpretation and reporting. A person with a B.S. or M.S degree in geophysics, geology, or physics with adequate geophysical emphasis shall qualify. A Staff Geophysicist will become familiar with the practical aspects of geophysical techniques. A Staff Geophysicist will be responsible for geophysical data collection, data processing. A Staff Geophysicist may process, interpret and report data under the supervision of an experienced Project or Senior Geophysicist.

4.4 Geophysical Technician

A person who is trained and capable of collecting and/or processing geophysical data, using at least one geophysical instrument.

5.0 MATERIAL/EQUIPMENT AND CALIBRATION

5.1 Material and Equipment

Specific equipment used to conduct geophysical surveys is described in individual geophysical procedures. A copy of individual geophysical procedures applicable to the project must be available in the field when the geophysical survey occurs. Since geophysical data are digitally recorded, the following shall be available for data downloading, transfer and processing:

1. Field Computer
2. Diskettes
3. Field notebook as appropriate
4. Portable Printer as appropriate

5.2 Calibration Requirements

Most geophysical equipment requires periodic calibration. Calibration and use of the instruments shall be in accordance with the manufacturer's instructions. Calibration checks shall be performed on a periodic basis by the manufacturer, or by personnel certified by the manufacturer. Documentation of calibration forms are included within method specific geophysical procedures.

6.0 PROTOCOLS

6.1 Geophysical Work Scope Preparation

All offers to perform a geophysical survey will be in written form with a stated scope of work, survey objective, and level of reporting. A senior geophysicist will review all geophysical proposals. Proposal review will include the technical method, level of effort, staffing levels, equipment and caveats, related to the proposed scope of work.

1. The technical method shall be reviewed by a Senior Geophysicist to verify that the proposed method will meet the objectives identified by the Client as reiterated in the proposal. In the event the proposed method is technically incorrect, or may not meet the Client's objectives; the Senior Geophysicist will identify alternative methods, or ensure appropriate caveat language is present in the proposal.

2. The level of effort shall include an evaluation of the proposed data collection density and the amount of data processing necessary to meet the Client's objectives. This will include an evaluation of the assumptions regarding the rate of data collection.
3. Review of the staffing levels will assure that the appropriate level of technical expertise is planned for the project.
4. An evaluation of potential health and safety issues shall be addressed.
5. Determine equipment availability.

As a way to demonstrate review, a Senior Geophysicist should countersign all letter proposals for Commercial Client, or cover letters for Public Client.

6.2 Geophysical Data Collection

The Geophysical Field Supervisor shall assure that all field data is collected following the appropriate geophysical procedure. The Geophysical Manager shall be responsible to assure all data collection forms are complete and are placed into project files during the course of the fieldwork.

6.3 Digital Data Management

Most geophysical procedures note that geophysical data are digitally recorded and downloaded periodically to a field computer for review in the field. In addition to the copy of data placed on the field computer hard disk, a copy of the data shall be placed on floppy disk(s), zip disk(s) or compact disk (CD) for backup before erasing the data on the equipment.

As an additional means of assuring data availability, **all** data will be transferred to the SAIC geophysical data processing center in Harrisburg on a daily basis. This offsite storage of data will further reduce the likelihood of lost data. Transfer may be accomplished by eMail attachment, FTP or overnight delivery of floppy, zip or CD disks. If possible, field data collection forms and appropriate field logbooks should be faxed.

A Senior Geophysicist will review all geophysical field data to verify that the data represents information instead of instrument noise. This will serve to double-check the field data review for quality control and quality assurance.

All digital data stored at the geophysical data processing center in Harrisburg is backed-up daily and weekly. In order to organize geophysical data, it will be placed onto drive "H:". The storage location shall be organized as H:\Jobs\Client\Site\DataSet. All reports, memorandums, spreadsheets, budgets, etc., should be maintained under the Client\Site subdirectory.

6.4 Geophysical Daily Reporting

A Daily Geophysical Operations Log (Attachment A) shall be completed for each field day. This log will be used to recognize daily work progress and serve as a critical quality control document. The log will identify equipment usage to compare against rental invoices, and to note equipment problems. In the event of a problem with SAIC owned equipment, the Geophysical Manager is responsible for forwarding a copy of the log to the SAIC Equipment and Supply Manager so appropriate equipment repairs can be made. The log will identify as a problem any deviation from the previously established work plan.

6.5 Geophysical Data Reporting

A written report or technical memorandum describing the objectives of the survey shall accompany all geophysical data conveyed to a client, in addition to the geophysical method utilized, method of data collection and processing, interpretation and recommendations. The Geophysical Field Supervisor should review the report to ensure identified geophysical anomalies are not related to known surface or subsurface interference. Furthermore the review should include an evaluation of geology and base line shifts that may result in mis-interpretation. A Senior Geophysicist shall review all geophysical reports and technical memoranda. The review should include the following points:

1. Verify the proposed work was implemented,
2. Verify that the reported work is internally consistent,
3. Work activities are consistent with SAIC protocols,
4. Report is technically sound,
5. Report contains appropriate caveats,
6. Review closely the conclusions and recommendations for logic and technical soundness,
7. Check the consistency of table, appendix and figure numbers, font, and styles,
8. Spot check any manually constructed tables against the raw data,
9. Verify that the person who collected the data has looked at the figures and is comfortable that identified anomalies are real and not missed cultural features.

A senior geophysicist shall include an independent data review to assure no anomalous features were overlooked, and shall verify the interpreted anomalies. The Senior Geophysicist shall verify the following caveat language is included in the report:

Survey Limitations

This geophysical investigation was completed using standard and routinely accepted practices of the geophysical industry. This survey was conducted with routinely used or state-of-the-practice instrumentation operated by experienced geophysicists, the data were processed with commercial or proprietary software packages utilized on projects with similar objectives, and the results were interpreted by an experienced and as necessary licensed individual. It is necessary to recognize that site-specific conditions may obscure some features of interest. The approach utilized was designed to reduce the likelihood of unidentified features. SAIC does not accept responsibility for survey limitations or unforeseen site-specific conditions, or inherent limitations of the method. The user of the information should acknowledge that the geophysical techniques used evaluate the subsurface conditions near the measurement locations. Extrapolation of this information beyond the immediate area of the measurement may result in misleading or an incorrect estimation of subsurface conditions due to natural subsurface variations.

7.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

None are defined within this geophysical procedure. Method Specific quality assurance and quality control criteria are presented in the method specific geophysical procedures.

8.0 RECORDS

The following records generated as a result of implementation of this procedure shall be maintained in a safe manner and submitted to the project central files for storage:

1. Proposal for Geophysical Services,
2. Daily Geophysical Operations Log,
3. Digital Records of Geophysical Data,
4. Calibration Records,
5. Data Processing Records,
6. Geophysical Report.

9.0 REFERENCES

9.1 Requirements and Specifications

Projects undertaken for commercial clients, or those with no specific standards shall be undertaken following publicly available, peer-reviewed standards. At a minimum, the following apply:

American Society of Testing and Materials, 1999 *Standard Guide for Selecting Surface Geophysical Methods*, ASTM Designation D6429-99.

American Society of Testing and Materials, 1999 *Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation*, ASTM Designation D5777-95.

American Society of Testing and Materials, 1999 *Standard Guide for Using the Direct Current Resistivity Method for Subsurface Investigation*, ASTM Designation D6431-99.

American Society of Testing and Materials, 1999 *Standard Guide for Using the Gravity Method for Subsurface Investigation*, ASTM Designation D5753-95.

American Society of Testing and Materials, 1999 *Standard Guide for Using the Electromagnetic Frequency Domain Method for Subsurface Investigations*, ASTM Designation DRAFT.

American Society of Testing and Materials, 1995 *Standard Guide for Planning and Conducting Borehole Geophysical Logging*, ASTM Designation D5753-95.

American Society of Testing and Materials, 1999 *Standard Test Methods for Crosshole Seismic Testing*, ASTM Designation D4428-95.

American Society of Testing and Materials, 1995 *Standard Guide for Conducting Borehole Geophysical Logging - Gamma*, ASTM Designation D5753-95.

Geophysical services may be undertaken for Public agencies, which publish requirements and specifications. When projects are undertaken for these clients, their standards shall be incorporated into the appropriate scope of work whenever a deficiency is discovered. Among the standards available are:

US Army Corps of Engineers, 1995 *Geophysical Exploration for Engineering and Environmental Investigations*, EM 1110-1-1802

9.2 Related SAIC Geophysical Procedures

Topic	Comments
Electromagnetic Surveys	GP-002
Ground Penetrating Radar Surveys	GP-003
Surface Magnetic Survey	GP-004
Borehole Geophysical Survey	GP-005
Field Activities Documentation (FADL)	GP-006
Mapping with Global Positioning Systems	GP-007
Subsurface Feature Locating	GP-008
Seismic Refraction Surveys	GP-009
Seismic Reflection Surveys	GP-010
Surface Electrical Imaging Surveys	GP-011 or FTP-110

9.3 Others

None

10.0 ATTACHMENTS

Attachment A, Daily Geophysical Operations Log

DAILY GEOPHYSICAL OPERATIONS LOG

Date:			Weather:		
Team Leader:			Field Crew:		
Project Num:			Project Name:		
Site Location					
Survey Application:	o Engineering	o Utility Locating	o UXO	o Environmental	o Groundwater
	o Resource Evaluation		o Other		
Survey Type:	o EM31	o EM61	o EM34	o EM47	o SP
	o Utility	o Gravity	o Magnetometer	o Electrical Imaging	
	o Resistivity	o GPR Ant Freq:____ o Mono o Bi	o Borehole Camera o Color o B&W	o Borehole Geophysics Borehole Tools:	
	o Seismic Refraction	o Seismic Reflection	o Other		
Positioning Used:	o Tape	o Hip Chain	o DGPS	o Ultra	o Professional Surveyor

Daily Activity Summary:

Data Recorded:

Problems/Observations:

CC: Project file, Project Manager, E&S (if equipment problem identified)

Geophysical Services
Harrisburg, Pennsylvania
(800) 944-6778
An Employee-Owned Company
www.quality-geophysics.com

Geophysical Procedure
GP-006

FIELD ACTIVITIES DOCUMENTATION

April 1998
(Revised February 8, 2002)

Reviewed by:

George R.A. Fields, P.G.
Senior Geophysicist/Geophysical Unit Mgr.

Prepared by:

Richard A. Hoover, P.G.
Senior Geophysicist/Geophysical Program Mgr

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1. Scope

This geophysical procedure provides requirements for documents generated during field investigations on projects when traditional logbooks are not in use. This procedure also provides for fundamental field activity documentation. This procedure is applicable to all personnel involved in the documentation of geophysical field activities on behalf of Science Applications International Corporation (SAIC).

1.2. Objectives

The objective of this procedure is to establish a uniform method of documenting field activities so that the resultant documentation is sufficient to withstand scientific and legal scrutiny.

2.0 DEFINITIONS

None

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1. Geophysical Project and Site Managers

Project and site managers are responsible for the proper documentation of all field activities through the development and review of the site-specific documentation requirements, by training field and subcontractor personnel in the documentation requirements, by maintaining appropriate quality control (QC) of documentation, and through records maintenance. At a minimum, managers will:

1. Develop and review the project site-specific work plans, which address the specific documentation requirements for the project and project-specific documentation forms.

2. Verify that personnel have reviewed, and are familiar with, site-specific work plans, which address documentation requirements, this procedure, and any other associated procedures.

3. Provide training for personnel in the requirements and use of forms required for the tasks being performed.

4. Review field-generated documentation on a regular basis to verify compliance with project requirements and, if needed, implement corrective action.

3.2. Field Personnel

Field personnel are responsible for legible, complete, and proper documented field activities.

4.0 EQUIPMENT AND MATERIALS

Field personnel are responsible to ensure the appropriate forms and/or logbooks are available for use, a notebook when forms are used, and an indelible pen is present.

5.0 METHOD

Documentation shall contain sufficient detail to allow future reconstruction of the recorded event. Records outlined in this procedure include:

1. Pre-field activity documentation
2. Tailgate Safety Briefing Forms
3. Field Activity Daily Logs
4. Sample Collection Forms
5. Photographic Logs

Record entries shall be concise, legible, and made in dark, indelible ink. All forms must be completed in such a manner as to accurately and thoroughly document the activity. When using a preprinted form, each blank or space shall be completed. Mark "NA" or equivalent in the space if it is not applicable to the activity.

Any correction or deletions shall be accomplished by drawing a single line through the entry without the use of erasers or correction fluid. The correction shall then be initialed and dated by the person performing the activity.

5.1. Pre-field Activity Documentation

The documentation of pre-field activities shall be performed prior to initiation of a major phase of work to ensure that personnel are adequately equipped and knowledgeable in the activities to be performed. Pre-field activities shall be performed and documented according to SAIC Readiness Review Standards.

5.2. Field Activity Daily logs (FADL)

The FADL (Attachment A) shall be produced to provide a chronological recording of each day's on-site activities. Each FADL must be completed with sufficient detail to allow future reconstruction of the events covered. Any activities performed that are not accounted for in activity-specific forms must be described in detail in the FADL.

Sequentially numbered bound logbooks may be used in place of a FADL. The Quality Assurance Officer (QAO) must approve the specific use of a bound logbook, which does not have preprinted data entry requirements. Data acquisition forms presented in individual geophysical procedures may be incorporated into bound logbooks provided all information requested on the form is recorded in the logbook. All information required in the FADL must be included in a logbook, and pages shall not be removed for any reason.

All entries in the FADL or logbook shall be legible and concise. At a minimum, the following shall be recorded:

1. Project identification (name and number)
2. The dates of activities
3. General description of field activity
4. General work activities
5. Sufficient information to allow trace ability to associated forms or records (e.g., Sample Collection Logs, Telephone Conferences)
6. Changes to plans, specifications, and/or procedures
7. Problems encountered
8. Visitors on-site (include organization and purpose of visit)
9. Weather conditions
10. SAIC and subcontractor personnel on-site
11. Pertinent phone calls
12. Meetings
13. Detailed Operating Procedure Data Forms prepared in the field during the day.

If a portion of the page of a FADL or logbook is intentionally left blank, then the preparer shall place a notation such as "Intentionally Left Blank" or a line through the blank portion. Any knowledgeable personnel may complete the FADL or logbook on-site; however, the field supervisor or lead shall enter critical field documentation and sign the log. If the field preparer of the FADL or logbook changes during its completion, then a notation shall be made indicating said change. In the event of multiple shifts, one FADL shall be completed for each shift. All preparer(s) shall sign and date the FADL.

The FADL shall include sufficient information to allow trace ability to more detailed information such as may be found in associated forms or records.

Discrete work groups performing different activities at one project event may complete a separate FADL. The site supervisor may prepare a "master" FADL.

5.3. Tailgate Safety Briefing Forms

Prior to each workday or shift, a safety briefing shall be conducted and documented on a Tailgate Safety Briefing Form (Attachment B). A separate meeting shall be held when a change in location or activity creates a change in potential working hazards (new or different potential hazards to personnel that could result in the need for personnel protective equipment). As a minimum, the following information will be discussed and recorded on the Tailgate Safety Briefing Forms:

1. Project name and number
2. Date and time of the briefing

3. Job location
4. A description of the work to be performed
5. Chemical/radiation hazards
6. Personal protection equipment required
7. General site and activity hazards
8. Decontamination/special procedures
9. Emergency information
10. Signature of all attendees
11. Name of the individual conducting the orientation.

5.4. Equipment Calibration Forms

Any test or measuring equipment, such as field analytical or health and safety instruments requiring on-site calibrations, shall be documented. The documentation must be completed/updated for each calibration. At a minimum, the following information shall be recorded:

1. Make and model number of the instrument
2. Serial number of the instrument
3. Calibration standard solution preparation or manufacturer, including lot number and expiration date, if applicable
4. The date and time of calibration
5. All calibration measurements
6. Any problems encountered during calibration
7. The names and signature of the person conducting the calibration
8. The name and signature of the person reviewing the calibration documentation

5.5. Photographic Logs

Photographs taken to support project documentation shall be logged on a standard Photographic Log (Attachment C), or equivalent. Photographic records shall be compiled in accordance with appropriate operating procedures, photo documentation and photo monitoring, for each activity that is photographed.

5.6. Records Maintenance

Records maintained on-site shall be managed in accordance with the SAIC Quality Management Plan. As a minimum, this will include:

1. Field documents shall be maintained in a protected on-site file.

2. The originals of all field documents shall ultimately reside in the office Central Files. Transfer to Central Files shall be as appropriate for the project based upon the length of the project and risks to the records in the field.

3. A list of material safety data sheets (MSDSs) for products used on-site shall be provided to the Environmental Compliance Manager, who shall maintain the records.

5.7. Electronic Forms Usage

Electronically produced forms may be used for documentation of project activities. Electronic form files may be used to print a hard copy for manual completion or may be completed in electronic format for applications approved by the QAO. As with any project documentation, generators of electronic forms are responsible for all information included on the form.

Standard SAIC forms used in electronic format shall be equivalent in content and similar in design to the original form. New forms produced that are not standard SAIC forms shall include header information sufficient to identify the project and shall contain information sufficient to thoroughly document the activity. Header information shall include, but not be limited to, project name, project number, date, and a title describing the information the form shall contain.

Forms completed in electronic format shall be printed in hard copy for inclusion in project files. Original handwritten signatures and dates shall be included as required by this procedure. A form that is printed a second time for use as a copy shall also be signed with original signatures and shall clearly be marked as a "duplicate copy" or equivalent.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

None

7.0 RECORDS

All project records generated in the field by the performance of this geophysical procedure shall be temporarily filed in a designated folder and kept with the field team while in the field. The following records generated as a result of implementation of this procedure shall be maintained in a safe manner and submitted to Project Central Files for storage and disposition:

1. Field Activity Daily Logs
2. Tailgate Safety Briefings
3. Photographic Logs

8.0 REFERENCES

8.1. Requirements and Specifications

SAIC Quality Management Plan, Rev. 1
Related Procedures
SAIC Readiness Review

Equipment Specific Procedures as necessary

9.0 ATTACHMENTS

Attachment A, Field Activity Daily Log
Attachment B, Tailgate Safety Briefing
Attachment C, Photographic Log

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SUBJECT .... PROJECT NUMBER ....

BY ...... DATE .... CHECKED BY .... DATE .... SHEET NUMBER .... OF .....

TAILGATE SAFETY MEETING

Date________________________
Time________________________ Job No.
Job Location________________________
Type of Work________________________

CHEMICAL/RADIATION HAZARDS

Contaminant	Symptoms of Exposure	Exp. Limit
		O TLV O PEL
		O TLV O PEL
		O TLV O PEL
		O TLV O PEL
		O TLV O PEL
		O TLV O PEL

PERSONAL PROTECTIVE EQUIPMENT

Garment:

O Tyvek, White	O Chemrel	O Cotton	O Viton	O Teflon
O Tyvek, Poly	O Barricade	O Butyl	O Cloropel	O Other:_
O Saranex	O PVC	O Neoprene	O Nomex	O Other:_

Respirator:

O None	O Dust Mask	O HEPA	O Ammonia	O Other:________
O APR, Full Face	O Airline	O Organic	O Formaldehyde	O Other:________
O APR, Half Face	O SCBA	O Acid Gas	O Pre-filter	O Other:________

Gloves:

O None	O Latex	O Rubber	O Silver Shield	O Polyethylene
O Leather	O PVC	O Nitrile	O Neoprene	O Safety 4H
O Cotton	O PVA	O Viton	O Butyl	O Other:________

Eyes:

O Safety Glasses	O Welding Goggles	O Other:________
O Splash Goggles	O FF Respirator	O Other:________
O Gas-tight Goggles	O Splash Shield	O Other:________

....

O Hard Hat	O Hearing Protection	O Other:________
O PVC Boots	O Boot Covers	
O Leather Boots		

(All footwear and eyewear ANSI approved)

O Slip and Trip:	O Noise:
O Radiation:	O Heat:
O Fire:	O Cut:
O Vermin:	O Machinery:
O Other	

DECON/SPECIAL PROCEDURES

EMERGENCY INFORMATION

FOR INJURY CALL: ( ) ____________________

FOR FIRE CALL: ( ) ____________________

FOR SPILL CALL: ( ) ____________________

FOR EXPLOSION CALL: ( ) ____________________

DIRECTIONS TO HOSPITAL/CLINIC

ATTENDEES

Print Name	Signature

Meeting Conducted by: ____________________
Project Title: ____________________

REVIEWS

Supervisor: ____________________ Date: __________
Project Manager: ____________________ Date: __________

PHOTOGRAPHIC LOG

Page ___ of ___

PROJECT NAME________________________________ CAMERA MODEL________________

PROJECT NUMBER______________________________ SERIAL NUMBER________________

PHOTOGRAPHER________________________________ FILM FORMAT Slides 9 Prints 9
Size__________Speed__________

SITE____

COMMENTS ____

____

ROLL NUMBER________________________________

Frame[1]	Neg.[2]	Direction[3]	Date[4]	Time[5]	Description (Location, Features, Personnel)

[1] Frame is the exposure number displayed on the camera.
[2] Neg. is the number identification on the negative (as applicable).
[3] One of eight compass directions (e.g., northeast) should be used to describe the direction the camera is pointed. Alternatively on _______ or relative orientation to a known datum may be used.
[4] The date is expressed for month/day/year.
[5] Time is using the 24-hour clock.

Geophysical Services
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Geophysical Procedure
GP-007

FIELD MAPPING WITH GLOBAL POSITIONING SYSTEMS

March 1998
(Revised February 8, 2002)

Reviewed by:

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Senior Geophysicist/Geophysical Unit Mgr.

Prepared by:

Jeffrey J. Warren.
Project Geophysicist

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1.0 SCOPE AND OBJECTIVES

1.1 Scope

This geophysical procedure provides instructions for obtaining mapping coordinates using a global positioning system (GPS).

1.2 Objectives

The objective of this geophysical procedure is to standardize the process of obtaining and documenting GPS coordinates to provide a permanent and accurate record of survey area boundaries, cultural features of the site that might be of interest, geophysical data locations, and other significant points. The focus of this geophysical procedure is for the use of the Trimble Pro-XR/XRS GPS units.

2.0 DEFINITIONS

Coordinate - Any of a set of numbers used in specifying the location of a point on a line, on a surface, or in space.

Global Positioning System - A satellite-based navigation system that provides precise position, velocity, and time information. A typical GPS receiver (equipment) consists of an antenna, signal processing electronics, and processor. The primary function of the receiver is to acquire signals, recover orbital data, make range and Doppler measurements, and process this information to obtain the user position, velocity, and time.

Rover Unit - GPS unit utilized to collect mapping data. For the purpose of this geophysical procedure, the Rover Unit is the Trimble Pro-XR/XRS GPS unit.

Base Station - Stationary GPS unit set up on a known coordinate, which calculates an error factor due to Selective Availability and other factors.

Selective Availability - Errors in the data and satellite-clock dithering that are deliberately included by the U. S. Department of Defense for security purposes.

Differential Correction - Processing GPS rover data with base station data in order to remove errors in the rover data caused by Selective Availability and other factors.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 SAIC Project Manager

The SAIC Project Manager is responsible for ensuring that the SAIC GPS field representatives are trained and indoctrinated in the content of this procedure and related procedures prior to performing the activity. Furthermore, the SAIC project manager shall ensure that the work is implemented in a fashion that is consistent with geophysical procedures GP-001 *Geophysical Project Management*, and GP-006 *Field Activities Documentation.*

3.2 SAIC Field Supervisor

The SAIC Field Supervisor is responsible for ensuring the completion of all applicable forms and for notifying the SAIC Project Manager or designee of site-specific activities and GPS progress, problems, and results on a minimum of a daily basis.

3.3 SAIC Field Representative

The SAIC Field Representative is responsible for the following:

1. Ensuring that the GPS equipment is in working order prior to use in the field.

2. Performing a daily GPS equipment operational check against a known survey station (if applicable).

3. Collecting and documenting of GPS coordinate data in the field.

All SAIC field representatives must be trained in procedures relating to this project such as health and safety requirements for site entry and work, basic GPS operation and fundamentals, field form documentation, and related procedures for other on-site field activities prior to the performance of this activity.

4.0 MATERIAL/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material and Equipment

The following equipment must be brought to the work site for this activity:

1. Navigational compass.
2. Fine-tip waterproof marker or pen.
3. Wristwatch or appropriate timepiece.
4. Measuring tape (with markings in both meters and feet) and/or surveyor's wheel.
5. Personal protective equipment as specified in the Site-Specific Health and Safety Plan.
6. Site identification tags or markers, as needed.
7. GPS unit and associated equipment or attachments.

4.2 Calibration Required

The instrument manufacturer shall perform periodic calibration of the rover unit. Documentation of factory calibration dates and services performed shall be submitted to SAIC central files for archival purposes, with a copy kept in close proximity to the instrument. In addition, at least once each day, an on-site check of the GPS unit operational accuracy against a known survey point should be performed for GPS unit field use, where possible.

5.0 METHODS

It should be noted that the accuracy and precision of a portable GPS unit such as the Trimble Pro-XR/XRS might not be sufficient to acquire data, which will satisfy regulatory or engineering specifications for surveyed points. Therefore, a portable GPS unit such as a Trimble Pro-XR/XRS should be used only as a mapping or positioning tool rather than a survey tool.

5.1 Preparation

Prior to conducting the on-site activities, the following preparatory activities must be completed by an SAIC field representative:

1. Ascertain site restrictions (i.e. security clearance, health restrictions, and radiological categorization) and ensure compliance capabilities.
2. Prepare and review a list of sites scheduled to be mapped using the GPS.
3. Determine if real-time satellite subscription-based differential service, coast guard beacon, on-site base station, or other local base stations will be utilized. Verify the operation of these support features during the planned data collection times.
4. Plan GPS data acquisition around optimal satellite coverage. This can be done by using the "quickplan" utility in Pathfinder Office.
5. Selection of a coordinate system that is site-specific, and verify the survey will meet the client's needs.
6. Recharge the GPS battery pack using the battery charger when low battery message appears.
7. Gather and load all appropriate materials and equipment as previously described. Verify that the equipment is available, functioning properly and, if applicable, is in calibration.

5.2 Field Methodology

The SAIC Field Representative shall complete a Field Activity Daily Log (FADL) in accordance with *Geophysical Procedure GP-006 Field Activities Documentation*, for each day of field activities. The FADL chronicles activities from arrival through departure at the site and should be detailed to allow for reconstruction of the day's activities at a later date. The Field Representative shall also conduct a Tailgate Safety Briefing once per day when shifts change, when new personnel arrive on-site, or when conditions change.

The Field representative shall perform a minimal coordinate determination. If a survey has area dimensions of less than 3 meters by 3 meters, obtain at least 1 coordinate to identify the center of the site location. One coordinate is the minimum required for a site. If the area is greater than 9 square meters, measure the 4 corner points, as in a square or another reasonable method, to establish the site location. The actual number of coordinates positioned at any one site using the GPS should be based on GPS resolution, data requirements, and site-specific conditions.

If a mapping point or site marker cannot be located with the GPS due to obstructions, transmission disturbances, or both, the GPS field representative shall have the authority to reposition the marker or choose an alternative mapping point to obtain an accurate position reading. The offset and bearing shall be recorded relative to the indicated mapped location. The GPS field representative must note the reason for any relocation of the markers in the FADL.

Field personnel are to use their field observations and best judgment in any decision-making process such as site conditions or coordinate determination. If necessary, or if authorization is required, appropriate management personnel may be called upon to assist in any decision-making process during field activities.

If GPS is being used to provide position data to support geophysical data, the user shall confirm that the internal clocks on both instruments have been synchronized to the nearest second of the GPS time. Field personnel shall also wear the GPS antenna and battery pack in the same position for each survey session, so the geophysical equipment does not produce varying background results due to the metallic properties of the GPS unit. The GPS unit shall be donned when calibrating geophysical equipment thereby normalizing the magnetic response of the GPS. When GPS is positioned directly above the geophysical sensor, a minimum of three-feet shall be maintained between the GPS antenna and geophysical sensor to minimize interferences. The GPS cables should be fashioned in such a way to minimize direct contact with the measuring components of the geophysical sensor.

5.3 Operation of the GPS

It is the Field representatives' responsibility to operate the GPS with the antenna pointed straight up and make sure objects or people do not block it. If a fixed, permanent, survey station with known coordinates is available and accessible in the work site vicinity, perform a GPS unit operational accuracy check at least once per day. All operational checks shall be documented. Record the station name, the known coordinate data, the actual data points obtained during the operational check, and the operational check times on the Global Positioning System Operational Check Form (Attachment A).

At each desired mapping location, obtain site coordinate data using the GPS unit in accordance with the instructions provided in the operations manual. For the Trimble Pro-XR/XRS, press the "on" button. When the unit is ready, select "Data Collection" followed by "Create New Rover" file. Once survey parameters have been selected, the field representative may select an attribute type to survey. The minimum survey time will be dictated by survey objectives, the accuracy needed, and whether differential correction from a local base station, coast guard beacon, or satellite DGPS service will be utilized. Attachment B includes a summary of operational instructions specific to use of a GPS Base Station with the Trimble Pro-XR/XRS.

5.4 Data Collection

The SAIC field representative shall record the GPS data gathered during operation of geophysical equipment on the Field Data File Tracking Form as presented in the individual equipment geophysical procedures. All field documents shall be reviewed for errors and completeness prior to signing by the field representative. The signature is an affirmation of both the accuracy of the document to the representative's best knowledge and a verification of the representative's onsite presence.

Field information gathered with the GPS should be stored in the system's memory bank. The information can then be downloaded and processed at a later time. Selection of coordinate system is site-specific and shall be determined prior to any field activities.

5.5 Data Download and Differential Correction

GPS data shall be downloaded via computer using software compatible with the GPS unit being used and in accordance with the manufacturer's instructions. If a Trimble Pro-XR/XRS is being used, see Attachments C and D for data downloading instructions. Attachment E provides for documentation of GPS data processing.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

The ultimate precision and accuracy of GPS data is determined by the sum of several sources of error. The contribution of each source may vary, depending on ionospheric/atmospheric conditions, satellite visibility, satellite clocks, receivers, multipath reception, and selective availability produced by the U. S. Department of Defense (DOD). Some of these errors can be reduced with real-time U. S. Coast Guard beacon correction or utilizing a base station for differential correction during post-processing. The precision for uncorrected data can typically be up to $\pm$15 meters (49.2 feet) with selective availability off and up to $\pm$40 meters (131.2 feet) with selective availability on. The accuracy of the GPS operation procedure is also a function of the field personnel's attention to unit operation and use. Consult the owner's manual (Trimble, 1997) for additional information specific to the Trimble Pro-XR/XRS GPS unit.

7.0 RECORDS

All project records generated in the field by the performance of this geophysical procedure shall be temporarily filed in a designated folder and kept with the field team while in the field. SAIC field crews shall maintain the following records for each field visit

1. Global Positioning System Operational Check Form,
2. Global Positioning System Data Processing Form.

These forms shall be submitted to central files upon completion of work.

8.0 REFERENCES

TSCI Asset Surveyor User Manual, 1997. Trimble Navigation Limited, Sunnyvale, California.

Trimble Pro-XR/XRS Receiver Manual, 1997. Trimble Navigation Limited, Sunnyvale, California.

Pathfinder Office, Software User Guide, 1996. Trimble Navigation Limited, Sunnyvale, California.

9.0 ATTACHMENTS

Attachment B, Global Positioning System Operational Check Form
Attachment A, Summary Instructions for Obtaining Coordinates with the Pro-XR/XRS GPS Unit.
Attachment C, Downloading a Trimble Pro-XR/XRS GPS Unit
Attachment D, Differential Correction
Attachment E, Global Positioning System Data Processing Form

ATTACHMENT A
GLOBAL POSITIONING SYSTEM OPERATIONAL CHECK FORM

SAIC Project Name______________________ SAIC Project Number______________
Site Name______________________ Date:________________
GPS Field Crew:____

OPERATIONAL CHECK:

Survey File Name:______________ Geophysical Data Set (if applicable)____________
Weather Conditions:____
GPS Unit Model No.:____________ GPS Datum (Circle one): NAD 27 NAD 83
Data Collected (UTM, lat/long, other__________):________________________
Start Time: ______________ End Time:________________
Number of Points Averaged:____________ Sigma (ft):________________
Comments (location of car and other structures):____________________
____
____
____

OPERATIONAL CHECK:

Survey File Name:______________ Geophysical Data Set (if applicable)____________
Weather Conditions:____
GPS Unit Model No.:____________ GPS Datum (Circle one): NAD 27 NAD 83
Data Collected (UTM, lat/long, other__________):________________________
Start Time: ______________ End Time:________________
Number of Points Averaged:____________ Sigma (ft):________________
Comments (location of car and other structures):____________________
____
____

Field Crew Signature:________________ Organization:________________
Date:______________________________

Note: The acronym NA shall appear on any line where the information required does not apply.
The acronym NF shall appear on any line where the information is not available or obtainable.
amsl: above mean sea level; lat/long = latitude/longitude; NE = northing/easting; UTM = Universal Transverse Mercator

ATTACHMENT B

SUMMARY INSTRUCTIONS FOR OBTAINING COORDINATES WITH THE TRIMBLE PRO-XR/XRS GPS UNIT

1.0 Equipment Hookup

Connect all cords before turning on the GPS unit or the Omnistar™.

1. Connect the 9-pin data/power cable (the elongated rectangular connector with adaptor) to the outlet on the Trimble Pro-XR/XRS receiver marked Port B. The 9-pin connector should be connected to the 9-pin inlet at the TDC2 data cable. Attach the other end of this cord to the power jack on the TDC2 data logger.

2. Hook up the Pro-XR/XRS antenna using the long black cord with round connectors at both ends. One end goes in the bottom of the Pro-XR/XRS antenna; the other end plugs into the outlet on the Pro-XR/XRS receiver marked ANT. The Pro-XR/XRS antenna must be mounted upright at least three to four inches above the user's head to receive a consistent signal. The dome at the top should have an unobstructed view of the sky.

3. Hook the black-colored dual battery cable to two fully charged camcorder batteries.

2.0 Preparing the Pro-XR/XRS GPS Unit

1. Once the GPS antenna is in a good position to receive the satellite readings, the GPS unit should be turned on.

2. After going through its normal cycle of acquiring satellite signals, it will give data transmission if working. If transmission is not working, the GPS unit will send one or more of the following messages:

   a. Too few SVs.
   b. Check antenna cable.

   Sometimes, the Pro-XR/XRS unit requires a couple minutes to receive a signal. These messages should go away as soon as the receiver begins working. If the message persists, the cord connections or antenna positions may need to be checked.

3. As the GPS acquires satellite data, the following screen shows the SV ratio for the number of usable satellite versus the number of visible satellites, individual

satellite codes, and the strength of the number of visible satellites. The PDOP value represents the configuration of satellites in the sky with respect to the rover's position, followed by either "R" or "#" whereby "R" indicates RTCM link to Coast Guard beacon signal for real time correction or "#" which indicates no correction signal (base station required for differential correction).

A minimum of 4 satellites (SV=4) and PDOP <4 is needed to acquire the most accurate data. As you increase the SV value and decrease the PDOP value, the accuracy of your data improves.

4. Verify that the logging interface is configured to the most appropriate time interval. This is set under Configuration/GPS Rover/Logging Options. Typical surveys require 1-second update intervals.

5. Verify that the project specific coordinate system is selected in the TSCI handset. Coordinate system information can be accessed through the Configuration menu under the Coordinate System sub folders.

3.0 Taking/Recording Corrected Position Readings

1. Turn on handset by pressing ON/OFF button in the upper right corner of the keypad.

2. Scroll with the arrow button on the GPS unit handset until the DATA COLLECTION is highlighted and press ENTER.

3. The top of the next screen should read at the top:

   CREATE NEW ROVER FILE

   Highlight and press ENTER. At this point, the Pro-XR/XRS will automatically assign a file name with starts with "R" for rover file followed by two digits representing the month; two digits representing the day; and two digits representing the current hour, based on a 24-hour clock, followed by a consecutive letter starting with "A" and increasing by one if more than one file is collected in a given hour.

   Select "Generic" for data dictionary (sufficient for most applications). Select "On" for carrier mode if real time DGPS will be utilized for selective availability correction or "Off" if a correcting base station will be utilized during post-processing.

4. Pressing OK will create the new data file. The asset surveyor will automatically open this data file for logging.

5. At this point, the select feature menu will appear. Select the type of feature to be surveyed (e.g., point, line, or area) by highlighting and pressing OK. Press OK to confirm the height of antenna dome versus the ground surface.

   The Pro-XR/XRS will begin collecting GPS data. Once you have finished surveying the feature, press OK. This will return you to the Select feature menu, and you may select another feature to survey.

   To exit the DATA CAPTURE, press the ESC key in the upper left corner of the keypad. Confirm exit DATA CAPTURE by pressing Y for yes or N for no. To turn off the Pro-XR/XRS, press the FUNC key followed by the ON/OFF key.

ATTACHMENT C
DOWNLOADING A TRIMBLE PRO-XR/XRS GPS

Before starting the process of downloading, you must have the following equipment on hand:

1. A Trimble Pro-XR/XRS GPS unit.
2. A personal computer (PC) with the Pathfinder office software preloaded on it.
3. The GPS unit-to-PC download cable (DE9 connector to 9-pin).
4. Trimble Pathfinder office donigal key if necessary.

Procedures:

1. Connect data logger to PC.
2. On the handset, select File Transfer from the main menu. The Asset Surveyor software is ready to transfer data files.
3. Select Utilities/Transfer from the Pathfinder office menu bar. A list of data files will appear in the Available Files dialog. Select one or more files to be transferred by highlighting the files in the Available Files field and pressing Add.
4. Press Transfer. All the files in the Selected Files field will be transferred.

ATTACHMENT D
DIFFERENTIAL CORRECTION

The Differential Correction Utility enables you to remove errors in GPS data caused by selective availability and other factors. It improves the accuracy of GPS positions from approximately 100 meters to between sub meter and five meters, depending on the receiver, data collection technique, and location of base station with respect to the rover.

GPS base station may be downloaded via several GPS Community Base Stations via the Internet. The sites can be found by performing a net search for "GPS Base Station."

All base fields must be in the same format. The Trimble SSF and DAT formats and the RINEX format are supported.

To achieve maximum accuracy, the base station must be within 500 kilometers (300 miles) of the survey site and relatively at the same elevation. It is also important to choose a base station that has a similar logging interval as the rover. Trimble recommends a logging interval that does not exceed 30 seconds.

1. Using the Differential Correction Utility:

   a. Enter the Pathfinder Office program.
   b. Select Utilities/Differential Correction from the pop-up menu. The main Differential Correction window will appear.
   c. By default, the last used set of files is selected as rover files. They appear in the Selected Files list box. To change the list of selected input files:

      1) Press Browse in the rover files area. The Select Rover File dialog appears.
      2) Replace or modify the list of input files and press OK.

   d. To select base files:

      1) Press Browse in the Base Files area. The selected Base Files dialog appears.
      2) Select the appropriate base files and press OK.

   e. To automatically select base files:

      1) Press Auto Select. The Auto Select Base File dialog appears.

2) Select Full Search to search all base files in a given directory, or select Quick Search to search base files for a specified range of base file names.

When the search is complete, the Confirm Selected Base Files dialog appears. The Rover file lists the rover file(s) that were selected. The Selected Base files box lists the base file(s) that were found.

The Coverage column (under Rover Files) displays Full, Partial, or None. This indicates how much of each rover file is covered by the selected base file(s).

f. Once you are satisfied with base station coverage, press OK in the Selected Base Files dialog. Next, the Reference position dialog box appears.

g. Confirm that the reference position is correct for the base station used and press OK. This will start Differential Correction.

The time required for correcting the file varies depending on the size of the rover files, the number of base files used, and the speed of your computer. If differential correction is successful, the Differential Correction Completed dialog box will appear and provide a log on the positions corrected.

ATTACHMENT E
GLOBAL POSITIONING SYSTEM DATA PROCESSING FORM

SAIC Project Name____________________ SAIC Project Number____________

Site Name____________________ Date:____________

GPS Field Crew:____

GPS Rover Name (SSF):____

Geophysical Data Type (if applicable):__________ Time Interval:__________

Corresponding Geophysical Data Files: __________ __________

__________ __________ __________

GPS Time Line: Date: __________ __________ __________

Time Span:__________ __________ __________

Correction for Selective Availability Coast Guard Beacon ? Base Station ? Satellite DGPS ?

GPS Base Station (if used): Location:____________________

Internet Address (if applicable): ____________________

Base Files Utilized for Differential Correction:

__________ __________ __________ __________

__________ __________ __________ __________

__________ __________ __________ __________

__________ __________ __________ __________

Differentially Corrected GPS File Name (.COR):____________________

Export File Format (e.g., AutoCAD, ASCII):____________________

Export File Names (may be text supported): __________ __________ __________

Comments:____

____

____

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Geophysical Procedure
GP011

SURFACE ELECTRICAL IMAGING SURVEY

June 1998
(Revised April 2002)

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TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVES

1.1 Scope

This Geophysical Procedure (GP) provides instructions and establishes requirements for conducting surface Electrical Imaging (EI) surveys. This procedure is applicable to all Science Applications International Corporation (SAIC) personnel involved in surface EI surveys.

1.2 Objectives

The objective of this GP is to provide uniform methods and instructions for conducting surface EI surveys including:

1. Site preparation.
2. Survey field procedures.
3. EI data processing.

2.0 DEFINITIONS

Anomaly - An anomaly is a feature distinguished by geophysical means that is different from the general surroundings (i.e., departure from the expected or normal).

Electrical Interference- electrical input measured during the resistivity data collection from sources other than those transmitted by the resistivity system.

EI Operator – An individual or geophysicist who operates the EI surveying instruments and records the results in the field.

3.0 RESPONSIBILITIES

3.1 SAIC Project Manager

The SAIC Project Manager is responsible for ensuring the EI survey crew is trained and indoctrinated in the content of this procedure and related procedures prior to performing the activity and that surface EI survey activities are documented in accordance with this geophysical procedure.

3.2 SAIC Geophysics Manager

The SAIC Geophysical Manager shall be responsible for ensuring that the EI survey is properly designed and implemented according to the objective of the investigation. The manager is also responsible for reviewing all of the survey data, data processing, reporting activities, and verifying that the data effectively achieves the objective of the investigation. The Geophysical Manager shall be responsible for the interpretation and geophysical reporting.

3.3 SAIC Field Supervisor

One of the SAIC surface EI survey field crew members shall be designated as the field supervisor and shall be responsible for ensuring the completion of all applicable forms and for notifying the SAIC Project Manager or designee of site-specific activities, survey progress, problems, and results. The SAIC field supervisor shall be a geophysicist responsible for ensuring that surface EI survey activities are performed in accordance with this geophysical procedure.

3.4 SAIC EI Survey Field Personnel

Each surface EI survey field team shall consist of appropriately trained and qualified personnel, as determined by the SAIC Project Manager. The SAIC field team shall be responsible for ensuring that surface EI survey activities are performed and documented in accordance with this geophysical procedure.

4.0 MATERIAL/EQUIPMENT AND CALIBRATION

4.1 Material and Equipment

Specific equipment used to conduct surface EI surveys may consist of one or more of the items shown in Table 1 below.

Table 1. Surface EI Survey Specific Equipment
AGI SuperSting® resistivity system main unit
AGI SuperSting® multi-electrode cables
AGI SuperSting® test box kit and supplies
Stainless steel electrodes (84)
Two 12-volt marine batteries

Note: The AGI SuperSting® may in some instance be substituted with an AGI R1 unit. The equipment is similar except that the switch box is external and separate from the main unit. Geophysical procedures will be modified based on the usage of the R1 unit if applicable.

The following is a list of additional equipment necessary to complete a surface EI survey:

1. Two heavy hammers
2. Salt (sodium chloride)
3. Water
4. Water jugs
5. Extra rubber bands
6. ~~Laptop computer and diskettes~~
7. Metric measuring tape(s)
8. Pin flags or wooden stakes/lath

9. Marking paint
10. Flagging
11. Caution tape
12. Electrical and rubber splicing tape
13. Field Logbook
14. Battery charger
15. Global Positioning System (GPS) (optional)

4.2 Calibration Requirements

Calibration and use of the instruments shall be in accordance with the manufacturer's instructions. Calibration checks shall be performed daily to verify the equipment is functioning properly.

5.0 METHODS

Surface EI surveys are conducted to aid in the characterization of the subsurface by locating buried features (e.g., buried structures, fractures, voids, waste pit/ trenches, bedrock/soil stratigraphy, plume delineation, top of bedrock). Instrument output of apparent ground resistivity is recorded electronically using a data logger built into the SuperSting® resistivity system main unit.

The SuperSting®, a multi-electrode switching system, passes an electrical current automatically along multiple paths at various depths and measures the resulting associated voltages. This system utilizes two arrays of multicore cables, which extend outward in opposite directions from the centrally located main unit, which contains a switching system and resistivity meter with data storage capability. Apparent resistivity measurements are automatically recorded from all possible combinations between electrode pairs. As the spacing increase, the resistivity meter measures at greater depths and increasing volumes of ground. At the completion of data collection the EI system automatically shuts the power supply off.

When performing an EI survey, SAIC typically collects the data with a dipole-dipole electrode arrangement. Other electrode configurations (such as the Schlumberger, Wenner, pole-dipole, or pole-pole) may also be appropriate to match site conditions and survey objectives. Generally, with the dipole-dipole survey method, two electrodes are used to provide current to the subsurface in one location, while two other electrodes some distance away are used to measure the voltage. The SuperSting® system is capable of being programmed to collect over six different types of arrays. For the dipole-dipole array, the SuperSting® system utilizes two electrodes to provide current to the subsurface and uses up to six additional electrodes to simultaneously measure voltage. This allows the SuperSting® to record data faster than conventional resistivity systems.

5.1 Surface EI Survey Preparation

Prior to performing surface EI surveys, the following activities should be performed:

1. Existing site information shall be reviewed such as ground surface cover (grass or asphalt) and topography changes.
2. The potential influence of cultural features (e.g., manhole covers, utilities, fences, buildings, well casings, grounding wires, and power lines) shall be evaluated.
3. Health and safety hazards shall be defined and documented within the Field Logbook.

5.2 Site Preparation

Prior to conducting a surface EI survey, the survey traverse will be established. The traverse must be as straight as possible for the entire length of the EI traverse. The traverse should not be set up running parallel to subsurface utilities or other subsurface conductors. If a subsurface conductor is present parallel to the survey traverse, the EI traverse should be moved as far away from the conductor as possible. If a subsurface utility or conductor transects the EI traverse the location of that conductor will be noted in the field notes or on the SuperSting® Field Data Sheets.

The survey traverse end location, and individual electrode locations shall be marked with pin flags or wooden stakes/lath to provide spatial control for the EI survey team. Ideally, the traverse shall be accessible by vehicle, however field personnel should be able to transport equipment for short distances across open terrain. If necessary, the proposed traverse should have passages cut through bramble patches, thickets, or other obstructions so the placement of the electrodes can proceed.

5.3 Surface EI Survey Field Procedures

A standard procedure for conducting EI surveys is provided below. The EI Field Supervisor shall conduct a visual survey along the proposed lines. The visual survey shall accomplish the following tasks:

1. Review site utility plans and complete site walkover to check for underground utilities.
2. Check for overhead features, grounded power lines, and other sources of potential electrical interference.
3. Check for manhole covers and steel-cased wells.

The location of any structure that may affect the EI survey data (i.e., subsurface utilities, ephemeral streams, changes in soil and vegetation, etc.) shall be located on a site map and the location described on the Field Logbook or on the SuperSting® Field Data Sheet.

Prior to data collection the EI operator, with advisement from the EI Field Supervisor and Geophysics Manager, chooses the array type, the appropriate number of current pairs (in electrode spacing measurements) to be used for energizing, and the maximum separation (in electrode spacing measurements) to be used for measuring the potentials. These parameters determine the total number of measurements to be collected along the electrode spread, the spatial distribution of the measurements, and the total depth of investigation. Once these parameters are determined, the EI operator can create the appropriate command file that operates the SuperSting® resistivity system. This command file is created within the AGI SuperSting® Administrator Software (SSADMIN©) and uploaded to the SuperSting® main unit. (Note: The command files can be stored within the SuperSting® main unit memory and may not need to be uploaded for every field effort.)

To set up the resistivity system, a series of stainless steel stakes (typically 56) are driven six to twelve inches into the ground at a fixed interval to establish earth contact. The SuperSting® cables and electrodes were attached to the stakes using a rubber band to complete the electrical circuits between the SuperSting® and the ground surface. These electrodes must be flush on the stake platform, clean, and dry.

Once the cable setup is complete, the EI Operator shall check the SuperSting® for adequate function (calibration). This is completed by attaching the test box to the SuperSting® (while the cables are not connected), using a small current input, and completing a test box survey. This survey is a ten-minute test that checks the measurement components of the SuperSting® main unit. This test is recorded digitally within the main unit and is identified with a file name denoted as "test__" with "___" being the site survey identifier. The test file will be downloaded to a field PC at the end of the field day.

The EI Operator shall then check the SuperSting® for sufficient charge and complete a contact resistance check using adequate current input. A contact resistance check is completed along the electrodes to ensure adequate contact with the ground surface (typically a contact resistance of less than 2,000 ohms with the earth is recommended). In the event an abnormally high contact resistance is measured, the earth is soaked with a salt/water solution to reduce the resistance. When elevated contact resistances are encountered at a site (i.e., dry sand within the near surface), pre-watering the electrode locations and allowing time for the solution to soak into the ground is recommended.

Whenever possible electrode locations should be pre-watered. The contact resistance data are recorded on the SuperSting® Field Data Sheet and also within the main unit memory. These data are downloaded from the main unit memory during each download event.

The SuperSting® cables are tested prior to mobilization to the survey site and should not need to be re-tested during the field effort unless a problem is detected.

The EI Operator shall record the survey parameters on the SuperSting® Field Data Sheet (Attachment A). The SuperSting® Field Data Sheets will document the survey start and end times, the initial battery charge, contact resistance information, starting and ending electrodes, data file name, array type, and command file name. The SuperSting® Field Data Sheet is also used to document surface conditions and changes, utilities, or cultural features along the EI traverse. The starting and ending survey times are also recorded within the Field Logbook. Surface EI measured data, station numbers, and time of acquisition and various quality control values are stored within the SuperSting® main unit. Weather conditions should be noted on either the field data sheet or the Field Logbook.

Subsequent to recording the survey data, an adequate number of markers shall be left in the ground, at an appropriate spacing, for land surveying of horizontal and vertical positions.

Surface EI survey data shall be downloaded to a laptop computer after each traverse of data is collected prior to the breakdown of the EI equipment. Checks to ensure correct data transfer shall be performed. Field team comments and file names assigned to the data files during downloading shall be recorded on the SuperSting® Field Data Sheet. At the end of the field day (or more often) survey data shall be backed up onto diskettes and also sent to the SAIC Geophysics computer network for further processing and archival purposes. Following download, the SAIC Field Supervisor should perform a preliminary inversion of the data to ensure the collected data is reasonable. At a minimum, this preliminary inversion should be performed daily. (Note, if download following the completion of the EI traverse is impossible due to field logistics, at a minimum the EI data file must be checked within the SuperSting® main unit memory).

5.4 Data Processing and Interpretation

Surface EI survey field data shall be tracked by recording the dates of acquisition, site-specific field data file names, and corresponding fil~names on the SuperSting® Field Data Sheet (Attachment A) and the Geophysical Daily Lc (Attachment B). Corresponding GPS data file names are also recorded on the Geophysical Daily Log or in the field log book.

Before processing, all EI field survey files shall be reviewed by the SAIC Field Supervisor to ensure data quality. Data quality parameters include reasonable root-mean-squared (RMS) errors from redundant field measurements, spatial distribution of field measurements, and minimal variation between adjacent measurement locations. EI data file names, line and station numbers, field errors, corrections made to files, and corrected file names shall be documented on EI Data Processing Form (Attachment C).

Interpretation of the raw imaging (apparent resistivity) data without reduction would provide a product very similar to electromagnetic (EM) methods (i.e., the interpretation would only be qualitative). Inversion of the data to true resistivities provides a more unique or quantitative interpretation of the data. SAIC will use the resistivity inversion program RES2DINV© to produce a two-dimensional resistivity model based on the apparent resistivity data. Using a three-step process, this program begins with the observed apparent resistivity. The apparent resistivities are calculated using finite-difference forward modeling. A resistivity pseudosection is developed with a non-linear least-squares optimization technique (deGroot-Hedlin and Constable, 1990, Loke and Barker, 1996) that is the best fit to the resistivity pseudosection. The data are then contoured using the mapping software SURFER© and record on the SURFER Data Processing Form (Attachment D).

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

The EI data shall be checked for quality assurance purposes and will be preliminarily processed during the field effort. The locations of all significant preliminary anomalies identified on the color cross-sections shall be checked against the SuperSting® Field Data Sheet information (for example, the identified field locations of cultural fill, underground utilities, or other surface features). By comparing the SuperSting® Field Data Sheet information and the preliminary inversion, any indications of surface features that could contribute to the anomaly may be identified.

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be maintained in a safe manner and submitted to the project central files for storage:

1. SuperSting® Field Data Sheet
2. Daily Geophysical Operations Log
3. Site Maps
4. EI Data Processing Form
5. SURFER Data Processing Form

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Environmental Protection Agency, 1987. *A Compendium of Superfund Field Operations Methods*. EPA/540/P-87/001.

U.S. Environmental Protection Agency, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. EPA, Interim Final.

U.S. Environmental Protection Agency, 1989. *RCRA Facility Investigation Guidance*, EPA, Interim Final.

8.2 Related Procedures

GP001 Geophysical Project Management
GP004 Field Activities Documentation Procedures

8.3 Others

Manufacturer's Manual for AGI SuperSting® EI System
Users Manual for RES2DINV© inversion software

9.0 ATTACHMENTS

Attachment A SuperSting® Field Data Sheet
Attachment B Daily Geophysical Operations Log
Attachment C EI Data Processing Form
Attachment D SURFER Data Processing Form

Attachment A

SUPERSTING® FIELD DATA SHEET

Survey Date: __________ By: ____________________________________ Line # ______

Electrodes ____ to ____ Bearing: _________ Data File Name: ______________

Command File Name: Survey Site Name: Project Number:

Cont.Res.	Electrode	Electrode	Elevation	
1 ——	1			Battery = ______v
2	2			Start Adr = ______
3	3			End Adr = ______
4	4			Command Line Start:____
5	5			Elect. Sep = _____m
6	6			Max Dipole (a)= ____
7	7			Nxt Dipole = 1
8	8			Max Sep (n)= _____
9	9			Next Sep = 1
10	10			Direction = Forward
11	11			Next B-Loc = 0.000
12	12			Start Survey Time:______
13	13			End Survey Time:______
14	14			Quality Checked?______

Cont.Res.	Electrode	Cont.Res.	Electrode
15	15	36	36
16	16	37	37
17	17	38	38
18	18	39	39
19	19	40	40
20	20	41	41
21	21	42	42
22	22	43	43
23	23	44	44
24	24	45	45
25	25	46	46
26	26	47	47
27	27	48	48
28	28	49	49
29	29	50	50
30	30	51	51
31	31	52	52
32	32	53	53
33	33	54	54
34	34	55	55
35	35	56	56

Attachment B

DAILY GEOPHYSICAL OPERATIONS LOG

Date:			Weather:		
Team Leader:			Field Crew:		
Project Number:			Project Name:		
Site Location:					
Survey Application:	o Engineering	o Utility Locating	o UXO	o Environmental	o Groundwater
	o Resource Evaluation		o Other		
Survey Type:	o EM31	o EM61	o EM34	o EM47	o SP
	o Utility	o Gravity	o Magnetometer	o Electrical Imaging	
	o Resistivity	o GPR Antenna Frequency:_____ o Mono o Bi	o Borehole Camera o Color o B&W	o Borehole Geophysics Borehole Tools:	
	o Seismic Refraction	o Seismic Reflection	o Other		
Positioning Used:	o Tape	o Hip Chain	o GPS	o Ultra	o Professional Surveyor

Daily Activity Summary:

Data Recorded:

Problems/Observations:

Attachment C

EI DATA PROCESSING FORM

Traverse: ________________
Project Name: __________________ Project Number: ________________ Sheet ___ of ___
Site Name: __________________ Processed by: __________________ Date: _______

File Conversion (SSADMIN)

Input File Name (.stg): ____________________ *Output File Name (.dat):* ________________

Output File Type: 2D Dipole-Dipole Other: ______ *Format:* 2DINV Other:

Keep Negative Values? Y N *Remove Errors >* ____ X 1/10% *Output Records:* _____

ELEVATIONS

Added? Y N *File Name with Elevations (.dat)* ________________

RES2DINV

Editing Data

Pseudo Section Reversed? Y N
Points Exterminated:____
____
____ *Output file name(.dat):* _______

Topography None Least Squares Straight Line
Average Elevation End to End Straight Line

Settings

Initial Damping Factor: 0.15 Minimum Damping Factor: 0.03
Line Search: Always Percentage Change For Line Search: 0.04%
Convergence Limit: 5.00% Number of Iterations: 5
Finite Mesh Grid Size: 4 Model Resistivity Values Check: Yes
Contour Intervals: Logarithmic Increase Damping with Depth: 1.20
Vertical/Horizontal Flatness Filter Ratio: 1.00
Thickness of Model Layers Increase: 10%
Include Smoothing of Model Resistivity: No

Inversion

Method: Least Squares Inversion
Finite -Difference -Element

Jacobian Matrix Chosen:
a) Quasi-Newton Approx. for all iterations
b) Recalculate Jacobian for ALL iterations
c) Recalculate Jacobian for 2 iterations

Iteration	RMS Error
1	
2	
3	
4	
5	

Output Data: Inversion File (.inv):
XYZ File (.xyz): ____________________
Edited XYZ file for Surfer (.dat): ________________

Attachment D

SURFER DATA PROCESSING FORM

(Page 1 of 1)

Traverse: ______________________
Project Name: __________________ Project Number: __________ Sheet ___ of ___
Site Name: ____________________ Processed by: ________________________
Data Type: ____________________ Date: _____________

				Comments:
INPUT FILE:	.dat	File name:		
Z data Column	-----	Column:		
DATA SUMMARY	Min.	Max.		
X:				
Y:				
Z:				
GRIDDING	-----	Grid Method:		
	-----	X Spacing:		
	-----	Y Spacing:		
	.grd	Output File name:		
BLANKING	.bln	File name:		
Blanked Grid File	.grd	File name:		
BASEMAP FILE		File name:		
POSTED DATA FILE:	.dat	File name:		
COLOR LEVEL FILE:	.lvl	File name:		
MAP SCALE	1.0"=	Length=		
X:		inches	-----	
Y:		inches	-----	
MAP LIMITS	Min:	Max		
X:			-----	
Y:			-----	
CONTOURED FILE:	.srf	File name:		

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HEALTH AND SAFETY PLAN ADDENDUM 3

Depleted Uranium Impact Area Site Characterization: Other Monitoring Equipment Installation, Other Monitoring (Precipitation, Cave, and Stream/Spring Gauges) and Electrical Imaging Survey Jefferson Proving Ground, Madison, Indiana

Final

Prepared for:

U.S. Department of Army
Installation Support Management Activity
5183 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5424

and

U.S. Army Corps of Engineers
Louisville District
600 Dr. Martin Luther King, Jr. Place
Louisville, Kentucky 40202-2230

Submitted by:

From Science to Solutions

Science Applications International Corporation
11251 Roger Bacon Drive
Reston, Virginia 20190

Contract No. W912QR-04-D-0019
Delivery Order No. 0012

July 2006

HEALTH AND SAFETY PLAN ADDENDUM 3

Depleted Uranium Impact Area
Site Characterization:
Other Monitoring Equipment Installation, Other Monitoring (Precipitation, Cave, and Stream/Spring Gauges) and Electrical Imaging Survey
Jefferson Proving Ground, Madison, Indiana

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July 2006

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HEALTH AND SAFETY PLAN ADDENDUM 3
Depleted Uranium Impact Area Site Characterization: Other Monitoring Equipment Installation, Other Monitoring (Precipitation, Cave, and Stream/Spring Gauges) and Electrical Imaging Survey
Jefferson Proving Ground, Madison, Indiana

Contract No. W912QR 04 D 0019
Delivery Order No. 0012

Nuclear Regulatory Commission License SUB-1435

July 2006

Final

Joseph N. Skibinski Project Manager	(703) 810-8994 Telephone	7/7/06 Date
Joseph E. Peters Quality Assurance Officer	(703) 318-4763 Telephone	7/7/06 Date
Randy C. Hansen Health and Safety Officer	(314) 770-3027 Telephone	7/7/06 Date
Harold W. Anagnostopoulos Radiation Safety Officer/Radiation Protection Officer	(314) 770-3059 Telephone	7/7/06 Date
Seth T. Stephenson Field Manager	(765) 278-3520 Telephone	7/7/06 Date

The approved Health and Safety Plan (HASP) Addendum 3 will be provided to subcontractors at the time of subcontract execution.

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CERTIFICATION 4

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has prepared this Health and Safety Plan (HASP) Addendum 3 for conducting the installation of cave and stream/spring gauging equipment and an electrical imaging survey at Jefferson Proving Ground's Depleted Uranium Impact Area, Madison, Indiana. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan (QCP). During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

Joseph N. Skibinski — 7/7/06
Project Manager
Science Applications International Corporation
Date: 7/7/06

JS for Joseph E. Peters
Joseph E. Peters
Quality Assurance Officer
Science Applications International Corporation
Date: 7/7/06

Corinne Shia
Corinne M. Shia
Independent Technical Review Team Leader
Alion Science and Technology Corporation
Date: 7/7/06

Significant concerns and explanation of the resolutions are documented within the project file.

As noted above, all concerns resulting from independent technical review of the project have been considered.

Lisa D. Jones-Bateman
Vice President
Science Applications International Corporation
Date: 7/7/06

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
AR	Army Regulation
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
CPR	Cardiopulmonary Resuscitation
CSP	Certified Safety Professional
CWM	Chemical Warfare Material
DO	Delivery Order
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DU	Depleted Uranium
EI	Electrical Imaging
EC&HS	Environmental Compliance and Health and Safety
EM	Engineer Manual
EMR	Electromagnetic Radiation
EOD	Explosive Ordnance Disposal
ER	Engineer Regulation
FSHO	Field Safety and Health Officer
FSP	Field Sampling Plan
HASP	Health and Safety Plan
HPT	Health Physics Technician
HSO	Health and Safety Officer
HSWP	Health and Safety Work Permit
HTRW	Hazardous, Toxic, and Radioactive Waste
JPG	Jefferson Proving Ground
NGB	National Guard Bureau
NRC	U.S. Nuclear Regulatory Commission
OE	Ordnance and Explosives
OSHA	Occupational Safety and Health Administration
PAM	Pamphlet
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RF	Radio Frequency
SAIC	Science Applications International Corporation
SOW	Statement of Work
USACE	U.S. Army Corps of Engineers
UXO	Unexploded Ordnance
VT	Variable Time

1. INTRODUCTION

This document is the third Addendum to the Health and Safety Plan (HASP) (SAIC 2005a) prepared for the Depleted Uranium (DU) Impact Area Site Characterization Project for Jefferson Proving Ground (JPG), Madison, Indiana. Science Applications International Corporation (SAIC) has prepared this Addendum in accordance with the statement of work (SOW) requirements under the U.S. Army Corps of Engineers (USACE) Contract No. W912QR-04-D-0019, Delivery Order (DO) No. 0012.

This Addendum was produced to define the additional policies and procedures that will ensure safe working conditions during field activities involving the installation of cave and stream/spring gauging equipment, and the conduct of an electrical imaging (EI) survey at the JPG DU Impact Area and surrounding areas. This document is to be used in conjunction with the existing HASP, and not as a replacement. With this understanding, this Addendum follows the same format of the HASP and relevant sections of the HASP are referenced. This document was developed to prevent and minimize the potential for personal injuries, illnesses, and physical damage to equipment and property. The information provided in this plan was developed for use by SAIC in support of JPG's site characterization program to assign responsibilities, establish personal protection standards and mandatory safety procedures, and plan for contingencies. SAIC assumes no liability for the use of this information for any other purpose than as stated in this Addendum or the HASP. The evaluations of potential hazards and their controls reflect professional judgments subject to the accuracy and completeness of information available when the plan was prepared.

This Addendum has been prepared in accordance with the *Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities*, Engineer Regulation (ER) 385-1-92 (USACE 2003b); *USACE Safety and Health Requirements Manual*, Engineer Manual (EM) 385-1-1 (USACE 2003a); *U.S. Department of Defense (DOD) Contractors' Safety Manual for Ammunition and Explosives, DOD 4145.26-M* (DOD 1997); *DOD Standard 6055.9-STD, Ammunition and Explosives Safety Standards* (DOD 2004); *U.S. Army Explosives Safety Program, Army Regulation (AR) 385-64* (U.S. Army 1997); *U.S. Ammunition and Explosives Safety Standards, Department of Army Pamphlet (PAM) 385-64* (U.S. Army 1999); U.S. Nuclear Regulatory Commission (NRC) Radioactive Materials License SUB-1435; NRC Service Providers License 24-32591-01; and SAIC's Environmental Compliance and Health and Safety (EC&HS) Manual. Note that SAIC's corporate EC&HS program includes EC&HS Procedure number 120 Unexploded Ordnance/Ordnance and Explosives/Chemical Warfare Material (UXO/OE/CWM) Safety (SAIC 2002) that also was used to develop this Addendum and is included in Appendix A. The HASP, this HASP Addendum, and relevant portions of EM 385-1-1 will be available onsite during field work activities. The provisions of this Addendum also implement the Occupational Safety and Health Administration (OSHA) standards and requirements contained in 29 Code of Federal Regulations (CFR) 1910, 1926, and 1960.

Additional details involving the installation of cave and stream/spring gauging equipment are provided in Section 2 and the conduct of EI survey activities is described in Section 3. An analysis of the potential contaminants and hazards associated with this work is provided in Section 4. The following appendices provide supporting documentation:

- Appendix A – SAIC'S EC&HS Procedure 120
- Appendix B – Activity Hazard Analysis for the Installation of Monitoring Equipment (Including Precipitation, Cave, and Stream/Spring Gauging) and an Electrical Imaging Survey
- Appendix C – Health and Safety Work Permit
- Appendix D – Anomaly Avoidance Safety Briefing Sheet
- Appendix E – JPG Biological Hazard Survey.

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2. MONITORING EQUIPMENT INSTALLATION

This section summarizes the cave stream and stream gauging station installation, calibration, and data collection activities to be conducted at JPG starting with the installation of the gauging stations in September 2006. The timing of the installation activities is partially dependent of precipitation and flow conditions at the site. It is preferred to install the gauging stations when surface water flows are not high for both safety and ease of installation. The objective of this task is to collect surface water stage measurements that will be used to calculate and monitor surface water flows and flow from selected cave streams. This flow data will be used to estimate recharge to the aquifer.

Seven stream stage gauging stations (three on Big Creek and four on Middle Creek) and three cave spring stage gauging stations will be constructed and electronic data loggers will be installed in the JPG DU Impact Area. The construction of each gauging station location will be unique and adjusted to the actual site conditions at the individual locations. A stilling well will be constructed at each location. The cave stream gauges also are anticipated to include a weir. Six of the stream gauge stilling wells will be secured to bridge pillars or culverts, if present in an orientation that is usable. The remaining stream gauge will be built into the bank of Big Creek immediately east of the DU Impact Area and it is anticipated that an excavation of approximately 10 feet long, 1 foot wide, and 5 feet deep (true dimensions will be determined in the field) will be completed for this installation. A backhoe may be used for this excavation if site conditions are appropriate. The cave spring gauges will be built into the banks of springs emanating from the caves and it is anticipated that an excavation approximately 5 feet long, 1 foot wide, and 2 feet deep (true dimensions will be determined in the field) will be completed for this installation. A staff gauge will be installed at an additional location at the intersection of Morgan Road and the Big Creek tributary immediately north of the main channel of the creek where periodic manual measurements will be collected.

Each of the automatic gauging stations will have an electronic data recorder and pressure transducer installed that will continuously and automatically record water levels (or stage) within the stilling wells. Each gauging station will be calibrated by manually measuring stream or spring/cave stream flows using a Gurley® flow meter (or equivalent) following gauging station installation. The manual flow measurement work instruction is detailed in Appendix A of the Field Sampling Plan (FSP) Addendum 3 (SAIC 2006). Each of the stage gauging station recorders will be operated for a minimum of two hydrologic years.

Because the entire DU Impact Area is located north of the firing line where the potential to encounter UXO is likely, anomaly avoidance procedures will be followed. This includes the anomaly avoidance screening of work areas by visual and instrument surveys conducted by a qualified UXO contractor and supervised by one of SAIC's qualified UXO specialists (i.e., graduate of DOD Explosive Ordnance Disposal [EOD] School in Indian Head, Maryland). The surveyed areas will be marked. Non-UXO personnel will operate only within the areas screened for UXO. All other field work in areas where UXO reasonably may be expected to be exposed at the surface and within excavated areas will be subject to continuous surveillance by qualified UXO personnel. All excavation activities will be monitored by a qualified UXO contractor under the direct supervision of one of SAIC's qualified UXO specialists. Additional procedures for work in UXO areas are included in Appendix A of this HASP Addendum.

Following the anomaly avoidance activities, establishment of ingress/egress routes, establishment of screened work areas, and completion of the excavation activities by the qualified UXO contractor, SAIC personnel will install the stilling wells, weirs, and electronic data recorders under supervision of the SAIC UXO specialist.

Prior to beginning work on a new gauge location, the excavation and installation equipment will be decontaminated by dry methods consisting of scraping and removing the loose soil and material clinging to the equipment. Equipment used during this task will include hand excavation equipment (e.g., shovels, picks, and digging bars), a backhoe, miscellaneous construction hand tools, and a flow meter. The Health

Physics Technician (HPT) will survey the equipment and additional decontamination will be completed if the equipment is determined to be contaminated with DU. Additional decontamination, if warranted, may consist of a water and Alconox® wash with a water rinse, if necessary. All equipment will be surveyed by a HPT for radioactivity and will receive an unconditional release prior to allowing it to leave the site.

Personnel conducting work under this contract are required to comply with all of the policies and procedures specified in this HASP Addendum, associated plans (SAIC 2005a, b, and c, SAIC 2006), and other referenced documents. The following bullets summarize the roles and responsibilities of the SAIC personnel responsible for conducting the monitoring equipment installation and activities related to the monitoring plan:

- Mr. Joseph N. Skibinski is SAIC's overall JPG Project Manager. He is responsible for all activities conducted at JPG, including the cave stream and stream gauging station installation, calibration, and data collection activities, and all external coordination.
- Mr. Todd D. Eaby is SAIC's Hydrogeology and Multimedia Sampling and Analysis Lead and Field Safety and Health Officer (FSHO) for the cave stream and stream gauging station installation, calibration, and data collection activities. He is responsible for developing the plans associated with the surface water gauging events and will be present at JPG during the installations of the gauging stations. While present at JPG, he will be the primary point of contact for SAIC.
- Mr. Seth T. Stephenson will serve as the Field Manager, provide anomaly avoidance support, and oversee subcontracted UXO personnel. He is a graduate of the EOD School in Indian Head, Maryland, and has served as the UXO Team Member and UXO Supervisor on surveys and removal actions at DOD sites. When Mr. Eaby is not present at JPG, he will be the primary point of contact for SAIC and will be responsible for ensuring work activities are conducted in accordance with the procedures and policies specified in this HASP Addendum and other related project plans.
- Mr. Randy C. Hansen will serve as the Health and Safety Officer. He is a certified safety professional (CSP) and has supervised the environmental radiation protection program on remedial action projects involving radiological contamination. He has experience supporting field operations at JPG.
- Mr. Harold W. Anagnostopoulos will serve as the Radiation Safety Officer. He is a certified health physicist (CHP) in SAIC's St. Louis office who specializes in environmental compliance, occupational safety, and radiation protection.
- Mr. Joseph E. Peters will be the Quality Control (QC) Manager for all of SAIC's work at JPG. He will ensure that data collection is accomplished following the established procedures specified in the project plans and in compliance with established SAIC procedures. He is the QC Manager for USACE, National Guard Bureau (NGB), and U.S. Department of Energy (DOE) contracts and has extensive experience in working with laboratories and validating chemical and radiological data.

SAIC is proposing to install all of the gauging stations in September 2006. It is anticipated that all of the gauging station installations will be completed over a 2-week period. The timing of the installation activities is partially dependent of precipitation and flow conditions at the site. It is preferred to install the gauging stations when surface water flows are not high for both safety and ease of installation. Immediately following installation, the first manual flow measurements will be collected for calibration purposes using a portable flow meter. Gauging station data downloads and manual measurements will be scheduled following the completion of the installations and will be completed monthly for the first year. During the first year, each data collection event will include the downloading of electronic data recorders at 10 locations and manual flow measurements at a total of 10 locations. These events are anticipated to begin in October 2006 and will be completed quarterly following the completion of the first year of data collection. During the second year, the data collection events will include the downloading of electronic data recorders at 10 locations, manual flow measurements at a total of 10 locations, and the recording of the stage as visually observed at the installed staff gauge on the tributary of Big Creek.

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3. ELECTRICAL IMAGING SURVEY PLAN

This section summarizes the EI survey to be conducted at JPG, which is scheduled to be completed in July through September 2006. The survey is planned to be completed during the summer to avoid frozen ground conditions, which inhibit electrical connection of the electrodes with the soil. The objective of this task is to refine the locations of potential preferred groundwater flow pathways and to further characterize the subsurface features. The results of this study will be used to assist in the selection of proposed monitoring well pair locations and refinement of the conceptual site model.

EI is a geophysical technique that measures the electrical properties of the subsurface. Specifically, the resistivity of the subsurface earth materials is measured along profiles. This is facilitated by placing electrodes attached along a cable along a traverse at a specified spacing and collecting resistivity measurements. For the purpose of this investigation, a SuperSting® automatic, multi-electrode system with an electrode spacing of 4 meters and up to 84 electrodes in an array will be used. This should provide a maximum investigation depth of approximately 150 feet, but will be partially dependent on actual site conditions. Depending on the actual site conditions, the field crew, with consultation of the senior geophysicist, may employ the use of additional electrodes to achieve the depth and/or resolution desired for the purpose of the investigation. The data collection method and array configuration consisting of "electrode rolls" in which the trailing electrodes and cables are moved to the leading edge of the array along the traverse, following data collection along that section of the traverse, will facilitate coverage along the entire traverse distance.

Because the entire DU Impact Area is located north of the firing line where the potential to encounter UXO is likely, anomaly avoidance procedures will be followed. This includes the anomaly avoidance screening of work areas by visual and instrument surveys conducted by a qualified UXO contractor, supervised by one of SAIC's qualified UXO specialists. The surveyed areas will be marked. Non-UXO personnel will operate only within the areas screened for UXO. Additional procedures for work in UXO areas are included in Appendix A of this HASP Addendum.

There is a remote possibility that the electricity injected into the soil surrounding Supersting® electrodes could inadvertently trigger a detonation of munitions equipped with variable time (VT) fuzes, which are susceptible to electromagnetic radiation (EMR) in the radio frequency (RF) range. Consequently, SAIC will withdraw a minimum distance of 1 mile to operate the electrical resistivity test equipment remotely after SAIC personnel emplaced the testing equipment at the site to address this concern. Additional UXO precautions are presented in Appendix D.

Following completion of the anomaly avoidance activities and establishment of work areas along the EI traverse, SAIC personnel will install the stainless steel stakes by driving them into the ground under the supervision of the SAIC UXO specialist.

The stainless steel stakes (electrodes) will be decontaminated by dry methods consisting of scraping, knocking, and removing the loose soil and material clinging to the stakes. If the electrode cables get soiled, they may be wiped clean. The HPT will survey the equipment. Additional decontamination will consist of a water and Alconox® wash with a water rinse, if necessary. All equipment will be surveyed by the HPT for radioactivity prior to exiting the DU Impact Area and/or de-mobilizing from the site.

SAIC personnel are required to comply with all of the policies and procedures specified in this HASP Addendum, associated plans (SAIC 2005a, b, and c, SAIC 2006), and other referenced documents. The following bullets summarize the roles and responsibilities of the SAIC personnel responsible for conducting the EI survey:

- Mr. Joseph N. Skibinski is SAIC's overall JPG Project Manager. He is responsible for all activities conducted at JPG, including the EI survey and all external coordination.

- Mr. Todd D. Eaby is SAIC's Hydrogeology and Multimedia Sampling and Analysis Lead for the EI survey. He is responsible for developing the plans associated with the EI survey and will be present at JPG during the start of the survey. While present at JPG, he will be the primary point of contact for SAIC.
- Mr. Seth T. Stephenson will serve as the Field Manager and provide Anomaly avoidance support. He is a graduate of the EOD School in Indian Head, Maryland, and has served as the UXO Team Member and UXO Supervisor on surveys and removal actions at DOD sites. When Mr. Eaby is not present at JPG, he will be the primary point of contact for SAIC and will be responsible for ensuring work activities are conducted in accordance with the procedures and policies specified in this HASP Addendum and other related project plans.
- Mr. Randy C. Hansen will serve as the Health and Safety Officer. He is a CSP and has supervised the environmental radiation protection program on remedial action projects involving radiological contamination. He has experience supporting field operations at JPG.
- Mr. Harold W. Anagnostopoulos will serve as the Radiation Safety Officer. He is a CHP in SAIC's St. Louis office who specializes in environmental compliance, industrial hygiene, and radiation protection.
- Mr. Joseph E. Peters will be the QC Manager for all of SAIC's work at JPG. He will ensure that data collection is accomplished following the established procedures specified in the project plans and in compliance with established SAIC procedures. He is the QC Manager for USACE, NGB, and DOE contracts and has extensive experience in working with laboratories and validating chemical and radiological data.
- Mr. Richard A. Hoover is SAIC's Senior Geophysicist and the Project Geophysics Manager for the EI survey. He will be in contact with the geophysics field crew and will ensure that data collection is accomplished following established procedures specified in the project plans and in compliance with established SAIC procedures. He will be responsible for providing oversight and review of all of the survey data, data processing, and guidance to the project hydrogeologist and geophysics field crew for any modifications to the field procedure due to site conditions to collect the best data to effectively achieve the project objectives. The Geophysics Manager will be responsible for the interpretation and geophysical reporting.
- Mr. Jeffery J. Warren, SAIC's Geophysics Field Supervisor and FSHO, is one of the EI field crew members, will be responsible for completing all of the applicable field forms and communicating the survey progress, problems, and results to the SAIC Project Manager.

SAIC is proposing to conduct the EI survey in July through August 2006. It is anticipated that the EI survey will be completed in three 10-day shifts with four day breaks between. The timing of the EI survey is partially dependent on weather and soil conditions at the site. The EI equipment can not be operated during electrical storms.

4. CONTAMINANT AND HAZARD DESCRIPTION

Site tasks will include, but are not limited to, installing monitoring gauges, conducting EI surveys, and conducting anomaly avoidance and radiological surveys to ensure protection of project staff. Because DU penetrators remain in the area, there is a slight potential for exposure to very low levels of ionizing radiation in contaminated soil and the spread of radioactive contamination (DU penetrator corrosion products) to previously uncontaminated areas. Exposure to chemical contaminants also is possible, but unlikely. Physical hazards include, but are not limited to, contact with UXO, being struck by moving equipment, encountering uneven terrain, drowning, excavation hazards, exposure to inclement weather, and potential for exposure to very low levels of radiation or radioactive contamination. Changes (i.e., upgrades and downgrades) in protective measures require prior approval of the Health and Safety Officer (HSO) or FSHO and concurrence from the Radiation Safety Officer.

Table 4-1 is a checklist of common hazards that were considered and that may be encountered during EI and stream gauge installation activities. It includes negative declarations for hazards that will not be encountered.

Table 4-1. Hazards Inventory
Jefferson Proving Ground, Madison, Indiana

Yes	No	Hazard
	X	Use of sharp tools
X		Biological hazards (e.g., insects, snakes, and plants)
	X	Confined space entry (potential for entry)
X		Drowning
X		Electrical shock
	X	Excavation entry (excavations will not be entered)
	X	Exposure to chemicals
	X	Fire
X		Unexploded ordnance
X		Heavy equipment
	X	Noise
X		Ionizing radiation or radioactive contamination
X		Temperature extremes
X		Lifting
X		Slips, trips, and falls
X		Inclement weather

An activity hazard analysis (AHA) has been prepared for this HASP Addendum and is presented as Appendix B. Potential hazards and controls are listed on the AHA for each step of the installation of cave and stream/spring gauging equipment, and the EI survey process.

The following sections present information on site contaminants, radiological hazards, and nonradiological hazards as they pertain to the installation of stream/spring gauging equipment, and the EI survey activities.

4.1 RADIOLOGICAL HAZARDS

Radiological hazards will be controlled in accordance with the HASP, the relevant HASP Addendum, AHA (Appendix B), Health and Safety Work Permit (HSWP, Appendix C) , and SAIC's health physics procedures (SAIC 2002b). The primary radiological hazard will be contact with intact DU penetrators in the DU Impact Area. Contact with potentially contaminated soil in the DU Impact Area is also a possibility, but poses less of a hazard. SAIC personnel and subcontractors and tools will be surveyed for contamination with DU prior to exiting the DU Impact Area. Air sampling will not be required.

4.2 NONRADIOLOGICAL HAZARDS

Although the work areas and associated access routes are not expected to contain UXO, the target areas, impact areas, ricochet areas, and other surrounding areas may contain UXO. UXO may be found on the surface and/or in the subsurface. The varying types of ammunition, angles of fire, types of soil, and depths to bedrock preclude the accurate estimation of the depth of any subsurface UXO. For these reasons, the UXO safety guidelines presented in Appendix D to this HASP Addendum will be followed.

While within areas where anomaly avoidance has not been conducted inside the DU Impact Area, all personnel lacking EOD training will be restricted from traversing any areas while outside their vehicles unless anomaly avoidance procedures have been conducted. All personnel supporting the installation of cave and stream/spring gauging equipment and the EI survey will be trained in UXO awareness and avoidance and will follow the UXO safety procedure documented in this HASP Addendum. In addition to reading this HASP Addendum and all related plans, field personnel are required to view a safety video that illustrates the types of munitions that could be encountered at JPG and procedures for non-UXO personnel to follow when contact with UXO is a possibility. SAIC and subcontractor personnel will conduct daily safety tailgate briefings that will address hazards associated with all activities planned for that day.

There is a small potential that JPG may contain UXO that have fuses that could be activated through the EI process. Due to this potential hazard, a minimum safe distance of 1,000 meters (approximately 1.1 miles) will be established and adhered to during the EI survey. The field manager and EI equipment operator will ensure that all personnel are beyond the minimum safe distance prior to and during activation of the EI equipment. The field manager and EI equipment operator also will ensure that EI equipment is disconnected from the power source when personnel are handling electrodes.

Excavation activities present additional hazards (e.g., operation of heavy equipment, and cave-ins) Requirements for controlling excavation hazards are outlined specifically in EM 385-1-1 Section 25 and 29 CFR 1926 Subpart P. Heavy equipment operators will be trained to operate their equipment and will avoid situations where other personnel could be crushed or impacted by their activities. Personnel working near the heavy equipment shall stay outside of the hazard zone as established by the Field Manager, and equipment operator. Personnel required to work within this zone will have developed a method to communicate with the operator prior to the activity, but shall never position themselves under a suspended load or in a crush zone. An excavation competent person shall conduct all required inspections prior to allowing personnel into an excavation. Personnel shall not enter an excavation until the competent person has approved the entry for that day. Personnel shall never enter an excavation where there is cave-in potential that could crush them.

To mitigate potential cases of hypersensitivity or allergic reactions due to exposures to natural biological hazards present at JPG, the Field Manager will ensure appropriate precautions, such as personal protective equipment (PPE) use, repellents, and barrier creams, are provided to personnel. The JPG Biological Hazard Survey form is included in Appendix E to solicit information supplied by field personnel regarding potential allergies or sensitivities.

Except for the potential use of a dilute solution of hydrochloric acid (10 percent), the use of hazardous chemicals is not anticipated for this activity. The health effects/potential hazards associated with exposures to dilute hydrochloric acid are included in the approved HASP (SAIC 2005a).

5. HEALTH AND SAFETY PROCEDURES

All health and safety requirements and procedures defined in the main HASP (SAIC 2005a) will apply to the activities covered by this HASP Addendum. Appendix A to this HASP Addendum provides SAIC's UXO/OE/CWM safety procedure (SAIC 2002), which establishes the minimum requirements under which field work will be conducted when the work involves a real or potential UXO hazard. This procedure is supplemented by the UXO Avoidance Safety Briefing Sheet included in Appendix D.

Additional SAIC-specific procedures also are noted in the AHA (Appendix B to this HASP Addendum). The FSP for installing monitoring equipment and conducting EI integrates specific UXO and radiation monitoring requirements based upon the hazards identified in this HASP Addendum. Finally, safety precautions for UXO avoidance have been developed based on SAIC's UXO/OE/CWM Safety Procedure 120, USACE guidance, and DOD guidance, is included in Appendix D to this HASP Addendum and is required to be followed when personnel are working in areas where contact with UXO is a potential.

SAIC has elected to utilize a HSWP for installing monitoring equipment and conducting EI. This permit is included in Appendix C to this HASP Addendum.

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6. REFERENCES

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SAIC. 2005a. Health and Safety Plan, Site Characterization of the Depleted Uranium Impact Area, Jefferson Proving Ground, Madison, Indiana, Final, Science Applications International Corp., May.

SAIC. 2005b. Field Sampling Plan, Site Characterization of the Depleted Uranium Impact Area, Jefferson Proving Ground, Madison, Indiana, Science Applications International Corp. May.

SAIC. 2005c. Quality Control Plan, Depleted Uranium Impact Area Site Characterization, Jefferson Proving Ground, Madison, Indiana, Final, Science Applications International Corp. May

SAIC. 2006. Field Sampling Plan Addendum, Site Characterization, Other Monitoring Equipment Installation, Other Monitoring (Precipitation, Cave and Stream/Spring Gauges) and Electrical Imaging Survey, Jefferson Proving Ground, Madison, Indiana. Draft. Science Applications International Corp. April.

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USACE. 2003b. *Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste and Ordnance and Explosive Waste Activities*, Appendix B, ER 385-1-92. July.

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APPENDIX A

SAIC's EC&HS PROCEDURE 120

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

ENGINEERING AND ENVIRONMENTAL MANAGEMENT SECTOR

CONTROLLED DOCUMENTS

The following document is controlled by the Engineering and Environmental Management Sector (EEMS), Health and Safety Officer. If you print this document, this page must be attached to the front of the document and you must fill in the information required below. The hard copy should be signed and dated the day it is printed by the user.

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Manual Name: **Engineering and Environmental Management Sector Procedure**

Document Number: EEMS EC&HS-120

Revision Number: 0

Date Printed: ______________________

Person Checking the Revision Number: ______________________

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION ENGINEERING AND ENVIRONMENTAL MANAGEMENT SECTOR			
Title: UXO/OE/CWM Safety			
Procedure No: EEMS EC&HS 120	Revision: 0	Date: 5/10/2002	Page : 1 of 17
Sector Manager: Date: 5/24/02		H&S Manager Date: 5/29/02	

1.0 PURPOSE

The purpose of this procedure is to establish the minimum requirements under which field work that may involve exposure to unexploded ordnance/ordnance and explosives/chemical warfare materials (UXO/OE/CWM) may be performed.

2.0 SCOPE

This procedure applies to SAIC and SAIC subcontractor field activities involving potential exposure to UXO/OE/CWM. SAIC subcontractors who perform UXO/OE/CWM field work may operate under their own programs and procedures if those programs and procedures satisfy the applicable regulatory and client requirements, and provide for a safe working environment.

3.0 REFERENCES AND DEFINITIONS

3.1 REFERENCES

3.1.1 EM 385-1-1, U.S. Army Corps of Engineers Safety and Health Requirements Manual, September 3, 1996.

3.1.2 EP-385-1-95a, Basic Safety Concepts and Considerations for OE Operations, 29 June 2001.

3.1.3 DoD 6055.9-STD, Department of Defense Ammunition and Explosives Safety Standards, October 30, 1992.

3.1.4 U.S. Bureau of Alcohol, Tobacco, and Firearms (BATF) Publication 5400.7, ATF – Explosives Law and Regulations, June 1990.

3.1.5 U.S. Army Corps of Engineers Regulation 385-1-92, Safety and Occupational Health Document Requirements for Hazardous, Toxic and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OEW) Activities, March 18, 1994.

3.1.6 U.S. Army Engineering and Support Center-Huntsville, Center of Expertise (CX) Guidance Document 97-09, Determination of Public Withdrawal Distances (PWD) for Fragmentation on Ordnance and Explosives (OE) Sites, September 30, 1997.

3.1.7 DA PAM 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT.

3.1.8 ER 385-1-92, Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities, 1 September 2000.

3.1.9 ER 1110-1-8153, Engineering and Design – Ordnance and Explosive Response, 14 May 1999.

3.1.10 EP 75-1-2, Unexploded Ordnance (UXO) Support During Hazardous, Toxic, and Radioactive Waste (HTRW) and Construction Activities, 2 November 2000.

3.1.11 EP 1110-1-17, Establishing a Temporary Open Burn and Open Detonation Site for Conventional Ordnance and Explosives Projects, 16 July 1999.

3.1.12 EP 1110-1-18, OE Response, 24 April 2000.

3.1.13 EP 1110-1-24, Establishing and Maintaining Institutional Controls for Ordnance and Explosives (OE) Projects, 15 December 2000.

3.1.14 EP 1110-3-8, Public Participation in the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS).

3.1.15 EM 1110-1-4009, Engineering and Design – Ordnance and Explosives Response, 23 June 2000.

3.1.16 DoD Directive 4715.11, Environment and Explosives Safety Management on DoD Active and Inactive Ranges Within the United States, 17 August 1999.

3.1.17 DoD Directive 4715.12, Environment and Explosives Safety Management on DoD Active and Inactive Ranges Outside the United States, 17 August 1999.

3.1.18 EP 75-1-3, Recovered Chemical Warfare Materiel (RCWM) Response, 4 January 2002.

3.1.19 DA PAM 50-6, Chemical Accident or Incident Response and Assistance (CAIRA) Operations, 17 May 1991.

3.1.20 DA PAM 385-61, Toxic Chemical Agent Safety Standards, 6 June 1997.

3.1.21 AMC Reg 50-6, Chemical Surety, 1 February 1995.

3.1.22 AMC Reg 190-11, Physical Security of Arms, Ammunition and Explosives.

3.1.23 U.S. Army TM 9-1375,213-12, Operator's and Organization Maintenance Manual (Including Repair Parts and Special Tools List); Demolition Materials, 1 November 1988.

3.1.24 U.S. Army TM 60A-1-1-4, Protection of Personnel and Property, Change 2, 24 September 1990.

3.1.25 U.S. Army TM 60A-1-1-31, Explosive Ordnance Disposal Procedures: General Information on EOD Disposal Procedures, Change 7, 1 November 1988.

3.1.26 TB 700-2, Department of Defense Ammunition and Explosives Hazard Classification Procedures.

3.1.27 AR 385-64, U.S. Army Explosives Safety Program.

3.1.28 DA PAM 385.64, Ammunition and Explosives Safety Standards.

3.1.29 HNC-ED-CS-S-98-1, Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives, January 1998.

3.1.30 HNC-ED-CS-S-98-2, Method for Calculating Ranges to No More Than One Hazardous Fragment per 600 Square Feet, January 1998.

3.1.31 EEMS QAAP 2.2 Readiness Review.

3.1.32 EC&HS Procedure 4, Accident Reporting.

3.1.33 EC&HS Procedure 12, Medical Surveillance.

3.1.34 EC&HS Procedure 20, Hazardous Waste Operations.

3.2 DEFINITIONS

3.2.1 Ammunition Storage Unit (ASU) – All types of explosives storage magazines including outdoor or indoor, open storage areas, bunkers, and earth-covered and aboveground magazines.

3.2.2 Barricade – An intervening barrier, natural or artificial, of such type, size, and construction as to limit in a prescribed manner the effect of an explosion on nearby buildings or exposures.

3.2.3 Blast overpressure – The pressure, exceeding the ambient pressure, manifested in the shock wave of an explosion.

3.2.4 Chemical agent – A substance that is intended for military use with lethal or incapacitating effects upon personnel through its chemical properties.

3.2.5 Compatibility – Ammunition or explosives are considered compatible if they may be stored or transported together without increasing significantly either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident.

3.2.6 Debris – Any solid particle thrown by an explosion or other strong energetic reaction. For aboveground detonations, debris usually refers to secondary fragments. For underground storage facilities, debris refers to both primary and secondary fragments, which are transported by a strong flow of detonation gasses.

3.2.7 Detonation – A violent chemical reaction within a chemical compound or mechanical mixture evolving heat and pressure. A detonation is a reaction that proceeds through the reacted material toward the unreacted material at a supersonic velocity. The result of the chemical reaction is exertion of extremely high pressure on the surrounding medium forming a propagating shock wave that originally is of supersonic velocity. A detonation, when the material is located on or near the surface of the ground, is normally characterized by a crater.

3.2.8 Donor/Acceptor – A total quantity of stored ammunition may be subdivided into separate storage units in order to reduce the most credible event (MCE) and consequently, the quantity distance of an accidental detonation. The separation distances, with or without an intervening barrier, should be sufficient to ensure that a detonation does not propagate from one unit to another. For convenience the storage unit which detonates is termed the donor, and the nearby units, which may be endangered, are termed the acceptors. The locations of the donor and acceptor define the PES and ES, respectively.

3.2.9 Explosion – A chemical reaction of any chemical compound or mechanical mixture that, when initiated, undergoes a very rapid combustion or decomposition releasing large volumes of highly heated gases that exert pressure on the surrounding medium. Also, a mechanical reaction in which failure of the container causes the sudden release of pressure from within a pressure vessel, for example, pressure rupture of a steam boiler. Depending on the rate of energy release, an explosion can be categorized as a deflagration, a detonation, or pressure rupture.

3.2.10 Exposed Site (ES) – A location exposed to the potential hazardous effects (blast, fragments, debris, and heat flux) from an explosion at a potential explosion site (PES). The distance to a PES and the level of protection required for an ES determine the quantity of ammunition or explosives permitted in a PES.

3.2.11 Fragmentation – The breaking up of the confining material of a chemical compound or mechanical mixture when an explosion takes place. Fragments may be complete items, subassemblies, pieces thereof, or pieces of equipment or buildings containing the items. Nearby items including, but not limited to building materials, equipment, rocks, etc. in the vicinity of an explosion can also become caught up in the explosion and contribute to fragmentation.

3.2.12 Inhabited buildings – Buildings or structures, other than operating buildings, occupied in whole or in part by human beings. They include, but are not limited to schools, churches, residences, aircraft passenger terminals, stores, shops, factories, hospitals, theaters, etc.

3.2.13 Magazine – Any building or structure, except an operating building, used for the storage of ammunition and explosives.

3.2.14 Maximum Credible Event (MCE) – In hazards evaluation, the MCE from a hypothesized accidental explosion, fire, or agent release is the worst single event that is likely to occur from a given quantity and disposition of ammunition and explosives. The event must be realistic with a reasonable probability of occurrence considering the explosion propagation, burning rate characteristics, and physical protection given to the items involved. The MCE evaluated on this basis may then be used as a basis for effects calculations and casualty predictions.

3.2.15 Ordnance and Explosives (OE) – Includes (but is not necessarily limited to) all items of U.S.-titled (owned by the U.S. Government through DoD Components) ammunition; propellants, liquid and solid; pyrotechnics; high explosives; guided missiles; warheads; devices; devices and chemical agent substances and components presenting real or potential hazards to life, property and the environment. Excluded are wholly inert items and nuclear warheads and devices, except for considerations of storage and stowage compatibility, blast, fire, and non-nuclear fragment hazards associated with the explosives.

3.2.16 Public Access Exclusion Distance – The distance arc (calculated) from the agent source at which no more than 10.0, 4.3, and 150 milligrams per minute per cubic meter is present for GB, VX, and mustard respectively.

3.2.17 Public Traffic Route – Any public street, road, highway, navigable stream, or passenger railroad (includes roads on a military reservation that are used routinely by the general public for through traffic).

3.2.18 Quantity Distance (Q-D) – The quantity of explosive material and distance separation relationships that provide defined types of protection. These relationships are based on levels of risk considered acceptable for the stipulated exposures and are tabulated in the appropriate Q-D tables. Separation distances are not absolute safe distances, but are relative protective or safe distances. Greater distances than those shown in the tables shall be used whenever practicable.

3.2.19 Unexploded Ordnance (UXO) – Explosive ordnance that has been primed, fuzed, armed, or other wise prepared for action, and that has been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material and remains unexploded either by malfunction or design or for any other cause.

4.0 RESPONSIBILITIES

4.1 EEMS Sector Manager

The EEMS Sector Manager is responsible for reviewing and approving this procedure and subsequent revisions thereto.

4.2 EEMS H&S Manager

The EEMS H&S Manager is responsible for:

4.2.1 approving this procedure;

4.2.2 verifying implementation of this procedure;

4.2.3 modifying this procedure as appropriate to meet changing needs;

4.2.4 reviewing/approving Site Specific Safety and Health Plans, and Explosives Safety Submissions for UXO/OE Projects; and

4.2.5 providing technical assistance to Project Managers as required.

4.3 Project Manager/Field Manager

The project chain of command is collectively and individually responsible for:

4.3.1 enforcing the requirements of this procedure;

4.3.2 approving hazard assessments for sampling pursuant to this procedure;

4.3.3 approving sampling plans for sampling pursuant to this procedure;

4.3.4 approving reports for work pursuant to this procedure;

4.3.5 ensuring compliance with related applicable requirements including, but not limited to, EC&HS Procedures 4, 9, 11, 13, 20, 24 and 25;

4.3.6 assuring hazard analysis/risk assessments are prepared and approved for each operation involving UXO/OE exposure or potential exposure;

4.3.7 assuring an approved Site Specific Safety and Health Plan is in place for each UXO/OE project under his/her control, and that the requirements are implemented;

4.3.8 assuring that, where required, an Explosives Safety Submission approved by the Department of Defense Explosives Safety Board is in place and that the requirements are implemented; and

4.3.9 assuring that all employees are trained in the UXO/OE hazards anticipated on the site and the correct procedures for working safely on the project site, and all required OSHA training;

4.4 <u>Division Manager</u>

The Division Manager is responsible for:

4.4.1 ensuring the application of this procedure at the division level; and

4.4.2 providing support for Project Managers as required.

4.5 <u>UXO Safety Officer</u>

The UXO Safety Officer is responsible for:

4.5.1 administering the safety and health program on the project site;

4.5.2 providing training in UXO/OE hazards to all workers on the site, as well as site visitors;

4.5.3 providing routine tailgate safety briefings;

4.5.4 coordinating with applicable emergency response agencies for emergency preparedness;

4.5.5 performing daily inspections of all UXO/OE operations and support functions and following up on deficiencies;

4.5.6 designating site control zones for UXO/OE/CWM hazards; and

4.5.7 Acting as the on site safety observer during all demo/venting operations.

4.6 Team Members

Team members are responsible for:

4.6.1 performing assigned tasks in a safe and effective manner;

4.6.2 according to established operating procedures;

4.6.3 attending required training and understanding all tasks assigned;

4.6.4 using all required personal protective equipment;

4.6.5 inspecting all equipment prior to use for condition and function; and

4.6.6 reporting any unsafe or questionable conditions to a supervisor.

5.0 GENERAL

5.1 SAIC will manage all work involving UXO/OE/CWM in compliance with EM 385-1-1, DoD 6055.9-STD, and all recognized rules, regulations, standards and requirements applicable to work involving UXO/OE/CWM.

5.2 All UXO/OE/CWM project work will also comply with all federal, state and local requirements regarding protection of workers in hazardous operations including, but not limited to, 29 CFR 1910 and 29 CFR 1926.

5.3 Deviation from this procedure may result in disciplinary action, up to and including termination, in accordance with EC&HS Program Implementation Guide C-2.

5.4 Only authorized personnel with requisite training and experience in UXO/OE operations will be permitted inside the exclusion zone of a UXO/OE project during operations.

5.5 Site Visitors must meet training and physical requirements of site personnel, and must wear required PPE in order to be admitted onto the site. Visitors will receive a briefing on site operations, site hazards, and emergency procedures from the UXO Safety Officer prior to site entry, and will be escorted by the UXO Safety Officer at all times while inside the exclusion zone. If the visitor is not UXO qualified, all UXO work will stop for the duration of the visitor's presence within the exclusion zone.

6.0 PROCEDURE

6.1 Hazard Analysis and Risk Assessment

The UXO Safety Officer will prepare an Activity Hazard Analysis and Risk Assessment for each planned operation in areas of the site that may contain UXO/OE/CWM. Information will be obtained regarding past uses of the site, past studies of the site, types of UXO/OE/CWM previously identified on the site, and types of UXO/OE/CWM potentially expected to be located on the site in order to accurately characterize the site and its inherent hazards. A hazard analysis will be prepared for each operation in accordance with EM 385-1-1 Figure 1-1. These will be the planning documents for the Site Specific Safety and Health Plan. If additional hazards are discovered, or there is a change in operations, or equipment during the course of operations, existing hazard analyses will be updated before proceeding, or new ones will be prepared.

6.2 UXO/OE Detection

UXO/OE detection methods will vary from visual observance on a surface clearance project to the use of geophysical instruments for the detection of buried items in a subsurface clearance. In all cases, the requirements of EP 385-1-95a will be applied to the operation. Even on a surface clearance, geophysical instruments may also be required to detect UXO/OE items prior to clearing and grubbing operations, or in areas of thick vegetation, where clearing and grubbing operations are not an option. Geophysical instruments are limited in the depth at which UXO/OE can be accurately detected (normally two foot depth is acceptable). Heavy equipment may be required to remove soil in two foot intervals, and the geophysical instruments are then used to detect UXO/OE for the next two-foot interval, etc. until the desired depth is achieved.

6.3 UXO/OE Recovery

All UXO/OE recovery operations will be performed in accordance with the requirements of EP 385-95a. On a surface clearance if part of a UXO/OE item is visible on the surface, the UXO-qualified personnel will clear the soil around the item by hand in order to recover it. If an item is within 12 inches of the surface, it will be recovered by hand. If it is more deeply buried, heavy equipment may be used to clear to within 12 inches of the item and then, it will be recovered by hand.

6.4 UXO/OE Storage

Storage of UXO/OE as well as explosives for use in disposal operations will be in accordance with the requirements of DoD 6055.9 STD, AMC Reg 190-11, and BATF Publication 5400.7. Strict attention will be given to storage compatibility of all explosive items, as well as to quantity distance requirements of the storage area from inhabited buildings, operating areas, site boundaries, other storage sites, and public transportation routes. Security of the UXO/OE and demolition explosives will also be a site priority to assure the general public is not exposed to the hazards presented.

6.5 UXO/OE Transportation

Transportation of UXO/OE offsite will be in accordance with the requirements of 49 CRF 177, EP 1110-1-18, and TB 700-2. Strict attention will be given to explosive compatibility issues, as well as packaging and bracing of the load. Security of the load will not be compromised during transport. Transportation onsite will be in accordance with EP 385-95a.

6.6 UXO/OE Disposal

UXO/OE Disposal Operations will be in accordance with the requirements of EP 385-1-91a, TM 60A-1-1-31, and TM-9-1375,213-12. Where a temporary open burn/open detonation pit must be prepared on the site, it will be in accordance with the requirements of EP-1110-1-17. Where possible, disposal will take place at the location where the UXO/OE is encountered per EP 385-1-95a. Where the UXO/OE is considered too hazardous to move, the disposal operation must take place at the location where the UXO/OE is found. Generally, electrical means will be used in all disposal operations, unless proximity of electromagnetic radiation sources makes this impossible. If engineering controls will be used to reduce shock, blast over-pressure, and/or fragmentation, the design and use must be approved through the DDESB. Separation distances for personnel during disposal operations will be in accordance with DoD 6055.9 STD. The UXO Safety Officer will act as the on site safety observer during all disposal operations.

6.7 Training

6.7.1 The following training will be required of all personnel entering the exclusion zone of a UXO/OE/CWM site.

6.7.2 Current OSHA HAZWOPER Training in accordance with SAIC EC&HS Procedure 20, Hazardous Waste Operations.

6.7.3 UXO/OE Training. All employees performing work involving the handling and destruction of UXO/OE must be graduates of the Naval Explosive Ordnance Disposal School (at a minimum Phase I, chemical; and Phase II, surface) or other DOD-approved UXO/OE training program. Currently, the only other DOD approved training program is the International UXO Training Program (IUTP) UXO Technician I Course conducted by the Texas Engineering Extension Service (TEEX), Texas A&M University. UXO qualified personnel shall have knowledge and experience in military ordnance, ordnance components, and explosives location, identification, render safe, recovery/removal, transportation, and disposal safety precautions.

6.7.4 Current Hazard Communication training in accordance with SAIC EC&HS Procedure 8, Hazard Communication and Hazardous Chemical Control. Information regarding specific types of UXO/OE/CWM expected to be encountered on the site will be presented in this training, to include ordnance recognition; safety and health hazards; required PPE; and safe storage, handling, transportation and disposal requirements.

6.7.5 Tailgate Safety Briefings will be conducted routinely in accordance with SAIC EC&HS Procedure 20, Hazardous Waste Operations. These briefings will include UXO/OE hazards and related safety issues on the project site.

6.7.6 Visitor Briefings will be given in accordance with SAIC EC&HS Procedure 20, Hazardous Waste Operations. The UXO Safety Officer will provide UXO/OE/CWM recognition and avoidance training and UXO/OE/CWM emergency procedures training, and will act as escort for all visitors while in the exclusion zone.

6.8 Medical Surveillance on UXO/OE/CWM sites will be in accordance with the requirements of SAIC EC&HS Procedure 12, Medical Surveillance and Procedure 20, Hazardous Waste Operations. For personnel who will be working on CWM project sites, the medical surveillance will also incorporate the requirements of DA PAM 40-173, Appendix B, which includes a slit lamp examination and an interocular pressure test in addition to the normal HAZWOPER physical requirements.

6.9 Equipment

Personal Protective Equipment on UXO/OE/CWM sites will follow the requirements of SAIC EC&HS Procedure 13, Personal Protective Equipment and Procedure 20, Hazardous Waste Operations. In addition to these requirements, personnel who will be using geophysical equipment for the detection of buried UXO/OE, will not be permitted to wear steel-toe safety boots, as it interferes with the detection equipment per EM 385-1-1. If they will be working in a foot hazard area, they must wear composite toe safety boots. Hard hats will not be worn on UXO/OE sites unless an overhead hazard exists. The potential for a hard hat falling off and striking a UXO/OE item on the ground creates additional risks for site personnel. When worn, hard hats will be secured by chin straps or other means, to prevent falling off.

6.10 Engineering Controls

Wherever possible, engineering controls will be used to reduce the hazards of UXO/OE operations as much as practicable for the protection of employees as well as the general public. Barricades, shielding, and distance, or a combination of these will reduce the potential for fragmentation and blast effects injuries on UXO/OE sites. Fragmentation distances based on net explosive weight (NEW) can be obtained from DoD 6055.9 STD. These will be used unless fragmentation information relative to the specific UXO/OE encountered is available. Sandbags may be used as a barricade to contain fragments during disposal operations in accordance with U.S. Army TM 60A-1-1-4 and Army TM 60A1-1-31. Directional shields may be used to direct the fragmentation hazards away from buildings, highways, etc. Personnel shields may also be used to protect workers who may be positioned within fragmentation distance of a potential hazard. Engineering controls used for mitigating the effects of fragmentation and/or blast over pressure must be approved in accordance with EP 385-1-95a.

6.11 Site Control will be handled in accordance with SAIC EC&HS Procedure 20, Hazardous Waste Operations.

6.11.1 On UXO/OE sites, the boundaries of the exclusion zone are based on the fragmentation distance for the maximum credible event (MCE), which is the largest UXO/OE item expected to be encountered at the project site. If specific information on fragmentation characteristics of this item is available, planning will be based on that information. Fragmentation distances based on NEW found in DoD 6055.9 STD will be used if specific information on the item is not available. If a larger item is identified on the site, the fragmentation distances will be re-evaluated and the boundaries of the exclusion zone will be adjusted accordingly. Public withdrawal distances identified in U.S. Army Engineering and Support Center-Huntsville, Center of Expertise (CX) Guidance Document 97-09, will be incorporated into the site control plan where there is a potential for exposure of the general public to the hazards of site operations.

6.11.2 On CWM sites, the boundaries of the exclusion zone are based on the No Significant Effects (NOSE) zone for the maximum credible event for CWM exposure on the site in accordance with DA PAM 835-61 and DoD 6055.9 STD. This zone is calculated using the most hazardous CWM item expected to be located on the site, in combination with wind rose data obtained from the National Weather Service which gives expected wind speed and direction in order to determine dispersion of CWM material should it become airborne.

6.11.3 On sites containing both UXO/OE and CWM hazards, the fragmentation distance will be determined based on the explosive hazards at the site per paragraph 7.10.1. The NOSE zone will be determined for the MCE CWM exposure scenario per paragraph 7.10.2. The larger of the two distances will be the determining distance for the exclusion zone.

6.12 Emergency procedures will be in accordance with SAIC EC&HS Procedure 20, Hazardous Waste Operations.

6.12.1 Emergency procedures on UXO/OE sites must comply with DOD 6055.9-STD and address coordination with the local emergency authorities to assure that all parties are aware of procedures during an explosion or fire situation on the site. Local emergency response personnel will not be permitted within fragmentation distance of the site either during or after the emergency until it has been cleared for entry by UXO qualified personnel, and they will be escorted at all times while on the site. The UXO Safety Officer will make the required coordination prior to start of site operations. As not all hospitals are equipped with a trauma unit, the nearest hospital equipped to handle this type of potential injury will be identified in advance of site operations. Emergency site evacuation plans must also be included which must include evacuation beyond fragmentation distance of the site operations. If this distance goes beyond the boundaries of the site owner, the evacuation plan must extend to all other property owners within this distance who could potentially be impacted by operations and they must be included in the emergency planning coordination.

6.12.2 Emergency Procedures on CWM sites will include the requirements of DA PAM 50-6, DA PAM 385-61, and EP 75-1-3. This includes the presence of an ambulance and Emergency Medical Technician Paramedics (EMTPs) on site during CWM operations, as well as the normal and emergency decontamination procedures required during an emergency situation.

6.13 Site Specific Safety and Health Plans (SSHP) will be prepared in accordance with SAIC EC&HS Procedure 20, Hazardous Waste Operations and contract/Delivery Order requirements.

6.13.1 SSHPs on UXO/OE sites will also include Activity Hazard Analyses for all UXO operations. Storage of demolition explosives for use in disposal operations will be addressed and sited in accordance with DoD 6055.9, AMC Reg 190-11, and U.S. BATF Publication 5400.7. Transportation of both demolition explosives and UXO/OE recovered on site will be addressed per EP 385-1-95a. Emergency procedures addressing UXO/OE emergencies and fires on UXO/OE sites will be incorporated into the SSHP. Site Control issues regarding fragmentation distances for the protection of workers and the general public will be addressed.

6.13.2 CWM sites will include wind rose data for the site and the calculated NOSE zone. It will also include the normal and emergency decontamination requirements as well as planned emergency response personnel and equipment.

6.14 Explosives Safety Submissions

6.14.1 A DDESB-approved Explosives Safety Submission is required on certain UXO/OE projects in accordance with DoD 6055.9 STD. Conditions requiring this document include: project sites without a DDESB-approved explosives safety site plan in place; projects involving changes in the approved plan such as a new building for explosive operations or storage, a change in the approved NEWs for an area; or modifications to an approved explosive operation. This document is an engineering evaluation of all aspects of the explosive operations, procedures, barricades and shielding, explosive quantity distances, etc. to assure the safety of the operations and the general public.

6.15 CWM Site Safety Submission

6.15.1 A DDESB-approved Site Safety Submission is required on all CWM projects in accordance with DoD 6055.9 STD prior to starting work on the site. This document is a thorough engineering analysis of all operations taking place on the site, the anticipated site hazards and steps taken to reduce hazard levels, standard operating procedures in place, monitoring program, personal protective equipment program, decontamination program, and emergency response planning, etc.

8.0 RECORDS

Documentation generated as a result of this procedure will be collected and maintained in accordance with requirements specified in QAAP 17.1, Records Management and EC&HS Procedure 18, Environmental Compliance & Health and Safety Records Management and contract requirements. In addition, copies of EOD or UXO training certificates for all UXO-qualified personnel working on the project will be maintained on site per ER 385-1-92. All accidents and near misses on the site will be documented per EC&HS Procedure 4, Accident Reporting and copies of the records will be kept on site for the duration of site activities. All unplanned functioning of UXO/OE on the site will be investigated and reported, regardless if injury and/or property damage occurred in accordance with DoD 6055.9 STD.

9.0 ATTACHMENTS

None.

APPENDIX B

ACTIVITY HAZARD ANALYSIS FOR THE INSTALLATION OF MONITORING EQUIPMENT (INCLUDING PRECIPITATION, CAVE, AND STREAM/SPRING GAUGING) AND AN ELECTRICAL IMAGING SURVEY

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ACTIVITY HAZARD ANALYSIS FOR THE INSTALLATION OF MONITORING EQUIPMENT, (INCLUDING PRECIPITATION, CAVE, AND STREAM/SPRING GAUGING) AND AN ELECTRICAL IMAGING SURVEY AT JPG DEPLETED URANIUM IMPACT AREA

Work Location: Jefferson Proving Ground, Indiana

Task Title: Installation of Monitoring Equipment (including Precipitation, Cave, and Stream/Spring Gauging) and an Electrical Imaging Survey

Work Phase:	**List Work Groups Needed for Each Phase:**
A. General Site Safety	A. All
B. Preparation for the Installation of Monitoring Equipment	B. All
C. Installation of Monitoring Equipment	C. All
D. Preparation for the Electrical Imaging Survey	D. All
E. Electrical Imaging Survey	E. All

Activity Steps	Work Groups	Hazards	Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A. General Site Safety Hazards	All	Heat/Cold Related Stress Risk Assessment Code (RAC): Low (L)	Heat/cold related stress will be monitored and controls will be implemented as necessary per the HASP. (EM385-1-1 06.J)
		Slips/Trips/Falls (RAC: L)	Tripping hazards will be identified during pre-work inspections and avoided or removed, if possible.
		Faulty/Damaged Equipment (RAC: L)	Equipment, including tools, will be inspected upon arrival and at the start of each shift. Damaged/faulty equipment will not be used. (EM385-1-1 16.A)
		Lifting (RAC: L)	Use proper lifting techniques, size up load, use teamwork, never twist or turn when lifting, keep load close to the trunk of the body. (EM385-1-1.A)
		Hand Injury (RAC: L)	Leather work gloves will be worn when handling rough material where pinch point hazards exist and for handling sharp material. (EM385-1-1 05)
		Foot Injury (RAC: L)	Steel-toed safety shoes will be worn by all personnel conducting work onsite. (EM385-1-1 05)
		Drowning (RAC: L)	A pre-job safety assessment will be performed by the field manager prior to conducting site work in or adjacent to surface waters. A potential for drowning shall be considered to exist when any or all of the following are present: water depth greater than knee height, flowing water that requires conscious effort to walk and/or maintain position without falling, slippery footing on banks or in the water, steep banks, other condition(s) that could hinder speed of rescue, other factors as noted by the field manager. Where the potential of drowning exists, personnel will wear a Type II, U.S. Coast Guard (USCG) approved personal flotation device (PFD). (EM-385-1-1 05.H) PFDs will be inspected prior to use. When PFDs must be worn, a life ring with a life line must be staged near the work area to facilitate rescue.
		Chest Waders (RAC: Moderate)	A Class II, USCG PFD shall be worn when chest waders are worn and a potential for drowning exists. A designated rescuer shall be assigned to man a life ring equipped with at least 100 feet of line prior to commencing work when personnel are wearing hip or chest waders and a potential for drowning exists.

Work Location: *Jefferson Proving Ground, Indiana*

Task Title: Installation of Monitoring Equipment (including Precipitation, Cave, and Stream/Spring Gauging) and an Electrical Imaging Survey

Work Phase:	**List Work Groups Needed for Each Phase:**
A. General Site Safety	A. All
B. Preparation for the Installation of Monitoring Equipment	B. All
C. Installation of Monitoring Equipment	C. All
D. Preparation for the Electrical Imaging Survey	D. All
E. Electrical Imaging Survey	E. All

Activity Steps	Work Groups	Hazards	Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
		Hypersensitivity or Allergic Reactions (RAC: L)	The Field Manager will ensure appropriate precautions, such as PPE use, repellents, barrier creams, etc., are provided as documented by conditions and based on information supplied by field personnel via the JPG Biological Hazard Survey form. (EM385-1-1 06.D)
		Lack of Communication (RAC: L)	Personnel will use the buddy system and remain in verbal or visual site of one another. Cellular telephones or radios will be used in remote locations in order to contact emergency services. (EM385-1-1 01.E)
		Severe Weather (RAC: L)	Check the weather forecast for the day prior to work. Take cover in a building/vehicle if lightning is spotted. The Field Manager will notify others when the hazardous weather conditions have cleared and it is safe to return to work. (EM385-1-1 06.J)
		Vehicle Accidents (RAC: L)	All site personnel operating motor vehicles shall comply with all Federal, state, and local traffic regulations. Personnel shall only use vehicles that are in good condition and are safe to operate. Personnel shall routinely inspect vehicles. All personnel will drive defensively, wear seatbelts while vehicles are in motion, and comply with site speed limits. Backing of vehicles shall be avoided when possible. Extra care shall be taken to back vehicles when unavoidable. Follow the requirements of EC&HS 110. (EM385-1-1 01.D; EM385-1-1 18.A, B, C)
		First Aid and Emergencies (RAC: L)	Follow emergency procedures outlined in the HASP. Two onsite personnel will be trained in first aid and CPR. (EM385-1-1 03.A; EM385-1-1 01.E)
		Radiological Contamination (RAC: L)	Personnel accessing and working in the DU Impact Area will be trained in accordance with the HASP. Work will be conducted in accordance with the HSWP. Minimize contact with radioactive material.
B. Preparation for the Installation of Monitoring Equipment	All	UXO Hazards (RAC: L)	Personnel will be trained in the recognition of UXO and will follow the UXO Safety Procedure in the HASP (SAIC UXO/OE/CWM Safety Procedure). Survey potential UXO areas prior to accessing. Avoid all UXO. (EM 385-1-1, EP 385-1-95a, and ER 385-2-92)
C. Installation of Monitoring Equipment	All	Excavation Hazards (RAC: L)	Excavations present additional hazards, including contact with underground utilities/UXO, cave-ins, etc. All excavations will comply with EM 385-1-1 Section 25 and 29 CFR 1926 Subpart P. Specific requirements include competent person inspections prior to entry and establishment of protective systems for personnel entry into excavations deeper than 5 feet or where there is a potential for cave-ins. The Field Manager will ensure these regulations are followed and personnel are trained prior to entry into excavations. (EM 385-1-1, Section 25)

Work Location: Jefferson Proving Ground, Indiana

Task Title: Installation of Monitoring Equipment (including Precipitation, Cave, and Stream/Spring Gauging) and an Electrical Imaging Survey

Work Phase:	**List Work Groups Needed for Each Phase:**
A. General Site Safety	A. All
B. Preparation for the Installation of Monitoring Equipment	B. All
C. Installation of Monitoring Equipment	C. All
D. Preparation for the Electrical Imaging Survey	D. All
E. Electrical Imaging Survey	E. All

Activity Steps	Work Groups	Hazards	Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
		Heavy Equipment Hazards (RAC: M)	Only trained personnel will operate heavy equipment. Personnel working around heavy equipment will stay out of the danger/crush areas around the equipment and will establish eye/voice contact with the operator prior to entering these areas. Operators must be aware of others working around their equipment. Equipment shall be inspected prior to use. Damaged/unsafe equipment will not be used. (EM 385-1-1, 16.A)
		UXO Hazards (RAC: L)	Personnel will be trained in the recognition of UXO and will follow the UXO Safety Procedure in the HASP (SAIC UXO/OE/CWM Safety Procedure). Survey potential UXO areas prior to accessing. Avoid all UXO. (EM 385-1-1, EP 385-1-95a, and ER 385-2-92)
D. Preparation for the Electrical Imaging Survey	All	UXO Hazards (RAC: L)	Personnel will be trained in the recognition of UXO and will follow the UXO Safety Procedure in the HASP (SAIC UXO/OE/CWM Safety Procedure). Survey potential UXO areas prior to accessing. Avoid all UXO. (EM 385-1-1, EP 385-1-95a, and ER 385-2-92)
E. Electrical Imaging Survey	All	Electrical Shock (RAC: L)	Although this is a very small hazard potential, personnel could get shocked if the SuperSting® is activated and personnel are handling the electrodes. The shock is not likely to be hazardous to the person. However, the Field Manager and EI equipment operator will ensure that EI equipment is disconnected from the power source when personnel are handling electrodes.
		Equipment Use Hazard (RAC: L)	All personnel will be familiar with the function of the equipment before use. Electrodes will be inserted into the ground only in areas that have been cleared of UXO. (EM 385-1-1, EP 385-1-95a, and ER 385-2-92)
		UXO Hazards (RAC: L)	All personnel will be familiar with the function of the equipment before use. Personnel will follow the manufacturer's recommendations for safe use of the SuperSting® and associated electrodes as presented in the Users Manual (AGI 2006). There is a small potential that JPG may contain UXO that have fuses that could be activated through the EI process. Due to this potential hazard, a minimum safe distance of 1,000 meters (approximately 1.1 miles) will be established and adhered to during the EI survey. The Field Manager and EI equipment operator will ensure that all personnel are beyond the minimum safe distance prior to and during activation of the EI equipment. The Field Manager and EI equipment operator also will ensure that EI equipment is disconnected from the power source when personnel are handling electrodes. (EM 385-1-1, EP 385-1-95a, and ER 385-2-92)

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APPENDIX C

HEALTH AND SAFETY WORK PERMIT

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HEALTH AND SAFETY WORK PERMIT

HSWP No: S-06-003.0 Date Issued: 6/12/2006 Expiration Date: 6/12/2007

Client: US Army Location: Jefferson Proving Ground Site: DU Area

Job Description: Installation of stream and cave spring monitoring equipment, and an electronic imaging survey in the DU Impact Area.

H/S COVERAGE	DRESS REQUIREMENTS		DOSIMETRY REQUIREMENTS
☐ Continuous	☐ Cotton Coverall	☐ No personal outer-clothing.	☐ Self Reading Dosimeter
☒ Intermittent	☐ Canvas Hood	☐ Tape gloves and booties to PCs	☐ Whole Body TLD
☒ Buddy System	☐ Paper Coveralls	☐ Other____	☐ Ring TLD
☐ Confined Space Entry Permit.	☐ Plastic Coveralls	☐ Other____	☐ Electronic Dosimeter
☒ Notify H/S upon entry to DU Impact area.	☐ Tyvek Coveralls	☐ Other____	☐ Multi-Badging
☐ HSWP Entry / Exit Log Required	☐ Skull Cap	☐ Other____	**RESPIRATORY PROTECTION**
☐ HPT perform all personnel frisk surveys	☐ Cloth Gloves	☐ Other____	☐ Air Purifying Respirator
☒ Radiological Workers may perform personnel frisk surveys (note 1)	☐ Rubber Gloves	☐ Other____	☐ Powered Air Purifying Respirator
	☐ Plastic Booties	☐ Other____	☐ Air Line Respirator
	☐ Lab Coat	☐ Other____	☐ SCBA
	☒ Surgeon's gloves (note 2)		☐ Other____
	☐ Rubber Apron		☐ Other____
	☐ Rubber Shoe covers		

SAFETY EQUIPMENT

☒ Safety Glasses	☐ Face-Shield	☐ Other ____
☒ Steel-toed Shoes	☐ Leather Apparel	☐ Other ____
☐ Goggles	☐ Hearing Protection	☐ Other ____
☒ Hard Hat (note 3)	☐ Welding Shield w/ ____ number lens	☐ Other ____

ADDITIONAL REQUIREMENTS (ALARA considerations, pen and ink changes, safety, job specific):

1. Frisk hands and feet prior to leaving the work area and/or prior to leaving the DU Impact Area.
2. As directed by the HPT.
3. When overhead hazards are present.
4. Follow SAIC EC&HS Procedure 120 UXO/OE/CWM Safety.
5. Hold Point: The EI equipment must be disengaged from the power source during handling of electrodes. All personnel must remain outside the minimum safe distance (1,000 meters) during activation of EI equipment.

A PRE-JOB BRIEFING IS REQUIRED PRIOR TO ENTRY ON THE HSWP

Reviewed By: ____________________ **Date:** ________
Local EC&HS Representative

Approved By: ____________________ **Date:** ________
Radiation Protection Manager

Collective dose goal: 0.0 **Approved by:** ________ **Date:** ________

Terminated by: ____________________ **Date:** ________

Revision termination____ **HSWP termination:**____ **(check one)**

Reason for termination: ____________________

HSWP CONTINUATION SHEET

Page 2 of 2

QUARTERLY ASSESSMENT VERIFICATION HSWP Number S-06-003.0			
Date (month/day/year)	Signature of RPM/HPT	Revision Required Yes*	No

*If "Yes", state the reason a revision is required and whether a pen and ink change or complete revision is necessary:

Revision approved: ______________________________ Date: ______________
RPM

PRE-JOB BRIEFING

HSWP No. S-06-003.0 **Date:** ____________

PRE-JOB BRIEFING CHECKLIST **INITIALS**

- Discuss Pre-job ALARA review, if applicable ☐
- Review requirements of HSWP ☐
- Review the step-by-step aspects of the job, ensuring all personnel are aware of their required actions ☐

Job Description: Installation of monitoring equipment and performance of the electrical imaging (EI) survey at the JPG DU Impact Area.

Attachment 4

PERSONNEL ATTENDING PRE-JOB BRIEFING for HSWP 06-003.0

Printed Name	Signature*	HPID No.

*** By signature, personnel certify they have read, understand, and will comply with the requirements of the HSWP.**

Signature ______________________________ ______________
RPM Date

APPENDIX D

ANOMALY AVOIDANCE SAFETY BRIEFING SHEET

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ANOMALY AVOIDANCE SAFETY BRIEFING SHEET

INTRODUCTION

This safety briefing sheet summarizes the minimum precautions to be taken when accessing areas containing unexploded ordnance (UXO). Additional SAIC requirements related to UXO safety are provided in Appendix A.

The DU Impact Area may contain UXO, which may be found on the surface and/or in the subsurface. The varying types of ammunition, angles of fire, types of soil, and depths to bedrock at JPG preclude the accurate estimation of the depth of any subsurface UXO. Some of the activities planned at JPG during the electrical imaging (EI) and installation of stream/cave stream gauges are intrusive. Therefore, the primary objective during these activities will be avoidance of UXO. Avoidance of UXO will be accomplished by field personnel trained on UXO awareness, conducting magnetometer surveys in areas where UXO may be located, and conducting intrusive work only in cleared areas.

RESPONSIBILITIES

SAIC's Senior UXO Supervisor and/or UXO subcontractors have the following responsibilities for UXO avoidance:

- Conduct a UXO safety briefing for all site personnel and visitors
- Obtain any and all utility clearances and/or excavation permits for underground utilities as required
- Complete an access clearance of the proposed work area that is large enough to support all planned activities
- Maintain onsite authority on all UXO procedures and safety issues with the Senior UXO Supervisor having final authority.

All **Field Sampling Team Members** are responsible for conducting their tasks in a safe manner, attending required UXO training, understanding and adhering to the UXO safety precautions, and reporting any unsafe or questionable conditions to the UXO Safety Officer.

Instructions for Conducting Anomaly Avoidance

- SAIC's Senior UXO Supervisor or UXO subcontractor will conduct an access survey (visual and of the footpath lanes approaching and leaving all areas where the soil verification will be conducted).
- SAIC's Senior UXO Supervisor or UXO subcontractor must complete an access survey of an area around the proposed investigation site that is large enough to support all planned operations (assume ingress/egress is 100 feet long and 10 feet wide and work areas are 50 feet in diameter so a backhoe can be used, if required).
- A Schoenstedt® Fluxgate Magnetometer will be used to locate anomalies just below the surface.
- If subsurface anomalies are identified or surface UXO is encountered, they will be clearly marked using pin flags. SAIC's Senior UXO Supervisor or UXO subcontractor will establish a system of flagging colors that will distinguish subsurface anomalies and surface UXO and establish ingress/egress route boundaries based on subsurface anomalies and surface UXO.
- Only UXO qualified personnel will perform anomaly avoidance operations.

Instructions When Encountering UXO

- If UXO is encountered during soil verification activities, SAIC's Senior UXO Supervisor or UXO subcontractor will immediately cease all activity. The Senior UXO Supervisor or UXO subcontractor will immediately notify Dr. Joe Robb of the U.S. Fish and Wildlife Service (USFWS) (812-273-0783). The Senior UXO Supervisor or UXO subcontractor will identify the location of the UXO for further disposal by the Explosive Ordnance Disposal (EOD) Response Team.
- All SAIC and subcontractor personnel will proceed to a safe evacuation distance (1 mile) from the UXO and avoid that area until the item has been disposed of by the EOD Response Team.
- DO NOT touch or move any munitions regardless of the markings or apparent condition.

General UXO Information

- The cardinal principle to be observed involving UXO is to limit the exposure of a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material consistent with a safe and efficient operation.
- The age or condition of ordnance does not decrease its effectiveness. Ordnance that has been exposed to the elements for extended periods becomes more sensitive to shock, movement, and friction due to the fact that the stabilizing agent in the explosives may be degraded.

Site-specific UXO Rules

- All SAIC and subcontractor workers will be trained to recognize the types of ordnance that may be present (e.g., JPG UXO safety video from USFWS).
- The UXO Team composition will consist of at least two personnel, one who must be a UXO Technician II. The UXO Team will be onsite during all sampling activities. The UXO Team may include additional UXO personnel, geophysicists, or any other team members, depending on site- and task-specific conditions/requirements.
- Local fire, police, rescue authorities, and medical facilities that would be utilized for emergency treatment of injured personnel will be notified prior to the start of any UXO operations to ascertain their response capabilities and to obtain a response commitment.
- All individuals will receive a safety briefing and sign the visitors' log prior to entering the exclusion zone.
- Daily "tailgate" safety briefings will reiterate the hazards and controls as they pertain to UXO avoidance at this site.
- All individuals will be escorted by SAIC's Senior UXO Supervisor or UXO subcontractor when not in a cleared area. Escorted personnel will follow behind the UXO escort. No personnel, except for SAIC's Senior UXO Supervisor or UXO subcontractor while performing avoidance, are allowed outside the surveyed areas.
- Personnel subject to this guidance will not handle, move, or otherwise disturb ordnance or any items that cannot be identified as not being ordnance.
- Consider ordnance that has been exposed to fire as extremely hazardous. Chemical and physical changes may have occurred to the contents, which render them more sensitive than they were in their original state.
- Always assume that ordnance contains a live charge until it can be ascertained otherwise.
- Employ the "buddy system" at all times.

- No personnel will be allowed into nonsurveyed UXO areas without an escort by a UXO qualified individual.
- First aid equipment and fire extinguishers will be available onsite during UXO avoidance activities.
- During the EI and installation of gauges, the area must be visually surveyed and each location must be cleared to a minimum depth of 1 foot before additional electrodes (stakes) can be driven into the ground or soil excavation can take place. If UXO is detected at any proposed EI array or gauge locations, SAIC's Field Manager will select a alternate location for these activities.
- DO NOT be misled by markings on the ordnance stating "practice bomb," "dummy," or "inert." Even practice bombs contain explosive charges that are used to mark/spot the point of impact. The item(s) also could be mismarked.
- DO NOT rely on color codes for positive identification of ordnance item(s) or their contents.
- DO NOT visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek shelter.
- DO NOT use radios or cellular telephones in the vicinity of suspect ordnance.
- DO NOT walk across an area where the ground surface cannot be seen. If dead vegetation or animals are observed, leave the area immediately because of potential contamination by chemical agents.
- DO NOT drive vehicles into a suspected UXO area; use clearly marked lanes. Clearance lanes must be at least twice as wide as the widest vehicle.
- DO NOT carry matches, cigarettes, lighters, or other flame or spark-producing devices into UXO areas of the site.

REFERENCES:

DOD (U.S. Department of Defense). 1997. DOD Contractors' Safety Manual for Ammunition and Explosives, DOD 4145.26-M, Under Secretary of Defense Acquisition and Technology.

DOD. 2004. U.S. Department of Defense Standard 6055.9-STD, DoD Ammunition And Explosives Safety Standards, Under Secretary of Defense for Acquisition, Technology and Logistics. October.

SAIC (Science Applications International Corporation). 2002. Engineering and Environmental Management Sector. EC&HS Procedure No. 120 – UXO/OE/CWM Safety. May 10.

U.S. Army. 1997. U.S. Army Explosives Safety Program, Army Regulation (AR) 385-64. Headquarters Department of the Army, Washington, DC. November 28.

U.S. Army. 1999. U.S. Ammunition and Explosives Safety Standards, Department of Army Pamphlet (PAM) 385-64. Headquarters Department of the Army, Washington, DC. December 15.

USACE (U.S. Army Corps of Engineers). 2000. Ordnance and Explosive Response. EP 1110-1-18. Headquarters Department of the Army, Washington, DC. April 24.

USACE. 2003a. *Safety and Health Requirements Manual*, EM 385-1-1. November.

USACE. 2003b. *Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste and Ordnance and Explosive Waste Activities*, Appendix B, ER 385-1-92. July.

USACE. 2004a. Munitions and Explosives of Concern (MEC) Support During Hazardous, Toxic, and Radioactive Waste (HTRW) and Construction Activities, Engineering Pamphlet (EP) 75-1-2. Headquarters Department of the Army, Washington, DC. August 01.

USACE. 2004a. Basic Concepts and Considerations for Munitions and Explosives of Concern (MEC) Response Action Operations, EP 385-1-95a. Headquarters Department of the Army, Washington, DC. August 27.

APPENDIX E

JPG BIOLOGICAL HAZARD SURVEY

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JPG BIOLOGICAL HAZARD SURVEY

Please take a moment to fill out this survey. It will help us in providing you with the best and most efficient prevention and emergency response measures should you need medical attention from contact with biological hazards in the field.

Thank you for your help in this matter.

Name: ______________________________ Employer: ________________

Signature: ______________________________ Date: ________________

Are you allergic or have you had adverse reactions to, including phobia, to any of the following:

☐ Bees	☐ Poison Ivy
☐ Wasps	☐ Poison Oak
☐ Hornets	☐ Poison Sumac
☐ Ticks	☐ (other)
☐ Spiders *	☐ (other)
☐ Snakes *	☐ (other)

* List the type(s): ____

____

____

Is there any particular first aid item we should have on hand to minimize adverse reactions from contact with these hazards as prescribed by a doctor due to a past adverse reaction (e.g., injectable epinephrine or "epi pen" for bee stings)?

____

____

____

NOTE:

The Job Safety Analysis (JSA) for each field activity lists controlling biological hazards in the following ways:

- Tape interfaces of clothing
- Use insect repellant
- Perform self-inspection for ticks
- Inform supervisors of allergies to biological hazards
- Wash hands and face when leaving areas where poisonous plants are present.

First aid kits are located in the site office and each work vehicle.

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