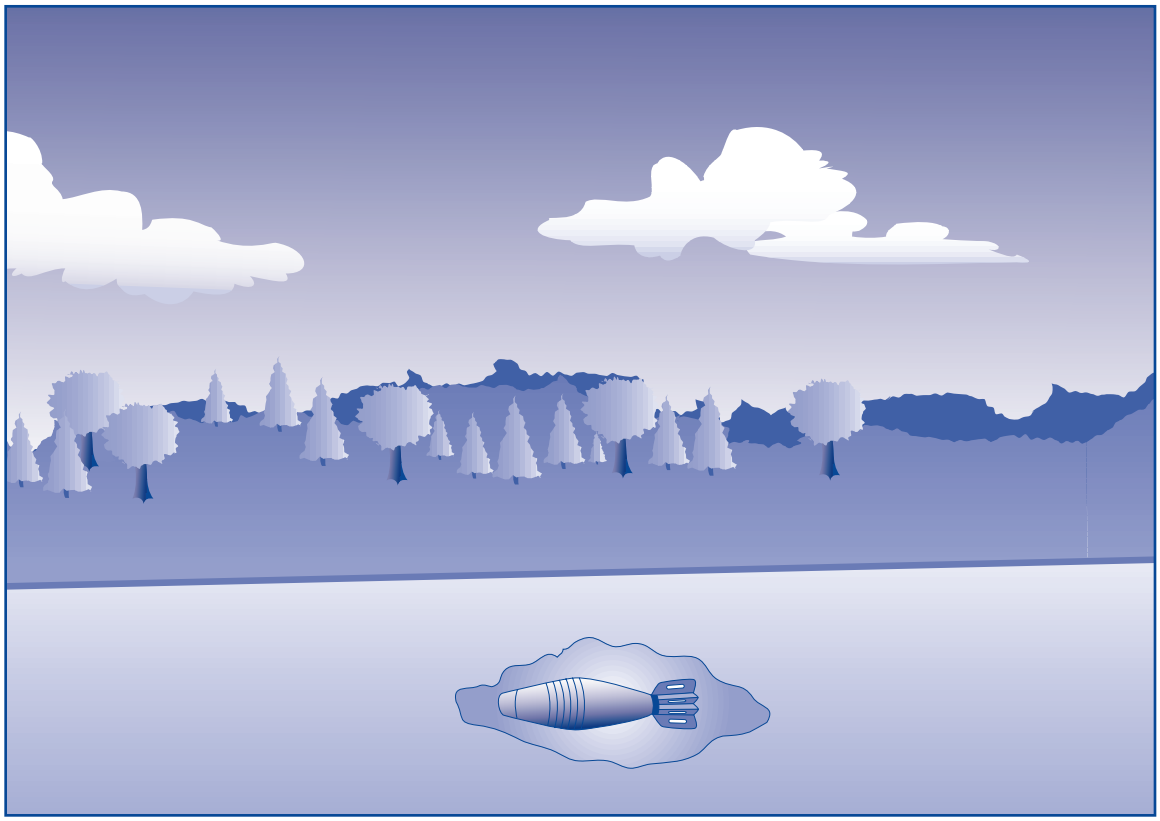
Case Study

Breaking Barriers to the Use of Innovative Technologies:
State Regulatory Role in Unexploded Ordnance Detection and Characterization Technology Selection



December 2000

Prepared by
Interstate Technology and Regulatory Cooperation Work Group
Unexploded Ordnance Work Team

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EXECUTIVE SUMMARY

The Interstate Technology and Regulatory Cooperation (ITRC) Unexploded Ordnance (UXO) Work Team wrote this case study analysis to provide an analysis of the role state regulators play in the ordnance and explosive waste (OEW) site characterization and technology selection process. The UXO Work Team also hopes to demonstrate how early and meaningful state regulatory involvement in the technology selection process can expedite more efficient regulatory concurrence and encourage the use of innovative technologies. Finally, this document will broadly map the technology selection and UXO contracting processes and provide recommendations as to where state regulatory input would best be served.

The UXO Work Team held a national summit in May 1999 in conjunction with the UXO/Countermine Forum 1999 to initiate this effort. The summit's purpose was to determine what barriers exist in common among the states regarding the application of advanced and/or innovative technologies and to find ways to remove those barriers. During this summit, the team was not aware of any incentives for using innovative technologies and believed that the initial use of innovative technologies must be encouraged before a contract has been awarded. The group decided that the key to encouraging the use of innovative and advanced technologies is to include a site-specific technology prove-out test (see Section 1.0) prior to contract award or request for proposal (RFP) development.

The UXO Work Team decided to focus on the contracting process in looking for ways to insert meaningful state regulatory participation. To this end, the team developed a detailed questionnaire for determining the level of state regulators' participation in the site characterization and technology selection process on UXO-contaminated sites in their states. Each questionnaire was then summarized and analyzed.

Several state regulators provided site-specific case study information on selected sites within their states containing known UXO contamination. Section 2.0 of this document summarizes the case study information, their similarities and distinctions, and uses that information to support the team's original hypothesis. Section 2.0 also describes the change in focus and methodology of this document from the original hypothesis due to evolving U.S. Department of Defense (DoD) policy. Section 3.0 broadly describes DoD's cleanup objectives and the current status of state involvement in the site characterization and technology selection process. It describes the main steps of the contracting process as compared to the level of participation each state experienced. Section 4.0 of the document provides an analysis of the case study data and outlines incentives for encouraging different parties to participate in the decision process. Finally, Section 5.0 presents the UXO Work Team's conclusions that early and consistent communication and involvement in the site characterization and technology selection process will positively impact the cleanup process. Section 5.0 also offers the team's recommendations to improve the process (Subsection 5.2).

During the development of this document, the involved parties have increasingly recognized the importance of early and meaningful state regulatory and stakeholder participation. ITRC and the UXO Work Team hope that this document will serve as a catalyst to improve state, tribal, and federal communication in regard to UXO/OEW contamination. This improvement in information exchange will help make the process more transparent to the community and other private stakeholders, who are the true end users of the land.

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Fort Ord, CA
Former Lowry Bombing and Gunnery Range, CO
Former Brooksville Turret and Gunnery Range, FL
Camp Grant, IL
Fort Sheridan, IL
Savanna Army Depot, IL
Camp Ellis, IL
Former Illinois Ordnance Plant, IL
Fort Hancock, NJ
Former Umatilla Chemical Depot, OR
Myrtle Beach Air Force Base, SC
Yellow Jacket, UT

BREAKING BARRIERS TO THE USE OF INNOVATIVE TECHNOLOGIES:
STATE REGULATORY ROLE IN UNEXPLODED ORDNANCE DETECTION AND CHARACTERIZATION TECHNOLOGY SELECTION

1.0 DEFINITION OF TERMS

For the purposes of this document, the following definitions are provided to describe materials found on the range. Where a regulatory issue is associated with the definition, a source has been cited.

Ammunition, Explosives, and Other Dangerous Articles (AEDA)	*(Source: DoD IG 97-213).* Any explosive or chemical-based munitions, such as small- and large-caliber ammunition, aerial bombs, grenades, mines, missiles, and rockets. In peacetime, the military departments expend most AEDA in controlled testing and training environments where its residue can be collected and disposed or sold as scrap.
Ordnance and Explosives (OE)	*(Source: Draft Literature Review Report, Former Fort Ord, CA, January 4, 2000)* OE is a nonpromulgated term that generally includes ordnance scrap and unexploded ordnance (UXO). *(Source: HQDA Policy Memorandum "Explosives Safety Policy for Real Property Containing Conventional OE")* OE consists of either (1) or (2) below: (1) Ammunition, ammunition components, chemical or biological warfare materiel or explosives that have been abandoned, expelled from demolition pits or burning pads, lost, discarded, buried, or fired. Such ammunition, ammunition components, and explosives are no longer under accountable record control of any DoD organization or activity. (2) Explosive Soil. See definition under "Explosive Soil. *(ER 1110-1-8153)*
Unexploded Ordnance (UXO)	*(Source: 40 CFR. Subpart M sections 266.202)* Military munitions that have been primed, fused, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

1.1 INTRODUCTION

An increase in environmental compliance and cleanup activities on former military property has forced states to provide regulatory oversight and concurrence on sites within their respective jurisdictions that are contaminated with unexploded ordnance (UXO). Limited experience and training in dealing with UXO, insufficient funding, and difficulties in the ability to quantify the unknown have added to the frustration states feel when they are forced to grapple with, and make regulatory decisions about UXO-contaminated property. In order to provide regulatory concurrence on UXO sites and be able to adequately communicate residual risk, the states need to associate a level of confidence in the site characterization technologies chosen to investigate the nature and extent of UXO contamination.

At the time this project began, there was no significant state or tribal notification of, or participation in, ordnance and explosive waste (OEW) site characterization request for proposal (RFP) development, nor were OEW site characterization statements of work (SOW) reviewed by states for inclusion of advanced or innovative technologies. The states expressed that UXO site characterization RFPs should reinforce and encourage the use of innovative technologies and the notion of a site-specific technology prove-out or a test bed. States are in agreement that RFPs should be performance-based rather than the current contract structure, which seems to promote the repeated use of one or two proven, but less innovative, technologies.

Site-specific technology prove-out testing consists of operating various UXO detection technologies on the site where the investigation will occur. The objectives of this prove-out testing are to assess: 1) the capabilities of various technologies to detect UXO in the various environmental settings that will be encountered during the UXO investigation, and 2) the ability to reacquire the positions of UXO detected for excavation. During the testing, the following parameters must be measured: detection rates, maximum detection depths, false positives, and the accuracy of the positioning systems. The objective is to select the best UXO detection technology for the site under investigation.

1.2 Background

The UXO Work Team convened a national summit in 1999 consisting of state, federal, tribal, and industry representatives from across the United States to identify barriers to the use of innovative and advanced technologies at UXO-contaminated sites and to come up with ways to remove those barriers. The work team members and summit participants agreed that the keys to removing barriers to the use of innovative and advanced technologies lie in including a site-specific technology prove-out system early in the contracting process. They also agreed on the importance of having early, consistent, and meaningful state regulator and stakeholder involvement in the technology selection and site characterization process. To this end, the work team determined that they should focus on the contracting process. Several state regulators offered to document, by way of case study questionnaires, their individual experiences with regard to their level of involvement in the technology selection and site characterization for UXO-contaminated sites (see Table 2-1 and Appendix C).

During this summit, the group identified several issues (outlined in Section 5.0) that kept state and federal representatives from working together effectively. The group agreed that the lack of

communication between states and the Department of Defense (DoD) perpetuated an atmosphere of mistrust. The states felt that DoD had not provided "full disclosure" on issues such as the extent of contamination, residual safety risks, and innovative technology selection. Generally, states were not made privy to the site characterization or the technology selection process, which occurs before or during the RFP process. The surveys indicated that they were not made aware of how, when, or why a particular characterization technology was chosen for sites within their state. This lack of early state regulatory involvement invariably affected the resulting regulatory actions and decisions.

The states have concluded that earlier state regulator involvement in the technology selection and RFP development process would raise state regulator confidence in the specific remediation process and expedite more efficient regulatory concurrence. States believe that part of the solution lies in finding ways to encourage characterization and remediation technologies that can detect the most ordnance, in the safest manner, in the least amount of time, and with the least associated cost to the responsible party. Since these issues were identified, significant progress has been made at sites such as Fort Ord in California and the former Lowry Bombing and Gunnery Range in Colorado.

The Interstate Technology and Regulatory Cooperation (ITRC) UXO Work Team and DoD recognize the inefficiencies in the past relationship between state regulatory authorities and DoD-led remediation efforts. In an effort to improve this relationship, the ITRC UXO Work Team has produced this document containing site-specific anecdotes detailing situations where state regulatory involvement in technology selection was initially omitted and, if applicable, the consequent actions required to bring the site to a mutually acceptable condition. This document maps the technology selection and RFP process and makes recommendations as to where state regulatory input would best be served, along with examples of successful DoD- and state-coordinated remediation efforts.

2.0 CASE STUDIES

2.1 Methodology and Objectives

The UXO Work Team held a national summit in Atlanta, Georgia during May 1999, in conjunction with the 1999 UXO Forum, to enlist the help of state regulators interested in encouraging contracting practices that would ensure the best use of available technologies at UXO- and OEW-contaminated sites. Several state regulators dealing with OEW site characterization were sent a case study questionnaire (see Appendix B) asking questions pertaining to their involvement in the technology selection and RFP development processes on UXO-contaminated sites within their states.

The questionnaires asked the regulators to provide information on site background and the source and extent of site contamination. The regulators were also asked to provide information regarding the site characterization process, including statistical sampling methods, surface and subsurface investigation techniques, and the technologies applied. They were then asked to explain in detail their states' involvement, if any, in the RFP and technology selection process, their interpretation of the success of the selected technologies, and the resultant regulatory oversight and/or decisions.

Initially, this effort focused on gathering sufficient information to determine if contracting procedures were a limitation to selecting innovative technologies for UXO detection. After the case study questionnaires were prepared and distributed, significant progress was made in this area by two states at different sites, Fort Ord in California and the former Lowry Bombing and Gunnery Range in Colorado. Many of the other sites and states involved in the UXO case study effort were not as involved, and the type of information received from the questionnaires was much more general in nature. As a result, the conclusions that can be derived from this case study are limited. Therefore, this document does not attempt to quantify and assess the data relative to the initial problem statement but instead focuses on using the two sites as benchmarks and summarizing the general information for all sites.

2.2 Limitations

Due to the increasing awareness of issues associated with UXO and OEW contamination and the push to transfer or closeout more former military property, state regulators have had their hands full dealing with UXO regulatory issues. State regulators had to overcome a steep learning curve to be able to provide meaningful regulatory oversight for sites with UXO contamination, and as a result, were often unavailable to respond to the case study questionnaires.

Many of the states that were able to respond did so with limited information. It was evident that many of the state regulators were unable to answer the questions posed because they did not have the information and were not involved in the initial phases of the technology selection process.

2.3 Case Study Data

The case study questionnaires were distributed in September 1999 in an effort to assist the states in responding to their commitment to provide input for this study. Twelve completed questionnaires were received from nine states: California, Colorado, Florida, Illinois, New Jersey, Oregon, South Carolina, and Utah. The UXO Work Team received additional information regarding states' needs for involvement in the technology selection and overall contracting process from Alaska and Ohio. The sites selected by the states for inclusion in this study included formerly used defense sites (FUDS) and base realignment and closure (BRAC) sites. The table on the following page illustrates the sites selected, the site name, the extent of contamination, and the site designation.

Table 2-1: Summary of Submitted Case Study Questionnaire Information

State	Regulatory Agency	Site Name	Site Designation	Site Size in Acreage	
				Total	Contaminated
California	California Environmental Protection Agency – Department of Toxic Substances Control	Fort Ord	BRAC	28,000	Total Acreage Unknown
Colorado	Colorado Department of Public Health and Environment	Former Lowry Bombing and Gunnery Range	FUDS	60,000	~7,500
Florida	Florida Department of Environment	Former Brooksville Turret and Gunnery Range	FUDS	10,200	Under Investigation
Illinois	Illinois Environmental Protection Agency	Camp Grant	FUDS	400	400
	Illinois Environmental Protection Agency	Fort Sheridan	BRAC	712	58
	Illinois Environmental Protection Agency	Savanna Army Depot	BRAC	13,062	7000
	Illinois Environmental Protection Agency	Camp Ellis	FUDS	17,445	1580
	Illinois Environmental Protection Agency	Former Illinois Ordnance Plant	FUDS	44,000	25
New Jersey	New Jersey Department of Environmental Protection	Fort Hancock	FUDS	1624	Under Investigation
Oregon	Oregon Department of Environmental Quality	Former Umatilla Chemical Depot	BRAC	19,728	1750
South Carolina	South Carolina Department of Health and Environmental Conservation	Myrtle Beach Air Force Base	BRAC	3,937	3
Utah	Utah Department of Environmental Quality	Yellow Jacket	FUDS	1000	Under Investigation

The completed questionnaires are summarized in Appendix C of this report. Each of the state regulators who submitted case study responses indicated a general lack of communication between the state and the responsible DoD agency (predominantly the U.S. Army Corps of Engineers and most prominently at the former Fort Ord and former Lowry Bombing and Gunnery Range). This lack of communication was manifested not only in the initial stages of the contracting process, but also after contract award. In the case of the former Brooksville Turret and Gunnery Range in Florida, state regulators only became aware that work was to be conducted at a particular site when the selected contractor applied for the required state permits to begin site work. At this point, technology selection was already complete with little or no technology prove-out.

Many of the case study responses indicated that the assigned state regulator often had little or no previous experience with UXO or OEW contamination. This has forced state regulators to quickly "get up to speed" on UXO detection and characterization technologies, often causing the regulating community to rely upon the regulated community to provide the necessary information. State regulators recognized the need to increase their knowledge of UXO and OEW issues. They understand the importance of training on available technologies and on technologies' limitations in order to meaningfully participate in the technology selection process. To this end, this UXO Work Team has chosen to address the need for basic UXO training courses as one of its FY01 deliverables.

State regulators who participated in the 1999 Summit or who submitted a case study questionnaire agreed upon the need for conducting site-specific technology prove-outs. They all agreed that technology prove-outs are necessary due to the differences in terrain from site to site. These differences in physical site characteristics comprised the main differences in the various questionnaire responses. Experience has proven that "one size doesn't fit all" in detection and characterization technologies at UXO sites.

The case studies highlighted that a central data warehouse to compare field data results for various technologies and their success rates under differing physical conditions does not exist. Different perspectives on the performance characteristics of technologies have repeatedly been shown between technology demonstrations and field applications. A central data warehouse would be a valuable tool for state regulators to ascertain the true capabilities of various technologies performed on their sites. A centralized database would also provide consistency in the parameters by which the technologies are judged. At the time the final draft of this document was under review, the Environmental Security Technology Certification Program (ESTCP) was providing funding to start a series of Standardized UXO Technology Demonstration sites with a centralized database for the field data results.

3.0 PROCESS OVERVIEW

3.1 Broad Contracting Process Overview

The contracting process for UXO and OEW removal actions (RAs) can be described in six basic steps. The UXO/OEW site characterization technology selection and contracting process begins with site/contaminant identification and the completion of the archival search report and ends with the completion of the project and basically follows the following broad RFP processes:

1. *Site/Contamination Identification and Archival Search Report*—At this stage, the responsible party identifies a site as a current or former military property containing some level of contamination and in need of site characterization/ remediation/ cleanup. This step may result from an archival search report completed by the installation or may be precipitated by contamination identification. Some installations and military command centers have initiated preliminary steps to inventory the number of potential UXO range sites.

2. *Project Scoping*—After identification of sites needing some form of characterization/ remediation, the "need" is scoped out for contract outsourcing. This is also the stage where technologies are identified and the process of technology selection formally begins.

3. *RFP Development*—The information collected during the project-scoping phase leads to a formal acquisition process and involves the development of an RFP. Technology options are often initially discussed and sometimes pre-selected during this phase.

4. *Contract Award*—Whether development of an RFP leads to full competition or a sole source award, a contract is awarded and negotiated with a successful offeror. By the time of the contract award, the site characterization technologies have typically been selected.

5. *Project Implementation*—At this stage, the project is initiated and the site characterization technology is selected and implemented.

6. *Projection Completion*—Projects involving selected site characterization technologies are completed at this time, unless the recommended solution is an institutional control, such as fencing.

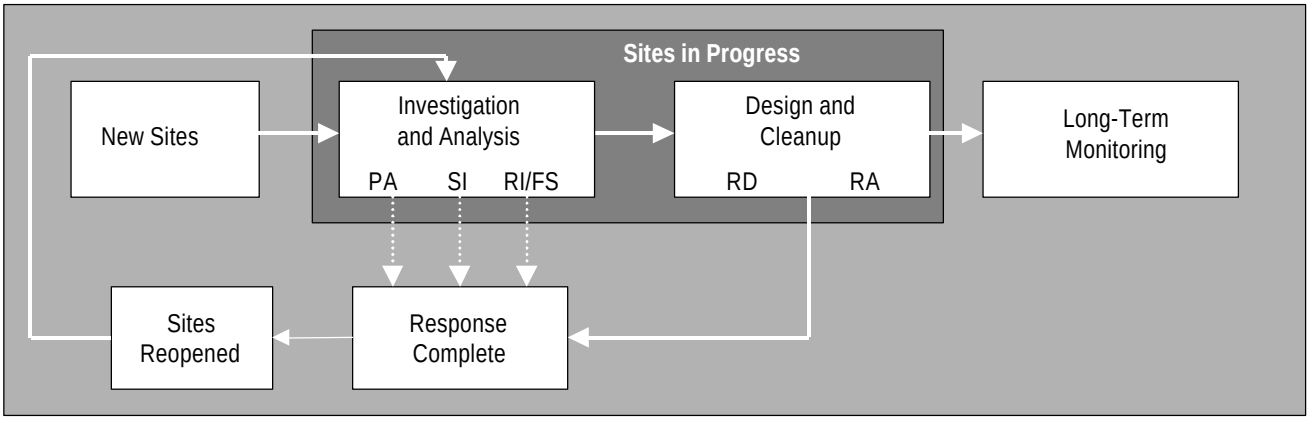
For practical purposes, early involvement or true partnership means involving states at some point during Step 1 (site/contamination identification and archival search report) of the site cleanup process. No involvement indicates that states have not become involved until Step 6, well after site characterization technologies have been selected and used. Depending on the scope of an RFP, the site cleanup process may include one or more places where RFPs are developed and subsequently awarded. Some DoD service centers package all of the steps of the site cleanup

process (site characterization and remediation/cleanup) into one contracting vehicle, while others separate these steps into two or more discrete packages. Therefore, state involvement in the RFP process can involve one or more separate efforts to select technologies and provide meaningful review and comment on proposed UXO characterization or remedial solutions.

3.2 Decision Process Participation Incentives

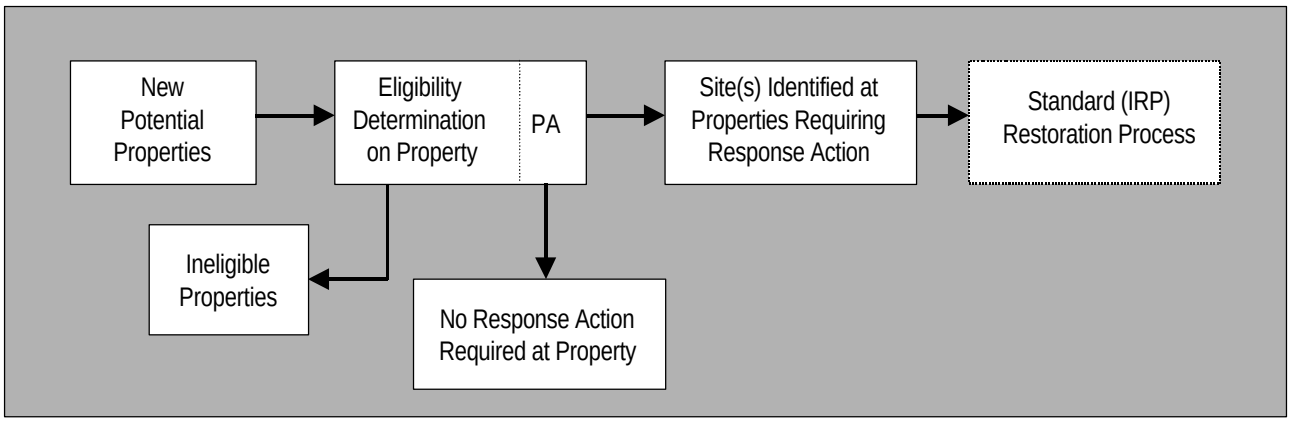
The standard environmental restoration project process for BRAC military installations is shown below in Figure 3-1. At the preliminary assessment (PA) phase, an assessment is performed to determine (1) the funding eligibility of the property for program funding and (2) to what extent, if any, contamination exists. If the property is eligible for funding and further action is required, the property is delineated into specific projects designed to tackle the environmental contamination problems unique to that property's site conditions.

Figure 3-1: Typical Restoration Project Process -- BRAC



The environmental restoration process for formerly used military properties, known as FUDS, is similar to that of BRAC installations. Figure 3-2: Project Activities at FUDS Properties, shown on the next page, illustrates the progression of FUDS properties from initial discovery through final disposition.

Figure 3-2: Project Activities at FUDS Properties



These environmental cleanup project processes, for both FUDS and BRAC and closed, transferred, and transferring (CTT) military properties, include one or more opportunities for the insertion and use of site characterization or remediation technologies. Generally, the cleanup process can be characterized as having two major categories of activity: the characterization of the contamination at a property, and the actual cleanup of the property. The site characterization category of activity corresponds to the first, second, and third elements of the broad process overview described in Section 3.0, and the cleanup category of activity corresponds roughly to the fourth, fifth, and sixth elements of the broad process overview.

It is self-evident that this relationship, early involvement resulting in satisfactory participation, yields benefits to both the state regulator and the military cleanup manager. However, the reality is that 90% of the case studies sampled did not include early participation, resulting in an overwhelming majority of less than satisfactory participation by the regulator in sampled cleanup activities.

3.3 DoD Property Cleanup Objectives

DoD's military services have several objectives as stewards of property requiring environmental cleanup:

- Protection of military and civilian personnel from any safety hazards associated with the contamination.
- Identification and elimination or containment of contamination to protect the environment and the public.
- Prevention of further contamination to protect the environment and the public.

To accomplish these objectives DoD uses a project-based approach that may entail one or several remediation projects, depending on site-specific conditions, for a single property. Project-level activities are designed to achieve the three broad objectives listed above. A well-defined process,

compatible with the requirements of the National Contingency Plan (NCP) and other federal environmental restoration statutes, guides each environmental project's implementation and provides clear milestones, decision points, and activity phases, leading to the ultimate objective of the process—site closeout.

Site closeout is the term used to describe the status of a property or site at which point no additional remediation actions have been identified and the cleanup of the property or site is, in effect, complete. Depending on the site-specific characteristics of the contamination and the technological remedy applied, some long-term operation (LTO), long-term monitoring (LTM), or land-use controls (LUC) may be required, but this does not interfere with the designation of the project as "closed", or completed. In essence, this designation signifies that the overarching objectives for the environmental cleanup have been successfully met.

3.4 Current State Involvement

Each state has its own set of priorities and achieved level of expertise in regard to UXO. Many states such as Alaska, Alabama, California, Colorado, and Illinois have been dealing with issues related to UXO-contaminated sites for quite some time and have had the opportunity to learn a lot about UXO contamination, available technologies, and the associated risks. Many other states are now stepping into the arena and will need to build upon the successes of those predecessor states. The DoD-state relationship (and that of the USACE) and the current level of state involvement in UXO technology selection are rapidly changing. In fact, some of those changes occurred during the evolution of this document while some state regulators were in the process of completing their case study questionnaires, changing their responses completely.

This document has focused on the states of California and Colorado as benchmark states. The current state involvement of California and Colorado offer prime examples of the benefits that can be achieved with cooperative engagement and meaningful participation between state and federal agencies.

The Colorado Department of Public Health and Environment (CDPHE) succeeded in applying a state-approved innovative technology to survey the total acreage of the former Lowry Bombing and Gunnery Range in order to identify potentially contaminated areas. The CDPHE regulators now continually work with the U.S. Army Corps of Engineers project managers to improve the remediation process.

California EPA, Department of Toxic Substances Control (DTSC) benefited from the development of the Strategic Management Analysis, Requirements, and Technology (SMART) Team for the UXO-contaminated sites at Fort Ord, which facilitated state regulator involvement in the contractor and technology selection process. The SMART Team provided program objective memorandum requirements in support of promising OE techniques; technologies; and research, development, and demonstration pilot projects and efforts. As a result, California EPA state regulators experienced early and meaningful involvement in the technology selection process that facilitated greater community support and buy-in and supported technology transfer.

4.0 ANALYSIS OF FINDINGS

4.1 Case Study Findings

As the case study developed, two sites, Fort Ord and the former Lowry Bombing and Gunnery Range, became benchmarks for the group. Fort Ord provided an example of senior-level management committing to breaking barriers to the use of innovative technologies. Through the SMART Team, composed of senior officials from California, the Army, U.S. EPA, and the Army Corps of Engineers, the state of California had a significantly improved level of involvement in contractor selection, as well as in the development of a technology selection matrix and sensor testing procedures. This improved involvement, as well as input into the SOWs, design documents, and other technical reports, has resulted in the review and use of various advanced detection systems as opposed to exclusive reliance on hand-held magnetometry (mag and flag). At the former Lowry Bombing and Gunnery Range, advanced UXO detection systems, including an aerial system Synthetic Aperture Radar (SAR), are being applied.

It's important to point out that the application of innovative technologies alone may not increase the probability of detection. Application of traditional mag and flag technologies in conjunction with innovative technologies may increase the detection and discrimination probability at a given site. DoD is making significant investments in UXO. Many of the innovative technologies are focused on increasing accuracy (i.e., using location data to reacquire the anomaly) and increasing discrimination (i.e., determining whether an anomaly detected is an "explosive-filled or inert ordnance item" versus scrap). As it stands now, there's no magic bullet or black box that can produce 100% detection with 95% confidence even under ideal circumstances.

Currently, DoD is concentrating significant effort to stimulate the design and testing of systems that can discriminate and reduce the number of "false positive"[1] excavations, i.e., digging fewer holes where nonordnance items are found or where anomalies are detected due to natural conditions. The rationale is that by reducing the number of false positives, the cost of the characterization will be reduced.

To overcome barriers to deploying advanced technologies, site-specific conditions must be considered, as well as many other aspects of ordnance remediation. However, to achieve a cost-effective, streamlined approach, early state regulatory involvement must occur. DoD project managers will increase the likelihood of regulatory concurrence on key decision points in the cleanup process if they invite early, meaningful participation and involvement in the site characterization and technology selection process by the state regulator and the community end user.

[1] Please note the term "false positive" is often interpreted with different meanings. For purposes of this report, a "false positive" will be defined as a nonexplosively charged anomaly that was investigated and excavated as a result of detection by any type sensor system.

4.2 Additional Observations

While not part of the survey, several other issues were highlighted as the group wrestled with providing the information, evaluating the data, and completing this document. These issues are:

- Inconsistencies in definitions of terms related to UXO.
- Lack of state resources, such as time, staff, and experience relative to UXO.
- Lack of standardized technology prove-out testing for UXO.
- Lack of communication and coordination among states, U.S. EPA regions and services, and the Army Corps of Engineers.

4.3 Stakeholder Involvement/Community Participation

The guiding principles for public participation in the cleanup of UXO on CTT ranges remain the same as for any cleanup of military property. Involve the public early and often in all remediation decision-making phases. Citizen stakeholders and tribes, like states, are frustrated by an historic lack of involvement they have had in initial site characterization and remedy selection at UXO sites. Additionally, they are looking for a level of confidence in selected technologies that determine the extent and nature of contamination.

Citizens and tribes are particularly concerned about residual risk, extent of contamination, and availability of innovative technologies. In order for communities to have a level of comfort with technology selection, full disclosure in all aspects becomes critical. They want to be made aware of things such as detection probability, depth and concentration of contamination, and rationale for percentages of statistical samplings of the total site. This is of particular concern at sites such as Fort Ord and the Former Lowry Bombing and Gunnery Range where residential development near or on the site is planned or underway. Citizens or tribes are the ultimate end users of transferred property and as such need to be included in all phases just as states do.

As stated in Subsection 3.4 of this document, positive changes in state involvement have occurred during the evolution of this document and continue to occur. One example is the SMART Team effort employed at Fort Ord. While this effort made significant strides in incorporating state regulatory involvement in the contractor and technology selection process, it left out one vital constituency—that of citizens. Though citizens were given updates of the SMART Team's progress, they were not a part of that team. This remains an area of concern specifically at sites where the public will use land that is either adjacent to and/or contains UXO contamination. One of the nine criteria of the NCP is community acceptance of a remedy. If the public is not brought into this phase of the decision-making process, that criteria becomes hard to meet.

4.4 Knowledge Increases Effectiveness of Participation

Being able to meaningfully participate in the contracting and technology selection process is meaningless without training in the available technologies and their subsequent limitations. Increased knowledge of the fundamental efficiencies and limitations of various available technologies will ultimately afford state regulators the ability to have meaningful participation in

the contracting and technology selection process. Participation will facilitate a detailed review of technical documents by state regulators asked to review EE/CAs, OEW RA work plans, and technology overviews and would improve communication and understanding for interested and affected stakeholders.

Currently, there remains a disparity among and between states pertaining to UXO-related issues. Only states that have been immersed in UXO site contamination issues have been able to learn on the job from their numerous collective experiences in dealing with UXO project managers, other UXO technical staff, and the day-to-day issues they face in providing regulatory oversight on UXO-contaminated sites. There are so many conflicting policy issues affecting UXO, and so much information available on the topic, that it can become overwhelming for state regulators who are forced to provide regulatory oversight on UXO-contaminated sites with little to no expertise, insufficient funding and resources, and limited staffing.

Several efforts are underway or already complete to train state regulators in the basic issues related to UXO and UXO-contaminated sites. The ITRC UXO Work Team has also endeavored to build upon already developed training programs developed by both federal and state agencies, such as the Alaska Department of Environmental Conservation, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, and the Army Environmental Center, and develop UXO/OEOEW training specifically catered toward state remedial project managers. This training project will include development, testing, and conducting regional (up to 12) training on UXO/OEW issues for site clean-up managers to assist them in review of work plans and site projects containing UXO/OEW.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The UXO Work Team National Summit in May 1999 resulted in a general consensus that early, regular, and meaningful state regulatory and stakeholder involvement in the contracting and technology selection process will help break barriers to the use of innovative technologies. In order to test this hypothesis, questionnaires were distributed to representatives of several state regulatory agencies, soliciting input in the contracting and technology selection process. The responses were reviewed and have been summarized in Appendix C of this document.

The lessons drawn for both DoD and the state regulator are:

- State regulators should participate in the decision-making process more effectively through early and consistent involvement at the project level, with activities such as the selection and use of innovative technologies resulting in greater confidence and concurrence on key decision points.

- States need to know where and when in the process innovative technologies should be evaluated at a particular site.
- There is disparity among the states with respect to knowledge, experience, and capabilities relative to UXO.
- States need to be more involved in state-of-the-art technology development

5.2 Recommendations

After completing this case study, the ITRC UXO Work Team has developed the following recommendations:

- Establish consistency or document the differences in terminology related to UXO.
- Develop a guidance document to standardize UXO technology prove-out testing.
- Develop a guidance document to apply the data quality objectives (DQO) process to UXO characterization/investigation.
- Develop and distribute fact sheets to states and other stakeholders to educate, inform, and accelerate technology transfer.
- Develop and implement a UXO basic training manual and course.
- Develop and/or support a central data warehouse for all prove-out testing results.

6.0 RELATED LITERATURE

CERCLA, 42 USC 9601-9657 and amendments Solid Waste Disposal Act (RCRA), 42 USC 6901-6992.

Defense Science Board Task Force Report on Unexploded Ordnance, Clearance, Active Range UXO Clearance and Explosive Ordnance Disposal Programs, April 1998.

GAO Report to Congress: A Coordinated Approach to Detection is Needed, GAO/NSIAD-95-197, September 1995.

Military Munitions Rule (MMR), 62 FR 6621, February 12, 1997.

Ordnance and Explosive Response, U.S. Army Corps of Engineers, EP 1110-1-18, April 24, 2000.

Ordnance Used or Fired Munitions and Unexploded Ordnance at Closed, Transferred, and Transferring Military Ranges: Interim Report and Analysis of EPA Survey Results, EPA 505-R-00-01, April 2000.

"Real Property Contaminated with Ammunition, Explosives, or Chemical Agents," Chapter 12

from *DoD Ammunition and Explosives Safety Standards*, DoD 6055.9, March 1, 1995.

"Safety Precautions for Ammunition and Explosives," DFARS Subpart 223.370.

Unexploded Ordnance (UXO): An Overview, October 1996, Naval Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV), October 1996.

"Unexploded Ordnance (UXO) Safety On Ranges," DoD Instruction 4715.11 and 4715.12.

UXO Advanced Technology Demonstration Program at Jefferson Proving Ground, Phases 1–4.

6.1 Related Web Sites

Following is a list of Web sites that were used in producing this document. This is by no means an exhaustive list of available UXO-related Web sites.

Base Realignment and Closure (BRAC) Environmental Cleanup
http://www.dtic.mil/enviroDoD/brac/

Denix DUSD(ES) Programs
http://denix.cecer.army.mil/denix/Public/ES-Programs/env-sec.html

Department of Defense Explosives Safety Board
http://www.hqda.army.mil/ddesb/esb.html

Department of Defense's Unexploded Ordnance Center of Excellence (UXOCOE)
http://www.uxocoe.brtrc.com/index.htm

Environmental Security Technology Certification Program (ESTCP)
http://www.estcp.org/projects/cleanup/index.htm

Federal Remediation Technologies Roundtable EOD-UXO Links
http://www.frtr.gov/topical/uxo/index.html

Military Munitions Rule
http://www.denix.osd.mil/denix/Public/Policy/Range/mrule.html

Strategic Environmental Research and Development Program (SERDP)
http://www.serdp.org/

U.S. Army Environmental Center (USAEC)
http://aec-www.apgea.army.mil:8080/prod/aechome.htm

USAEC UXO Technology Support
http://aec-www.apgea.army.mil/prod/usaec/et/uxo/uxo.htm

UXO/Countermine Forum
http://www.denix.osd.mil/TheForum

APPENDIX A

List of Acronyms

List of Acronyms

AAA	Anti-Aircraft Artillery
ADA	Ammunition Demolition Activity
AOC	Area of Concern
BCT	BRAC Cleanup Team
BEC	Base Environmental Coordinator
BRAC	Base Realignment and Closure
CDPHE	Colorado Department of Public Health and Environment
CPEO	Center for Public Environmental Oversight
DDESB	Department of Defense Explosives Safety Board
DEP	Department of Environmental Protection
DEQ	Department of Environmental Quality
DERP	Defense Environmental Restoration Program
DFAR	Defense Federal Acquisition Regulations
DoD	Department of Defense
DOI	Department of Interior
DQO	Data Quality Objectives
DSMOA	Defense – State Memorandum of Agreement
DTSC	Department of Toxic Substances Control
ECOS	Environmental Council of the States
EE/CA	Engineering Evaluation / Cost Analysis
EM	Electro-magnetic
EPA	Environmental Protection Agency
ERIS	Environmental Research Institute of the States
ESTCP	Environmental Security Technology Certification Program
FDE	Findings and Determination of Eligibility
FFA	Federal Facility Agreement
FIB	Firing in Buttress
FLBGR	Former Lowry Bombing and Gunnery Range
FUDS	Formerly Used Defense Site
GAO	Government Accounting Office
HE	High Explosive
HEAT	High Explosive Anti-Tank
IRP	Installation Restoration Program
ITRC	Interstate Technology Regulatory Cooperation
JUXOCO	Joint UXO Coordination Office
LTM	Long Term Monitoring
LTO	Long Term Operation
MBAFB	Myrtle Beach Air Force Base
MMR	Military Munitions Rule
MTADS	Mobile Towed Array Detection System
NCP	National Contingency Plan
NPL	National Priorities List
OB/OD	Open Burn / Open Detonation
OE	Ordnance and Explosive
OECert	Ordnance and Explosive Cost-Estimating Risk Tool

OEW	Ordnance and Explosive Waste
PA	Preliminary Assessment
POC	Point of Contact
QA	Quality Assurance
RA	Removal Action, Remedial Action
RAC	Risk Assessment Code
RD	Remedy Design
RFP	Request for Proposal
RI/FS	Remedial Investigation / Feasibility Study
SCDHEC	South Carolina Department of Health and Environmental Control
SAR	Synthetic Aperture Radar
SI	Site Investigation
SMART	Strategic Management Analysis, Requirements and Technology Team
SOW	Statement of Work
SSEB	Southern States Energy Board
STOLS	Surface Towed Ordnance Locating System
TCRA	Time Critical Removal Actions
TDEMI	Time Domain Electromagnetic Induction
UMCD	Umatilla Chemical Depot
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Center
UXO	Unexploded Ordnance
WGA	Western Governor's Association

APPENDIX B

Blank Case Study Questionnaire

ITRC UXO Work Team
Case Study Questionnaire

Research Question: How can/could early State involvement in the RFP / Solicitation process remove barriers to the use of new innovative UXO remediation technologies?

Goal: To define how can States become more involved in the contracting (RFP) process.

1. Please provide the contact information requested below.			
Name			
Organization			
Mailing address			
Phone		Fax	
E-mail Address			

2. Please provide the following background information for your site.	
Location	
Approximate Total Acreage	
Original Purpose	
Range Designation (e.g. Closed, Transferring, or Transferred)	
Reason for Closure	

3. Please provide the following contamination information for your site.	
Source	
Type	
Extent	
Approximate Acreage of Contaminated Area	

4. Please provide the following site characterization information.	
Statistical sampling	
Surface investigation techniques	
Subsurface investigation techniques	
Technologies attempted/success rate	?
Area segregation	
Grid size Terrain Etc.	

5. Answer the following questions regarding the RFP process in your State.	
On a scale from one to five, how would you rate your knowledge of Federal government contracting procedures? (5 being extensive and 1 being low to nonexistent) 1	
How did you find out about the RFP process?	
At what point did you find out about the RFP process? (e.g. Broad Area Announcement (BAA) Phase, Solicitation Phase, or the Award phase)	
Did you have input in RFP development/contracting process? If yes, at what point did you become involved?	

If you were not involved in the RFP selection, at what point did you become involved in the contracting process?
If you were not involved do you feel a different technology should have been selected?
Is there a formal mechanism for information exchange between the government, the contractor and the State once a contract has been awarded? (e.g. weekly meeting, Federal Facilities meetings, etc.) If yes, what is that mechanism?

6. Answer the following questions on the site characterization/investigation process.
Were you are aware of, or did you understand the technologies used during the site characterization process?
Did the characterization process acknowledge advanced or innovative technologies? (e.g. detection/data acquisition technologies)
Did the technologies used meet the State and/or government expectations?
If not, are there any dispute mechanisms in place for issue resolution?
Would a different technology have impacted the regulatory actions?

Thank you for your participation

Mail To:	**Fax To:**
Booz Allen & Hamilton Inc. Attn: Michelle Brown 8283 Greensboro Drive McLean, VA 22102-3838 Phone: 703-902-5838	Attn: Michelle Brown **703-902-3613**

APPENDIX C

Case Study Summaries

Site: Fort Ord
State: California

Fort Ord is a 28,000-acre former Army installation located in Monterey, California. Under the 1988 Base Realignment and Closure Act (BRAC), the site was recommended for closure and is now closing. The site is contaminated with a variety of infantry munitions that date back to the early 1900s resulting from range activities and training maneuvers. The installation is divided into two primary areas, the 8000-acre multipurpose range and the inland training ranges. The approximate total acreage of the contaminated area is unknown, but current estimates list approximately 70 suspected contaminated sites.

The initial statistical sampling was conducted via Grid Stats/Site Stats. The final engineering evaluation and cost analysis (EE/CA) dated September 1997 listed several sites showing a wide percentage of sampling variation. After an archival search report was prepared and other discoveries made, the terrain was separated into 100ft x 100ft grids with five-foot survey lanes. The surface investigation was performed by visual and hand-held magnetometry (mag and flag) detection, while the subsurface investigation involved mag and flag, and recently the opportunity to use more innovative geophysical techniques, after discussion with Army headquarters.

Until the latter part of 1999, the California Environmental Protection Agency, Department of Toxic Substance Control (Cal EPA-DTSC) state regulators had little knowledge of the federal government contracting process and a general understanding of the request for proposal (RFP) process. At that time, the Army implemented the Strategic Management Analysis, Requirements, and Technology (SMART) Team.

Prior to the implementation of the SMART Team, Cal EPA-DTSC was not permitted to review or participate in the contractor selection. Now, however, the current RFP process has been significantly revised and incorporates state and federal regulatory involvement. Under the current RFP selection practices, Cal EPA-DTSC state regulators are involved very early in the process, during the internal development and writing of the scope of work. These activities are governed under a statement of confidentiality signed by both federal and state representatives.

Cal EPA-DTSC state regulators are not sure whether a different technology should have been selected for the initial effort when they were not involved in the regulatory process (prior to late 1999). However, they suspected that supplemental technologies would have likely been assessed and incorporated. Prior to the revision of the contracting process, the characterization process did not acknowledge advanced or innovative technologies.

Regular facility meetings were held to provide reports for review. Difficulties were encountered due to the lack of an agreement regarding a submittal schedule for delivery and timelines for review. In addition, significant difficulties occurred due to the limitation of the contract. Because the contract did not require the determination of detection efficiency, state and/or government expectations were not met. Although it has not been invoked, a formal dispute mechanism exists within the Defense Memorandum of Agreement (DSMOA) between California and the Department of Defense (DoD).

Cal EPA-DTSC regulators felt that a different technology could have impacted the regulatory actions. They felt that a sensor technology that digitally recorded anomaly signals could have been used to assess the efficiency of the remediation conducted in the field and remove some of the uncertainty.

Site: Former Lowry Bombing and Gunnery Range (a.k.a. Buckley Field)
State: Colorado

The former Lowry Bombing and Gunnery Range (FLBGR) is a formerly used defense site located in Arapahoe County, Colorado, approximately 20 miles southeast of Denver. The western end of the site is in the City of Aurora. FLBGR encompasses approximately 60,000 acres, or 94 square miles. FLBGR was opened in 1942 as an Army airfield and was used heavily during World War II for training, using both practice and high explosive bombs. The range consisted of at least seven major bombing targets, twelve gunnery targets, a rocket range, and two demolition ranges. Three camps were established on the range during WWII for basic troop training. Portions of the range continued to be actively used during the Korean War and Vietnam War. Four Titan I missile facilities were added to the range in 1959 and closed in 1965. The majority of the range was sold or transferred in 1965 through public action, land swaps with the State of Colorado Board of Land Commissioners, and donations to local governments.

Current land use at FLBGR is diverse and includes residential, outdoor recreation, ranching, farming, industrial, and mining uses. The City of Aurora operates a recreational facility at the Aurora Reservoir Park on the western end of the site. The majority of the range is currently used for cattle grazing and outdoor recreation. Residential growth is occurring rapidly in the region. Several large areas of the range are now being planned for residential development. The development trend on the range is expected to accelerate in the future.

The Colorado Department of Public Health and Environment (CDPHE) first expressed concern with the investigation and cleanup of FLBGR in 1996 when the U.S. Army Corps of Engineers (USACE) refused to conduct time-critical removal actions (TCRA) at areas where live ordnance was being found on the surface of the range. CDPHE utilized the formal dispute mechanism of the Defense State Memorandum of Agreement (DSMOA) in an attempt to resolve its concerns. The dispute was elevated to Tier II and initially settled in October 1996. By early 1997, it became apparent USACE would not fulfill CDPHE's expectations from the dispute resolution agreement.

In spring 1997, USACE initiated an Engineering Evaluation/Cost Analysis (EE/CA) at FLBGR. The EE/CA investigation was designed and implemented by USACE Huntsville Center based on the Grid Stats and Site Stats statistical ordnance site characterization models and the OECert ordnance risk assessment model. During development of the EE/CA, CDPHE expressed additional major concerns with the proposed statistical methodology, questioning the accuracy of the models and how they were to be implemented in the EE/CA. Major concern with USACE's statistical approach included failure to identify hotspots (unknown areas of concern), failure to accurately characterize known UXO-contaminated areas at the site, and underestimation of exposure risks to UXO. USACE was unwilling to consider innovative technologies or alternative approaches to characterize the site in the EE/CA.

In June 1997, unable to resolve its concerns, CDPHE filed an Emergency Compliance Order against the United States. USACE, under pressure to complete the EE/CA investigation, proceeded with the statistical ordnance site characterization and released a draft EE/CA in January 1998. In April 1998, USACE and CDPHE entered into a settlement agreement, resolving the litigation and outlining how to proceed with the investigation and cleanup of FLBGR.

One major aspect of the settlement agreement is the use of innovative technology (airborne synthetic aperture radar) to survey the entire site to assist in identifying potential areas of concern (AOC). Very early in the project, CDPHE expressed concern that additional unknown bomb targets, impact areas, or other AOC not identified in the historical archive search report might be present on the range. Several areas had been identified during field visits that were not in the historical site records, including bombing targets 6 and 7 and the mortar range. USACE claimed that it was cost prohibitive to search the entire range for unknown AOC using traditional visual and geophysical techniques.

To get innovative technology used at FLBGR, CDPHE was forced to take legal action. Legal action could likely have been avoided at FLBGR if USACE had acknowledged CDPHE's concerns and fully explored innovative approaches to address them.

Site: Former Brooksville Turret and Gunnery Range
State: Florida

The former Brooksville Turret and Gunnery Range is a 10,200-acre site located in Florida. The range was originally used for turret gunnery training, infantry training, jungle warfare training, and firing practice with rifles, rifle grenades, and machine guns. The site was closed in November 1946 when the U.S. government divested itself of all ties to the property.

The range employed static and moving target ranges and firing points that fired .30-caliber and .50-caliber small arms, 37-mm high explosive (HE) artillery shells, HE and inert rifle grenades, 81-mm HE and inert mortar rounds, 37-mm HE anti-tank (HEAT) artillery shells, and 2.36 HEAT and inert rockets. The full extent of contamination or the appropriate acreage is still under investigation.

Site characterization is currently in progress, using the EM61 employed in a meandering path route with an attached GPS receiver. The outcome of the characterization and the associated success rate is, as yet, unknown.

Florida State Department of Protection (FL DEP) regulatory involvement did not occur until after the contract had been awarded. FL DEP state regulators were not aware that the RFP process had begun and were not involved in the contracting and technology selection process in any way. FL DEP regulators had somewhat of an understanding of the site characterization technologies used. However, they were not sure whether the characterization process acknowledged advanced or innovative technologies, or whether the technologies chosen were able to meet state and/or federal government expectations. FL DEP was also unaware of any dispute resolution mechanisms or whether a better technology could have impacted any state regulatory actions.

Site: Camp Grant Impact Range/Area
State: Illinois

Camp Grant is a former World War I- and II-era Army training facility located within Atwood Park in the town of New Milford, Illinois. The site is approximately 400 acres, with suspected 100% UXO contamination. The Army declared the site as surplus in the mid-1950s and conveyed the area to Rockford Park District in August 1956. Predominant UXO contamination consists of 3-inch Stokes mortar rounds, 37-mm projectiles, and small arms projectiles.

Initial site characterization was performed using magnetometers and Site Stats/Grid Stats, with apparently satisfactory results. Subsurface contamination was clearly seen in the preliminary investigation. Time critical removal actions (TCRA) were performed in 1997 and again in 1998. Grids were laid out in 100-ft x 200-ft and 100-ft x 100-ft sections. The area has hilly terrain covered with underbrush and trees, with the exception of that portion which lies along the Kishwaukee River.

The U.S. Army Corps of Engineers (USACE) was the predominant force in the contracting process. Although Illinois EPA had concerns about the use of Site Stats/Grid Stats (because USACE had additional information about the extent and depth of contamination from the previous UXO clearance), the state agreed to the use of Site Stats/Grid Stats.

State involvement at this site began before the TCRAs were performed and has consisted of document reviews and comment, as well as participation in scoping meetings.

Site: Fort Sheridan
State: Illinois

Fort Sheridan lies 25 miles north of Chicago on Lake Michigan and consists of approximately 712 acres, with an estimated 58 acres of UXO-contaminated area on land and a large, but not quantified, area of contamination in Lake Michigan. The fort has been used for training U.S. Army cavalry and infantry from 1887 through the 1950s, when it converted to an administrative Headquarters and NIKE missile site/regional maintenance hub. During World War II, anti-aircraft artillery (AAA) was fired from Fort Sheridan into Lake Michigan.

Magnetometry (mag and flag) has been the predominant method of characterization, with the use of an EM61 on some portion of the impact areas. Full clearance of 38 acres of impact areas within the 58-acre contaminated area has been accomplished. Initial clearance on rifle ranges was set at 10% but ultimately increased to almost 100%. Grid areas 100-ft x 100-ft were established for site characterization. Six Stokes mortars were found on the current golf course and surrounding areas.

State involvement on this site occurred only after contract award. Hence, there was no state input to the request for proposal. There is, however, a mechanism through which information is exchanged between concerned parties via the Base Realignment and Closure (BRAC) Cleanup Team (BCT).

Site: Savanna Army Depot
State: Illinois

The Savanna Army Depot is a 13,062-acre site located seven miles north of Savanna, Illinois, on the east bank of the Mississippi River. In 1917, the site was initially used as a proof firing range for artillery that was produced at Rock Island. In the 1920s, the mission then changed to ordnance testing and the storage, reclamation, and demilitarization of ammunition. The Base Realignment and Closure (BRAC) Commission, in July 1995, recommended the site for closure, and today, the site is designated as transferring.

The proof firing, demilitarization, and authorized/unauthorized disposal activities performed on the site have resulted in contamination, such as reactive concentrations of explosives in the soils and live and inert ordnance items. The total extent of the contamination is unknown but is estimated at approximately 7,000 acres. The contamination is thought to include upland and bottomland environment, as well as some of the property beyond the boundary of the installation.

The U.S. Army Corps of Engineers (USACE) in Huntsville, Alabama, employed a modified version of Grid Stats/Site Stats for statistical sampling called the UXO Calculator and then used the Hopkins Statistic to test for homogeneity. It intends to use OECert to complete the risk assessment. For both surface and subsurface site investigation, the areas were sectioned off into 50-ft x 50-ft or 100-ft x 100-ft grids. Random grids were chosen based on projected future use to represent a 1–2% statistical sampling of the total site. The grids were then swept with Geonics EM61 and evaluated for anomalies and homogeneity. One sector will be evaluated with a transecting method. (This sector is long and narrow and cannot accommodate a grid)

Three configurations of characterization technologies were conducted on the geophysical test plot: Geonics EM61 TDEMI metal detector, Geometrics G858 magnetometer, and the Geometrics G858 cart based magnetometer. Huntsville recommended the use of both the EM61 and the G858 magnetometer. The third configuration, the G858 cart-based system encountered problems with the GPS system, that are yet to be resolved, and was unable to meet Huntsville's minimum detection requirements.

The Illinois Environmental Protection Agency (IL EPA) did not have any input into or influence on the request for proposal (RFP) development or contractor selection process. It was provided a copy of the scope of work (SOW) after the contractor had already been chosen. Base Realignment and Closure (BRAC) Cleanup Team (BCT) meetings are held on site each month to aid in information exchange. The reporting of contractor activities was carried out through the installation's point of contact (POC). A Strategic Management Analysis, Requirements, and Technology (SMART) Team has been formed to help resolve outstanding issues.

Though IL EPA did understand the technologies used during the site characterization process, it did not understand how USACE interpreted the results pertaining to the technologies' success rates. USACE informed IL EPA that advanced or innovative technologies had been evaluated internally, but that evaluation process did not appear in the work plan. IL EPA was unaware of whether the chosen technologies met state and/or government expectations.

Site: Camp Ellis
State: Illinois

Camp Ellis is a 17,445-acre site 50 miles southwest of Peoria in central Illinois. The site was closed and transferred to private ownership in the 1950s after World War II (WWII) when the facility was abandoned by the National Guard due to a lack of suitable facilities for artillery use.

The site was originally used for training support troops during WWII with light hand-held weapons, demonstration bombing, and aircraft strafing. The site contamination included 2.36-in bazooka rockets, rifle grenades, 60-mm mortar rounds, mines, grenades, and demolition materials spread across 17 areas adding to 1,580 acres.

The U.S. Army Corps of Engineers (USACE) in Huntsville, Alabama used the UXO Calculator to estimate the density of the UXO. OECert was offered, but a more qualitative interpretation was expected. A minimum of 2% of the investigation areas was planned for screening for the engineering evaluation and cost analysis (EE/CA) with an option for an additional 6%.

The surface and subsurface investigations were performed by the cart and hand-held EM61. The investigation areas were chosen from the archival search report that served as the basis for the EE/CA investigation and were based on the areas used for training. Equally spaced transects were used across most of the fields, and a wandering path was employed in wooded and hilly terrain. Unfortunately, UXO of a type that was not identified in the archival search report was discovered in the demonstration area. This cast considerable doubt on the adequacy and accuracy of the report.

The Illinois Environmental Protection Agency (IL EPA) representative did not have a broad knowledge of the federal contracting process. The state is usually not asked to participate in the contracting process. The state was not aware that the RFP process was underway nor did it have any influence over contractor selection. IL EPA was provided a scope of work for the EE/CA, but the contractor had already been chosen. Detection technology selection was not an issue for IL EPA; however, there were concerns regarding the technique of usage.

Although formal and informal dispute resolution processes existed through the Federal Facility Agreement, there was no formal mechanism of information exchange among the government, contractor, and state. Even though IL EPA did not feel that the characterization process acknowledged new and innovative technologies, it did not think that a different technology would have impacted the regulatory process.

The issues surrounding Camp Ellis stemmed more from the risk assessment, statistical methods, and interpretation of those results than technology selection. Any fundamental problems with the technology revolved around the limitations of the available technology and the organization employing it. USACE has volunteered very little information and has yet to submit the sampling report of the EE/CA.

Site: Former Illinois Ordnance Plant
State: Illinois

The former Illinois Ordnance Plant is located as part of the Crab Orchard National Wildlife Refuge in southern Illinois. The plant occupied approximately 25 acres of the 44,000-acre Wildlife Refuge but was shut down by the War Department at the end of World War II with custody transferring to the Department of the Interior. Since the time of Army occupation of the facility, there have been a number of industrial tenants manufacturing a variety of explosives. There are a number of sites within the area that have been used in the past for off spec, unwanted, and unused munitions disposal and/or demilitarization.

The site is contaminated with M1A1 anti-tank mines, boosters, and M48 fuses. Site characterization has been done predominantly using magnetometers and Grid Stats/Site Stats in order to determine which areas to clear. The initial study areas were identified through record searches, aerial photography, and anecdotal information. The site was divided into 100-ft x 100-ft grids to aid in site characterization. Unfortunately, there is not sufficient information to determine the success rate of the magnetometer characterization.

Initial contracting efforts were coordinated and handled through the U.S. Army Corps of Engineers Louisville District Office, with little to no state involvement. Magnetometry was apparently specified in the contract; and while the results are uncertain, there is room for doubt as to whether or not it was sufficient as a means of characterizing the area, or whether a more efficient technology would produce better results.

State involvement occurred on a peripheral basis after the contract was awarded. There is a Defense State Memorandum of Agreement (DSMOA) in place for this site, as well as a Federal Facilities Agreement (FFA).

Site: Former Fort Hancock
State: New Jersey

The Former Fort Hancock is composed of approximately 1,624 acres located on Sandy Hook, a coastal finger of land that projects northward into Lower New York Bay. The site was utilized by the U.S. Army for military operations from 1807 through 1974. During this period, the site served as a military fort, proving ground, a firing range, an ammunition storage area, an anti-aircraft defense site, and a NIKE missile site. In 1962, the State of New Jersey took possession of 460 acres of Fort Hancock to be utilized as Sandy Hook State Park. Additional acreage was added to the park in 1964, and in 1973, the National Park Service (NPS) took possession of Sandy Hook State Park and renamed it the Gateway National Recreation Area. Fort Hancock was deactivated by the U.S. Army in 1974. The final conveyance of the property occurred in 1978 with 1,623.85 acres allotted to the NPS and 67.78 acres allotted to the U.S. Coast Guard.

The periodic discovery of ordnance items at various portions of the site after 1978 prompted the U.S. Army Corps of Engineers (USACE) to perform risk reduction actions to remove any imminent hazards to the public. Under the Defense Environmental Restoration Program (DERP), in 1991 USACE prepared an Inventory Project Report, which included a Findings and Determination of Eligibility (FDE) for the site. The report determined that the site was eligible for the DERP for Formerly Used Defense Sites (FUDS). Based on the presence of OE, a Risk Assessment Code (RAC) was assigned to the site. A site inspection was performed in June, 1993, by USACE, which concluded that an EE/CA investigation was warranted.

Ten areas of concern were designated for investigation based on historical data obtained by USACE during the archives search and a review of historical aerial photographs compiled by the U.S. Army Topographic Engineering Center (TEC). One geophysical test plot was established for the site. Based on the results of the prove-out, the geophysical technique of line-based time domain electromagnetic induction (TDEMI) using a Geonics EM61 was selected over the Geometrics G-858G magnetometer (configured as vertical gradiometer) as the best currently available technology for this particular detection and mapping effort. This instrument selection was based primarily on the higher target identification accuracy rate of the EM61 (93% for the EM61 verses 73% for the G858G) in the predominately sandy subsurface environment at this site. Additionally, abundant subsurface anomalies and cultural interference was responsible for the decreased effectiveness of the magnetic method. Geophysical survey of plots within the areas of concern using the EM61 was performed on a total of 90 rectangular grids, each measuring 30 meters by 30 meters. Grid dimensions were varied based on pre-existing clear areas due to NPS concerns regarding vegetative clearance. Total grid area of 1/4 acre was maintained, with grid dimensions varying to fit the pre-existing open areas. Grid Stats was used in the selection of individual anomalies for investigation, and OECert was used to complete the risk assessment

A total of 3,904 individual anomalies were identified during the geophysical survey; of these, 1,710 were intrusively investigated. A total of 107 anomalies (6%) were OE or OE-related debris, including projectiles, fuses, grenades, metal fragmentation from exploded ordnance, and various Chemical Warfare Service (CWS) related material and debris. Five confirmed conventional OE items containing explosive charges were found.

The New Jersey Department of Environmental Protection (NJDEP) was not involved in the scoping, contracting, or technology selection aspects of this project. The scope of work was included in the EE/CA as an appendix, and only a summary of the prove-out was addressed in the narrative. While this is only the second EE/CA ever submitted to the NJDEP for review, only general comments could be provided due to the lack of guidance available to the case managers in assessing UXO prove-out, identification, and clearance. Additionally, NJDEP has not adopted/endorsed any form of risk assessment associated with live OE materials at such sites where human exposure is proposed to be increased. NJDEP does not want in any way to discourage the beneficial continuation of OE cleanup efforts at sites in New Jersey; however, it must point out that if EE/CAs continue to be submitted for departmental review, policies and guidance regarding all aspects of OE cleanup and site re-use must be developed and acceptable to NJDEP.

Site: Former Umatilla Chemical Depot (UMCD)
State: Oregon

The Former Umatilla Chemical Depot (UMCD) is a 19,728-acre site located in northeastern Oregon. The depot was constructed by the U.S. Army in 1941 and ordered closed by the 1988 Base Realignment and Closure Act (BRAC). The Army has until 2006 to destroy stored chemical munitions on the site and vacate the property. From the 1950s through 1965, the Army operated an explosives washout plant at the depot, which resulted in explosive contamination of two explosives washout lagoons. These washout lagoons are listed on the National Priorities List (NPL). A 1,750-acre area located in the northwestern portion of the depot was used for ammunition demolition activities (ADA), which has resulted in significant UXO contamination within the area.

A multiphase approach to UXO remediation was begun in 1990 and continues today. There have been visual surface sweeps over all but approximately 106 acres of the 1,750-acre site. There has been a geophysical investigation of almost the entire 1,750 acres using surface towed ordnance locating system (STOLS). A “prove-out” was initially conducted using three different technologies: magnetometer, gradiometer, and transient electromagnetic (TEM) methods (EM61). Of these technologies, the magnetometer had the lowest detection rate (71%) but the highest productivity rate (estimated 40 acres per day). All but 40 acres of the ADA area were mapped. These 40 acres were heavily wooded with sagebrush and, consequently, not accessible to the STOLS.

The progress at the Umatilla site has involved the state environmental agency to a greater degree than other state environmental agencies have been involved at other sites around the country. The contracting mechanisms seem to have included vigorous state involvement, although it is not clear as to exactly when the state became involved. The use of a “prove out” site indicates there was at least an attempt to verify the site-specific usefulness of various technologies. The final selection of magnetometers as the technology of choice appears to have been made logically, with full realization of performance values, tempered by other pertinent factors. The implementation of an FFA provides regulators with a formal dispute resolution mechanism, which has recently been implemented by U.S. EPA regarding the means with which the Army has been evaluating various potential technologies on the site.

Site: Myrtle Beach Air Force Base (MBAFB)
State: South Carolina

The Myrtle Beach Air Force Base (MBAFB) is a 3,937-acre site in Myrtle Beach, South Carolina. The site is not designated as a range but was originally used for firing in buttress (FIB). The FIB was designed as a barrier during bore sight alignment testing. The Base Realignment and Closure (BRAC) Commission, in 1990, recommended the site for closure during Round II base closure deliberations.

The site is contaminated with 20-mm HEI rounds from various USAF aircraft. The approximate acreage of the FIB site is 3 acres. Initially, the site was divided in 5-ft x 5-ft grids, and then 10% of the grids were randomly selected for sampling. The surface investigations were completed using the magnetometer (mag and flag), while no subsurface investigation took place at the time of the screening.

The South Carolina Department of Health and Environmental Control (SCDHEC) understood the mag and flag procedure; however, it was never informed of the technology's success and/or failure rate. At the MBAFB FIB site, the mag and flag procedure failed to identify unexploded ordnance (UXO) that was later visually discovered by field personnel after the site investigation.

SCDHEC had no involvement or input into the request for proposal (RFP) or contracting processes. It was never made aware that the RFP process had begun. Information exchange is facilitated through monthly Tier I BRAC Cleanup Team (BCT) meetings. Any disputes are handled through the dispute resolution clause in the Defense State Memorandum of Agreement (DSMOA) grant.

SCDHEC felt that, at a minimum, other technologies should have been considered to determine the most appropriate technology for the site in question. To its knowledge, advanced or innovative technologies were not considered in the site characterization. SCDHEC has not taken any regulatory action or formally disputed any activities on the FIB site to date; however, it has expressed to the Air Force that it would not concur with any land transfer until additional and more appropriate technologies have been considered.

Site: Yellow Jacket
State: Utah

Thousands of tests of biological, chemical, and radiological agents occurred at Dugway from the 1940s until 1969. The 1000-acre Yellow Jacket FUDS is located just south of Dugway and was used for one of these tests. The test was called Project Sphinx and involved test firing of chemical munitions and napalm into abandoned mine shafts. The site is contaminated with UXO, explosives, and chemical agent residues.

This area is remote but is unsecured and easily accessible to rock collectors and others who consider the west desert of Utah to be their "backyard." Yellow Jacket spans both the Bureau of Land Management (BLM) land and private property, and the property owner believes the area has economic value for mining. The Utah Department of Environmental Quality (UDEQ), BLM, and the property owner have expressed concern to the Army about the potential hazards associated with the site. Based on this concern, the U.S. Army Corps of Engineers (USACE) hired a contractor to identify and detonate any UXO found on the surface.

USACE thought the surface removal was all that was needed at the site, but UDEQ and BLM considered the surface removal as a "phase 1" type action. Since BLM and UDEQ were not involved in the RFP process, USACE only budgeted for surface removal. UDEQ was occasionally made aware of the RFP process when it was sent a scope of work (SOW) for regulatory review by USACE. UDEQ also felt that USACE in Huntsville, Alabama, had little understanding or sympathy for Utah’s UXO-related issues.

UDEQ was kept abreast of contractor activities through monthly meetings that were held to facilitate information exchange. It was aware of, and had an understanding of, only the mag and flag technology used in the site characterization process. It did not feel that advanced or innovative technologies were acknowledged. UDEQ did not feel that the technologies used met state or government expectations because buried munitions were not addressed and the surface grids were not large enough. It felt that a better technology could have had a better impact on the regulatory actions (perhaps cleanup objectives or remedial actions would be more accurate).