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MEC ITEMS AS ARCHAEOLOGICAL ARTIFACTS: LEGAL AND TECHNICAL CONSIDERATIONS

Abstract

As an increasing number of Formerly Used Defense Sites are identified across the United States, more Department of Defense officials, non-military federal land managers, State Historic Preservation Officers, and members of the Advisory Council for Historic Preservation have raised concerns about the effects that unexploded ordnance (UXO) projects have upon archaeological sites. The broadening exposure of agency archaeologists to the methods employed in UXO projects has contributed to the understanding that remediation impacts cultural resources. Causing further agency concern, domestic sites associated with the 1963 escalation of joint US warfare in South Vietnam are now reaching 50 years of age, and a growing number of Cold War properties are being regarded as archaeological sites. Existing laws require that federal undertakings consider potential effects to cultural resources, and require consultation between various agencies. As projects come under increasing scrutiny, agencies tasked with consultation have begun to comment upon discarded military munitions, UXO, munitions of explosive concern (MEC), frag, and related materials as artifact types themselves. This raises questions not only of how to integrate archaeologists into the existing framework of UXO teams, but also of how to simultaneously comply with standards for both remediation and cultural resource laws. These challenges coupled with the need for additional specialists on teams coincide with a lean financial environment, with all parties attempting to do more with less funding. ACR Consultants, Inc. has been involved with the application of cultural resource law on UXO projects and has first-hand knowledge of how these dynamics interact on the ground. ACR discusses procedures and methods that achieve compliance with Section 106 of the National Historic Preservation Act and address military munitions as elements of a cultural landscape while reducing field costs, improving project safety and efficiency, and bolstering chances for mission success.

Introduction

The National Historic Preservation Act of 1966 (the NHPA) was passed into law to mandate the federal consideration of cultural resources. The NHPA and its implementing codes are very well known within most ground-disturbing industries who work frequently with Federal property, funds, licenses, or permits. It is the job of the contractor to ensure that their product reflects compliance with federal regulations, and agency representatives are often present to document compliance.

Section 106 of the NHPA, *16 U.S.C. 470f — Advisory Council on Historic Preservation, Comment on Federal Undertakings*, mandates, in full:

The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under Title II of this Act a reasonable opportunity to comment with regard to such undertaking.

36CFR800 – *Protection of Historic Properties*, establishes the processes for consultation, and mechanisms for mitigation of adverse effects to properties eligible for inclusion in the National Register of Historic Places (the NRHP). The consultation process seeks to accommodate historic preservation concerns while achieving the needs of Federal undertakings. This is achieved through consultation

between the lead agency official and parties with an interest in the effects of undertakings on cultural resources (Parties). 36CFR800 further defines the terms of a “reasonable opportunity to comment” and, for each party, establishes that opportunity as a minimum of 30 days. This process is designed to commence at the earliest stages of project planning and are to continue through to the end of a project.

The NHPA contains other sections and is not, in and of itself, the only body of legislation that places a burden of responsibility upon federally-funded projects. It and its implementing codes are, however, the most frequently cited of cultural resource requirements in the United States.

Department of Defense officials, non-military land managers, State Historic Preservation Officers (SHPOs), and members of the Advisory Council for Historic Preservation (ACHP) have increasingly come to view Unexploded Ordnance (UXO) projects as a type of undertaking possessing the potential to adversely affect cultural resources eligible for inclusion in the NRHP (hereafter referred to as Historic Properties or eligible properties). These agency archaeologists, and others (e.g. Federally Recognized Tribes), are recognized as Parties to the Section 106 process. It remains common for Parties to agree that certain UXO projects do not trigger Section 106 of the NHPA, but an increasing number of projects are being held to the full extent of 36CFR800 or program alternatives that satisfy the requirements of law.

Program Alternatives

Program alternatives to 36CFR800 exist, and can range from limited, project-specific agreements between Parties to enduring agreements between an agency and the ACHP. It is important for contractors to become aware of the potential range of agreements that they may be held to, for any given project.

Programmatic Agreements

The program alternative most commonly employed by agencies is the Programmatic Agreement (PA). In terms of cultural resource laws, a PA is established in order to supersede specific laws through mutual agreement between the Parties. In its simplest form, a PA engages all Parties in a cooperative agreement for an ongoing consultation process, and may incorporate archaeological methods that the Parties agree will eliminate or minimize adverse effects to Historic Properties. Furthermore, when adverse effects to Historic Properties cannot be avoided, a PA will often stipulate the roles, responsibilities, and tasks for each of the Parties to mitigate those adverse effects.

At a minimum, through application of 36CFR800, a PA meets the requirements of the NHPA and the Native American Graves Protection and Repatriation Act (NAGPRA), dictates project-specific procedures and contingencies, and establishes roles and responsibilities for Parties. A PA outlines a course for changes and amendments, and possesses a limited life. This life should be sufficient to cover the duration of a project but, for longer projects, may require several amendments.

Any number of different projects, each on different contracts perhaps issued by the same lead agency, may occur simultaneously or over several years on the same installation, FUDS site, or property. In the instance of multiple projects, each with a scope that cannot be predicted, it is entirely probable that contractors may be faced with multiple PAs for the same general property. For these reasons, it is extremely important for lead agency personnel to coordinate very well with other project leads in an effort to ensure that program alternatives do not contradict one another wherever project areas may overlap.

Two other documents that are not technically program alternatives have grown to take on such common importance that they are mentioned here as component parts of the PA. These are archaeological monitoring plans and mitigation plans:

- An archaeological monitoring plan (AMP) is often included as part of a PA. Archaeological monitors investigate ground disturbing activities while they occur in order to document the presence or absence of effects to cultural resources. The AMP establishes specific methods, documentation standards, reporting standards, and safety protocol for archaeologists monitoring a project. They are typically drafted by archaeological contractors for the review and approval of the lead agency that, in turn, seeks consultation with the Parties pursuant to 36CFR800. For this reason, it is often efficient to combine consultation on the AMP along with the PA.
- A mitigation plan may be drafted in response to an adverse effect to a significant archaeological site, or may be drafted in anticipation of unavoidable adverse effects. Multiple mitigation plans may be required for very large projects. When drafted in anticipation of adverse effects to sites, a mitigation plan may be bundled with the PA and the AMP; however, this can be cumbersome. Mitigation plans are usually drafted as totally separate documents and, again, must conform to 36CFR800. Mitigation plans also establish methods, documentation standards, reporting standards, and safety protocol for archaeologists, but are specific to mitigation activities.

PAs, AMPs, and mitigation plans may incorporate the following topics:

- Archaeologists who are not UXO-qualified may be required to be outside of an exclusion zone while UXO crews are completing intrusive work. Or, the archaeologist may be required to monitor the excavation in real-time from a safe distance using a video camera. Note that PAs and AMPs would normally specify the diameter of the exclusion zone based on the maximum frag radius of the most powerful ordnance that could possibly be anticipated on-site.
- Work may be required to halt due to the discovery of any human remains and NAGPRA tribal consultation begun.
- If MEC items are uncovered that cannot be moved safely, they would be blown in place. The PA may stipulate that archaeologists may not enter the exclusion zone of any MEC artifacts. In this instance, the UXO team would assist the archaeologist in recording the item from outside of the exclusion zone, or a UXO-qualified archaeologist may enter the exclusion zone to complete that task.
- Definitions of “qualified archaeologists”.
- Roles of Parties in consultation, beyond 36CFR800.

Army Alternate Procedures

Army Alternate Procedures have been implemented by the Department of the Army in consultation with the ACHP. Programs and categories of undertakings that are exempt from the Section 106 process, however, are extremely limited under these alternatives. Exempted categories of undertakings for the Department of the Army;

- may apply or not apply under certain circumstances, as set forth by conditions.
- must have foreseeable and minimal, or no adverse, effects on Historic Properties.
- only apply in limited cases (e.g. imminent threats to human health and safety, emergency response to haz-tox situations, in place disposal of UXO, etc.), provided the above limitations are satisfied AND provided the installation is operating with a functioning Historic Properties Component.

As outlined in the *Federal Register, Vol. 69, No. 74: Advisory Council on Historic Preservation; Amendments to the Army Alternate Procedures* (2004), a notice of approval of amendments to the Army Alternate Procedures, individual US Army installations are encouraged to develop a Historic Properties Component (HPC) that is reviewed by the Assistant Chief of Staff for Installation Management (ACSIM) for endorsement following consultation pursuant to 36CFR800. The HPC establishes how an installation will comply with Section 106, and is a component of a fully-articulated Integrated Cultural Resource Management Plan (ICRMP).

The HPC is required for a complete ICRMP, and both are required to exempt undertakings including the in-place disposal of unexploded ordnance, pursuant to Section 4.5(a) through 4.5(3)(iv). As such, Army Alternate Procedures rarely apply to FUDS properties.

Cultural Resources Overview

Cultural resource management, like any industry, is awash with jargon and technical terms with heavily-weighted an inferred meanings. Many of these terms, such as “eligible properties”, tie into very specific inferences that elude to regulatory process. In order to understand cultural compliance requirements in the context of UXO remediation, a review of basic archaeological definitions is listed below.

- Cultural Resource: A broad term and, with regard to the subject of archaeology, is taken to mean any man-made artifact or permanent feature (ie foundations, stone circles, fire pits, etc.) or collection thereof that is 50 years of age or older.
- Prehistoric: a type of cultural resource that is the archaeological remains of cultures prior to recorded history. The time depth varies throughout the world. In the Americas it refers to cultures prior to European contact.
- Historic: a type of cultural resource that is the archaeological remains of cultures that were recorded directly by written histories. In the Americas it refers to the era after European contact.
- Cultural Resource Site: the location of a significant event, prehistoric or historic occupation or activity, or structure, where the location itself possesses historic, cultural, or archaeological value. Specific requirements vary by state and/or land managing agency.
- Isolated Find/ Isolated Resource: a cultural resource that does not meet the requirements to be considered a site. The definition varies according to the state; for instance in Oregon it is defined as 1 to 9 artifacts, in Florida, West Virginia and Washington it is a single artifact, in Delaware it is

1 or 2 artifacts, in Wyoming it is fewer than 50 historic artifacts or fewer than 15 prehistoric artifacts, and in Georgia it is fewer than 3 artifacts from the same cultural period.

- **Historic Property:** a term specific to sites that are listed on, or eligible for, the National Register of Historic Places, also referred to as “eligible sites” or “eligible properties”. If actually listed on the NRHP, such properties are generally referred to as “listed sites”, although whether eligible, nominated, or listed they are afforded the same consideration.
- **Federal Undertaking:** any project that is funded, in whole or in part, by federal funds, or; any project that, were it not for a Federal permit, would not be allowed to be completed, or; any project that occurs on Federal lands.
- **Effects:** any result of any activity that results in a change to a site’s integrity of location, design, setting, materials, workmanship, feeling, or association; can be adverse, or beneficial.
- **Mitigation:** an activity that the Parties agree will compensate for or ameliorate adverse effects to a Historic Property.

The take-home message of the above definitions is this: only sites can be Historic Properties and therefore, generally only sites are recognized under cultural resource law. Remember too, that only consideration, not necessarily preservation, is mandated.

Evaluating Cultural Resource Site Significance

As noted above, cultural resource sites that are eligible for nomination to the NRHP are designated Historic Properties. 36CFR60.4 provides the criteria by which cultural resource sites are evaluated:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and

(a) that are associated with events that have made a significant contribution to the broad patterns of our history; or

(b) that are associated with the lives of persons significant in our past; or

(c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(d) that have yielded, or may be likely to yield, information important in prehistory or history.

Archaeological contractors evaluate cultural resource sites based upon their assessment of integrity, and defend their recommendations of whether or not a site is eligible for nomination to the NRHP through a series of justifications for each criterion set forth in 36CFR60.4. The lead agency may apply the contractor’s recommendations when drafting a determination of a site’s eligibility for nomination to the NRHP that, in turn, are subject to the consultation process mandated by 36CFR800.

Abbreviated Timeline of UXO and CRM Regulatory Landmarks

In regard to cultural resource law, the regulations to which UXO projects are being held accountable have not much changed during the progression of the UXO industry. A brief timeline of regulations, significant to both UXO and cultural resource management (CRM) fields, follows:

(CRM) 1906 – The Antiquities Act: An Act for the Preservation of American Antiquities (16 U.S.C. § 431–433) is passed into law by President T. Roosevelt.

(CRM) 1966 – The National Historic Preservation Act (NHPA; Public Law 89-665; 16 U.S.C. § 470 *et seq.*) is signed into law by President Nixon.

(CRM) 1966 – The Advisory Council on Historic Places (ACHP) is authorized, with suggestions for consultation.

(CRM) 1970 – The National Environmental Policy Act of 1969 (NEPA; Public Law 91-190, 42 U.S.C. § 4321) is signed into law by President Nixon.

(CRM) 1976 – Congress amends the NHPA to extend the Section 106 review process to include buildings, archaeological sites, and other historic resources eligible for listing, not just those already on the National Register of Historic Places.

(UXO) 1976 – The Resource Conservation and Recovery Act (RCRA; Public Law 94-580, 42 U.S.C. § 6901 *et seq.*) is signed into law by President Ford.

(CRM) 1978 – The American Indian Religious Freedom Act (AIRFA; Public Law 35-341, 42 U.S.C. § 1996) signed into Law by President Carter.

(CRM) 1979 – President Nixon’s Executive Order 11593 was codified as regulation to enact 36CFR800, superseding the 1966 “suggestions”.

(UXO) 1980 – The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, Public Law 96-510, 42 U.S.C. § 9601) is enacted by the 96th United States Congress.

(CRM) 1980 – The NHPA is amended to include Section 110 of the NHPA, requiring agencies to maintain internally-staffed historic preservation programs and implement plans for the management of all cultural resources under their jurisdiction.

(CRM) 1987 – SHPO offices exist in 57 jurisdictions including all 50 states and several territories.

(UXO) 1984 – The Defense Environmental Restoration Act passes, but is quickly supplanted by reauthorization and expansion of CERCLA to cover military industrial sites.

(UXO) 1986 – The Superfund Amendment and Reauthorization Act (SARA) is passed by Congress, making key changes to CERCLA including the implementation of the Defense Environmental Restoration Program (DERP) and formalizing the Defense Environmental Restoration Act funded via the Defense Environmental Restoration Account (DERA). One aspect of DERP is the Formerly Used Defense Sites (FUDS) program.

(CRM) 1990 – The Native American Graves Protection and Repatriation Act (NAGPRA, Public Law 101-601, 25 U.S.C. § 3001 *et seq.*, 104 Stat. 3048) is signed into law by President G.H.W. Bush.

(UXO) 1990 – OSHA HAZWOPER (29 CFR 1910.120 and 1926.65) applies to all UXO remediation operations including FUDS, BRAC, and active military sites.

(UXO) 1992 – Section 107 of the Federal Facilities Compliance Act of 1992 (The Munitions Rule; 40 CFR Part 266 Subpart M) requires the EPA, in coordination with the DOD, to issue rules and standards for classification of conventional and chemical ordnance as hazardous materials.

(CRM) 1992 – The NHPA is amended to afford Federally Recognized Tribes and Native Hawaiians increased rights in consultation, and to implement plans for Tribal Historic Preservation Offices (THPOs) to administer Federal law on sovereign lands.

(UXO) 1996 – The DoD Explosives Safety Board (DDESB) and Component Explosives Safety Responsibilities are established.

(UXO) 1998 – DoD issues policy to implement the Munitions Rule.

(UXO) 1999 – DoD Directive 4715.11: *Environmental and Explosives Safety Management on Department of Defense Active and Inactive Ranges Within the US* is released.

(CRM/UXO) 2001 – ACHP approves Army Alternate Procedures effective July 31

(CRM) 2003 – President H.W. Bush issues Executive Order 13287, “Preserve America”, requiring each agency to maintain oversight of cultural resources at a senior policy level and improving stewardship of Historic Properties.

(CRM) 2004 – 36CFR800 is amended to refine processes for negotiating alternate procedures.

(CRM/UXO) 2004 – The Federal Register, Vol. 69, No. 74, provides notice of approval of amendments to the Army Alternate Procedures.

NEPA, the NHPA, and “Undertakings”

Of all laws passed since 1906, the one most commonly associated with cultural resource management is the NHPA and, more specifically, 36CFR800 – *Protection of Historic Properties, Section 106 Review Process*. The connection between this body of legislation and its effects on project planning and implementation are so far reaching that most participants refer to any compliance archaeology simply as “Section 106” or the “Section 106 Process”. Other laws may apply for a project, but typically are addressed by the course of review mandated by Section 106.

NEPA is often confused with the NHPA on a number of levels and, at times, projects have disregarded the NHPA because they had already gone through a full NEPA Environmental Impact Statement (EIS) or Environmental Assessment (EA) review. Although it is possible to execute a NEPA study in lieu of Section 106 of the NHPA, this requires a PA between the lead agency, the SHPO, and all consulting parties (e.g. Tribes, stakeholders, etc.). The consultation process is identical to that set forth in Section 106. Furthermore, as public review and comment on NEPA documents is a required part of the NEPA process, additional care must be taken as disclosure of site locations is classified for Official Use Only pursuant to 43CFR7.18 – Confidentiality of Archaeological Resource Information.

The Section 106 process does not include a public comment period, and confidentiality of archaeological resource information is much easier to control. When both NEPA and the NHPA must be considered, separating the two processes allows for greater flexibility in review. Cultural resource sections of the NEPA document can be condensed, and are subject to less scrutiny than when NEPA is conducted in lieu of Section 106. By trying to satisfy Section 106 within the framework of NEPA, parties soon realize that the NEPA framework is not well suited to the consultation process where the whole of the administrative record must be evaluated by consulting parties. With Section 106 reviews, parties can be held to stricter timelines for review and response. With NEPA, timelines are much more difficult to project. This can spell certain trouble for project managers who are forced to wait to mobilize project personnel.

Moreover, NEPA documents do a poor job at addressing industries with which most reviewers may be unfamiliar. Most review archaeologists have never been involved in UXO projects, and they may regard the archaeological methods required to maintain compliance with UXO safety needs as “unconventional”. Technical reports produced for Section 106 review are much better suited to conveying the intricacies of “unconventional” methods, and can save the lead agency time addressing comments that are out of scope.

Industry Perception of Cultural Resource Laws

Based upon past negative experiences, or based upon loose perceptions of regulatory issues, many within the UXO and other technical fields vocalize a dim view of what it means to have cultural resource requirements as a condition of a contract.

A 1991 report released by the ACHP in joint request from the House Committee on Interior and Insular Affairs, the Subcommittee on National Parks and Public Lands, and the House Committee on Science, Space and Technology entitled *Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities* resulted in a number of conclusions and observations. Included among these:

- Many project proponents feel that the requirements of the NHPA are fine for road construction and urban development, but are inappropriate for truly important technical missions.
- Members of scientific and technical communities in some cases display unfamiliarity with the requirements of the NHPA, and perceive a threat of extended delays and other problems where there is little direct supporting evidence of this to be the case.
- Historic preservation is rarely seen as a mechanism for meeting other agency objectives and, too often, tends instead to be viewed as a “compliance problem”.
- ACHP regulations and the Section 106 review process are seen by some as inflexible.
- There is a real concern on the part of the technical and scientific community that issues outside the primary scope of the mission will either cloud the worth of a proposed activity or result in changes that will make the primary mission less effective or comprehensive.

Although written primarily with regard to cultural resources on highly scientific and active facilities (e.g. NASA space centers), the ACHP observations hold true when considering the perspectives of many UXO project proponents. The ACHP study also points to the fact that although the current number of properties recognized as significant for technological achievements is fairly small, the number is likely to increase as the World War II and Cold War eras recede into the past. For the UXO industry, this is a point central to increased regulatory involvement.

In October, 2012 ACR conducted a non-scientific, anonymous survey of UXO and EOD technicians and contractors in an effort to gauge industry perceptions of cultural resource laws. The question was posed “What has been your experience with archaeological compliance requirements on commercial UXO projects?” Participants in the survey responded to the question thusly:

- No exposure to archaeology on UXO jobs: 11%
- Favorable experiences: 55.5%
- Negative experiences: 27.9%
- Neither positive nor negative experiences: 5.6%

Given the limited number of respondents (n=18), the representativeness of these responses remains highly suspect. Roughly half of the respondents, however, indicate no exposure to archaeological regulation, negative experiences, or neither positive nor negative experiences. These results suggest room for improvement in how cultural resource compliance is achieved. Such a goal requires further coordination between agencies, UXO contractors, and archaeological contractors.

Increases in the Regulatory Environment

At this time, agencies and contractors face an increasingly uncertain budgetary outlook. At the same time, the regulatory environment has been increasing. Agencies and contractors are expected to do more with less. The recent enforcement of ca. 1966 cultural resource laws on UXO projects is one example of this shift of the UXO industry toward increased compliance with existing laws.

ACR suggests three primary factors driving the increasing frequency by which UXO projects are being required to consider potential effects to cultural resources. The three primary factors are:

- the increasing historical depth of the military industrial complex.
- the increased exposure of the Parties to the methods employed in UXO projects, and;
- the addition of newly-identified FUDS properties,

These three factors combine to ensure that more UXO projects will be considered subject to existing cultural resource laws in the future.

Increasing Historical Depth

Recognizing that the age for a site being considered “historical” and, therefore, subject to review for significance is 50 years, the growth of the World War II and Cold War military presents a staggering challenge for both the UXO contractor and for those tasked with managing sites associated with the military legacy of the United States. To put this time depth in context, at the time this paper was drafted, the 1963 escalation of US involvement in Vietnam is now entering what is legally termed the historic period of significance.

As technological achievements continue to grow at an ever-quickening pace, even those from military backgrounds are becoming increasingly distanced from past military practices, technologies, and developments. Familiarity breeds contempt, but a deepening historic context lends to the perception of value, historical merit, and general interest. Among other reasons, the deepening historical value associated with military ordnance plays a contributing role in why MEC debris are increasingly being regarded as archaeological artifacts.

Federal undertakings within all industries are subject to some of the same laws, including the NHPA and its implementing regulations. Contractors working within remediation industries such as UXO are unique in the fact that they deal primarily with disturbed areas, removing materials that were left behind at some point in the relatively recent past. As more of those materials and the material evidence of the activities that resulted in their deposition reach the 50-year criterion, it is easy to understand why contractors in the remediation sector are slowly being exposed to the ramifications of the Section 106 process.

Increased Exposure from Regulatory Parties

In ACR’s informal survey to gauge industry perception of archaeological compliance, 11% of respondents stated that they had never encountered archaeological requirements on commercial UXO projects, in spite of the fact that most UXO projects are classified as federal undertakings. Furthermore, it has been the experience of ACR that a fair number of UXO contractors and agency representatives are unfamiliar with how cultural resource laws may apply to UXO projects. Why is it that, only recently, archaeological requirements have been pressed within UXO projects if, in fact, the NHPA has been in existence since 1966?

The answer is relatively simple. Agency representatives having both direct and indirect jurisdiction over UXO projects have, in the past, come to agreements that UXO projects lack the potential to effect districts, sites, buildings, structures, or objects that are included in or eligible for inclusion in the National Register (Historic Properties).

Increasing Number of FUDS sites

The third point ties directly into increased exposure and education. Land managing agencies other than the US military have taken a primary role in the management of FUDS properties. The US Forest Service, Bureau of Land Management, Department of Energy, and even the National Park Service (NPS) maintain properties that are known to possess UXO hazards. Accustomed to dealing with cultural resource issues on development and lease projects, public interpretation, or historic preservation programs, these agencies place a heavy emphasis on cultural resource management. The NPS, in fact, is tasked with maintaining the NRHP.

Even if the Army Corps of Engineers takes the lead on a project, land managing agencies carry enormous sway over the management of cultural resources on their property. As not only consulting Parties under the stipulations of 36CFR800, but also as land managing stakeholders, the influence of land managing agencies should not be underestimated.

The relationship between the employees of land managing agencies and the SHPO should also not be underestimated. The employees of a land managing agency have had every opportunity to develop smooth working relationships with the SHPO in the state(s) where they work. If an “outsider” jeopardizes their relationship with one Party, chances are other Parties will become less flexible in interagency consultation.

The designation of more FUDS sites has not only introduced land managing agencies to UXO remediation, but it has placed the industry right on their home turf. Given any degree of exposure and education, land managing archaeologists will likely push back if faced with a determination that UXO remediation is not the sort of undertaking likely to adversely impact cultural resource sites.

The UXO Archaeologist

Archaeologists supervising cultural resource compliance fieldwork must meet specific standards that have been set forth by the Secretary of the United States Department of the Interior. The UXO contractor may be completely unfamiliar with ways to comply with the NHPA and other laws, and most companies cannot justify the overhead expense of retaining in-house qualified archaeologists. Lacking predictable availability of agency support assets, most contractors will opt to sub-contract to a qualified cultural resource consultant.

The involvement of archaeologists on a MEC site justifiably raises concerns of safety, lost productivity, and increased cost; however, to maintain an existing contract and to win future bids, the contractor is forced to meet the compliance obligations of the lead agency. If sub-consultants are experienced with UXO projects, they can often assist their client with the challenges of integrating archaeologists within the established framework of a UXO team. If sub-consultants are not experienced with UXO projects, they can lack the understanding of UXO methods, schedules, and objectives.

The consequences of neglecting regulations can severely impact a company's bottom line. Failure to efficiently achieve compliance can lead to added cost, lost time, injunctions, lost contract opportunities and, in some circumstances, lost revenue in the form of monetary fines.

The fairly recent emphasis upon addressing archaeological concerns as part of UXO projects has resulted in very few case studies presenting successful methods, approaches, research designs, and models that could be built upon. Previous written work addressing ordnance and archaeology has focused primarily on the health and safety of archaeologists working on archaeological sites that are, coincidentally, UXO sites: Discussions regarding MEC as artifacts has focused almost entirely upon demilling items for safe curation and display (Linck and Vann 2001). Additional effort must be made to disseminate within the archaeological community information useful in devising pertinent approaches to dealing with the archaeology of UXO sites.

Further complicating the issue of compliance is the fact that agency archaeologists responsible for administering regulations possess little or no understanding of the UXO industry. Rightly or wrongly, regulatory archaeologists have grown accustomed to the "one correct way" to consider cultural resources. This "one correct way" has been born of more traditional development projects such as oil and gas wells, pipelines, mine expansions, highways, or other engineering projects where the area of potential effect can be, more or less, projected.

Traditional archaeological methods that agency archaeologists have grown familiar with follow a rote systematic progression that appears something like this:

1. Conduct archival research to define previous projects conducted in an area, and to identify previously documented archaeological sites.
2. Define scope of proposed inventory; typically cultural resources deemed "historical", or 50 years of age or older. Military contexts may include Cold War, 1947 through 1989 or 1994, as a significant period in recent history.
3. Conduct a pedestrian or systematic shovel test survey to identify cultural resources that had not been previously reported.
4. Differentiate isolated cultural resources from archaeological sites based on artifact count and density of distribution.
5. Evaluate sites for possible nomination to the National Register of Historic Places (NRHP). If eligible, those resources are classified as Historic Properties.
6. Advise avoidance of Historic Properties. If avoidance of adverse effects to a Historic Property is not feasible, prescribe mitigation. Data recovery by archaeological excavation is a commonly accepted form of mitigation.
7. Provide a minimum of 30 days for review by SHPO, tribes, and other consulting parties.
8. If avoidance of Historic Properties is not possible, a Programmatic Agreement (PA) must be drafted to implement mitigation. Typical timeframe for a signed PA is 1-18 months.
9. Execute mitigation to ameliorate adverse effects to Historic Properties.
10. Demonstrate and defend sufficiency of mitigation.
11. Lead agency issues cultural resource clearance, with State Historic Preservation Office (SHPO) concurrence. The project is allowed to move forward.
12. Mandate monitoring of ground disturbing activities to ensure documentation of undiscovered archaeological sites.

Clearly, traditional approaches to archaeological permitting do not work well for UXO projects. Stringent adherence to this standard model of compliance is diametrically opposite the requirements for successful UXO projects. Fortunately, no specific recipe is required for maintaining compliance with any specific cultural resource regulation. Consideration of cultural resources is required, as is a formal chain of consultation. The steps in achieving these ends, however, are left open for consultation and mutual agreement between the agencies involved in the process.

For UXO projects, the approach to maintaining regulatory compliance must diverge from the old tried and true “one correct way”. Agency archaeologists responsible with maintaining compliance must be engaged so that they feel reassured that UXO projects will achieve regulatory success. Moreover, those within the UXO industry must be made to feel comfortable that their projects are covered from a legal perspective.

Methods

The methods employed in UXO projects necessitate the indiscriminant removal of metallic objects from the ground surface, and from below the ground surface. This fact is not lost on agency representatives tasked with managing cultural resources. Metallic artifacts constitute the greater part of historical archaeological sites, and removal of these materials can constitute a dramatic loss of context for surviving archaeological deposits. Intrusive excavation for metallic objects can inadvertently disturb other archaeological deposits as well, including prehistoric sites.

As more military maneuver areas, installations, and proving grounds enter the historic realm of 50 years and older, archaeologists and historians begin to identify more research questions. Many of these research questions focus upon the effects of domestic military installations upon the development of local economies, how socio-economic patterns evolved during and following the desegregation of the US armed forces, how health and sanitation policies affected the hygiene practices of troops, or how wartime demand for resources constrained training protocols stateside. In contrast to written history, the value of archaeology is its ability to document the heritage of a population in ways that may have been neglected in written documentation.

The appearance of historical MEC, in this context, underlies the primary theme of this paper; MEC items as archaeological artifacts. Any UXO professional who has conducted intensive archival research of range reports for a test and training center understands all too well that what is anticipated rarely represents what is found in the field. As a UXO project progresses, the astute UXO tech is able to gradually piece together a refined understanding of the activities at a project area. Patterns of impact areas, firing points, observation bunkers, camp and work locations, roads, and architectural features combine to make sense through gradual recovery of data. Though it is not the task of the UXO contractor to document and formally interpret many of these patterns, experienced members of UXO teams rely on their understanding of certain observations so that they can contribute to a successful and safe project.

Using a similar approach, archaeologists are tasked with documenting these patterns so that a better understanding of the patterns of land use history can be developed and documented. Much information can be obtained from the presence and distribution of MEC and other ordnance-related artifacts.

The Significance of MEC Artifacts

In some cases, live historic ordnance may be disarmed in order to preserve it for future study, public interpretation or museum display, or as part of an arsenal comparative collection. MEC artifacts may have value in and of themselves – due to their rarity, uniqueness, or their importance in relation to a greater historical theme, context, events, or landscape. In some cases it may be decided that MEC items are significant enough to be rendered safe for archival curation; but, for obvious reasons, safety trumps historic preservation.

The National Park Service (NPS) has specific guidelines relating to the recovery and preservation of unexploded ordnance. The NPS states that: *“If the object is rare, novel, or limited in production (for example, Whitworth projectile, Armstrong projectile, Confederate Mullane projectile) ... make every effort to defuse[SIC] it and preserve the inert object in the collection”*. However, the NPS explicitly states that safety considerations trump the preservation of even rare ordnance; *“Treat any unexploded ordnance ... with extreme caution. Considerations for the safety of staff, visitors, and resources take precedence over the preservation of even rare ordnance”*.

In ACR’s experience, MEC artifacts are typically destroyed, but they are first recorded by archaeologists in an effort to document their presence in a specific context. Following is a discussion of MEC artifacts, both preserved for study and destroyed as part of remediation actions.

Vermont

In 1996, an underwater deposit of 63 American Civil War-era mortar projectiles was discovered by sport divers in a Vermont lake. Each of the 12-pound projectiles possessed a wooden sabot, representing some of the earliest known, best-preserved examples of this type of ordnance. Three years prior to this discovery, a cache of the same type of mortars were found in the lake. These were deemed to be a public hazard and were destroyed by the police. Because examples of this type of mortar are so rare, Senator Patrick Leahy secured funding from the DoD Legacy Program to preserve the second cache. The Vermont National Guard worked with a team from Indian Head to render the ordnance safe for display. They are currently on public display at a maritime museum (Perkins 1996).

Alabama

In a more recent example, a prototype 70mm spin-stabilized rocket assisted projectile was discovered at Redstone Arsenal. This item likely dates to the late 40s or early 50s. When it was discovered, the UXO team, with a combined UXO experience of over 120 years could not identify it. The item was destroyed by Army EOD. However, arrangements have been made for future items of this type to be rendered safe and taken into custody of Picatinny Arsenal for future study. There are many benefits to preserving examples of these munitions. For instance, there is not good historic documentation of many types of experimental ordnance. Keeping ordnance for study and promulgating this information can help UXO teams to identify and render such items harmless in the future. Also, it can help fill in gaps in the military’s history of experimental munitions, including early rocket assist technology.

Utah

At present, the Bureau of Land Management Salt Lake Field Office (BLM-SLFO) is dealing with stationary bombing targets used during World War II. Elsewhere, similar targets have been determined eligible for nomination to the NRHP under various criteria; the MEC and MD have, however, been determined non-contributing elements of similar sites. Certain elements within consulting Parties maintain that the distribution of the MEC and MD comprise a data set that is significant under 36CFR60.4, Criterion D.

When addressing the research question, “Were historical reports of the extreme accuracy of US aerial bombing sights during World War II true, or was the accuracy of these systems exaggerated?” the historical record lacks consistency. An analysis of the distribution of artifacts associated with this sort of site could address this question, and others. This is an example of a valid research question that could validate the significance of MEC on a site, while not impeding or precluding remediation efforts.

Miscellaneous Training Areas

Training areas for troops who fought in World War I, World War II, Korea, Vietnam, and other conflicts are located across the United States. Some of these sites remain in use today, but an ever-growing number of these sites have been designated under BRAC or survive as FUDS properties. As more of these sites achieve the 50-year criterion for historical consideration, an increasing scrutiny has been placed upon these sites by the archaeological community.

The distribution of MEC, MD, features, and other artifacts across the landscape yields much information important to the understanding of the development of training, doctrine, and land use patterning in the years leading up to and following certain conflicts. The information that is present at these sites is highly important, not only from an archaeological perspective, but from the perspective of military heritage and scholarship.

The occurrence of MEC artifacts, in contrast to the artifact assemblages of work and living areas, lends to a more refined understanding of the formation of modern military practices. Additional work being done in these areas is contributing to our understanding of America’s military heritage.

Various Arsenals and Proving Grounds

Arsenals and proving grounds are the focus of great attention because nobody actually knows what prototypes were created and which experiments were conducted. Any UXO tech who has worked at a major arsenal or proving ground has numerous examples of rare and novel ordnance, or ordnance that was of limited production. It is perhaps most common that arsenals and proving grounds may yield examples of ordnance possessing the capacity to provide the community at large with comparative examples for comparison. While EOD personnel are the only individuals capable of rendering safe a piece of ordnance for archival curation, these specialists are not trained in the documentation and interpretation of archaeological context. Archaeological context of MEC artifacts, once lost, is lost once an artifact is removed from its original provenience. As such, it is advised that archaeologists be utilized in an effort to collect all possible information so that the artifact may be able to convey its greatest significance. Safety considerations pertaining to MEC are obvious, however, highlighting further the application of UXO-qualified archaeologists in such a setting.

MEC Artifacts in a Remediation Context

In ACR’s experience, when a MEC artifact is discovered on a UXO project, whether or not the item is part of a site, it is destroyed. If the UXO team leader decides that the item can be approached safely, the archaeologist would take photos and record a description of the ordnance. Depending on the relative danger of the item, it may even be measured. Generally, however, non-UXO qualified individuals would

not be allowed to handle munitions. This is where having UXO-trained archaeologists comes in handy. A UXO-qualified archaeologist, like any other UXO tech, would be able to approach and handle the item if it was approved by the team leader. This way, a more thorough documentation can take place, and useful information could be gathered before the item is destroyed. If the team leader decided that the item was a hazard, he or she could deny the non-UXO qualified archaeologist entrance into the exclusion zone. In this case, the programmatic agreement may stipulate that the UXO team assist the archaeologist in recording the munition. They may need to take photos, measurements, if possible, and note key features and the orientation of the item. Unfortunately, this takes time away from the UXO team's essential work obligations. However, it may be a necessary requirement.

Application of Cultural Resources Laws on UXO Sites

Cultural resource laws can require a variety of procedures and protocol on UXO sites, depending on the programmatic agreement, the land managing agency, the lead agency for the project, site-specific conditions, and the SHPO. ACR has seen first-hand how these laws, cultural resource compliance practices and UXO remediation procedures interact in the field.

General Template and Options for Integrating Archaeology Into UXO Project Methodology

The following is a hypothetical model with varying options for how archaeologists can be successfully integrated into the functions of a UXO team in order to maintain cultural resource compliance while the remediation task is accomplished. This is based on ACR's experience of evolving methods on UXO projects involving archaeology.

Transect Survey Ahead of DGM Data Collection

To characterize the nature and extent of munitions contamination on a project, linear transects are often surveyed. These transects may be only visually surveyed or they may employ data collection of subsurface anomalies (e.g. digital geophysical mapping [DGM] with an EM-61). One or more archaeologists can be integrated into the UXO survey team. When cultural resources are encountered the archaeologist(s) can record the resource immediately. If the resource is small (e.g. an isolated resource) recording should only take 5 to 10 minutes. If it is a large resource (archaeological site), a separate, designated archaeological recording team can return to the location (escorted by a qualified UXO technician) to record it. This saves time as the UXO survey team does not need to be idle while the archaeologist(s) on their team record the resource. If the PA stipulates avoidance of sites, the archaeological recording team can determine the site boundaries and map a re-route (provided in a Shapefile format) for the DGM crew to follow.

Grid Clearance

For grid surface clearance ahead of DGM data collection, options are available for integrating archaeologists into the UXO team. Again, if the PA stipulates avoidance of sites, a quick archaeological survey of the area will be required to locate any cultural resources which have not been previously-identified. If a site is encountered, the grid location may need to be adjusted out if it. If the PA does not stipulate avoidance of sites, the resource will still need to be recorded. If it is small, the UXO team's archaeologist can accomplish the task while the remainder of the team is conducting their survey. If it is a large resource, a separate recording team can again come to record and evaluate the resource so there is no lost time on the part of the UXO team.

Subsurface Anomaly Clearance

Integrating archaeologists into the UXO dig team may become more complex than for surface clearance. Most PAs and archaeological monitoring plans will stipulate a safety exclusion zone for all non-UXO qualified personnel during anomaly excavation due to the possibility of encountering MEC. This can create issues from a cultural compliance perspective as UXO personnel would not be qualified to identify cultural deposits, especially prehistoric ones. This can also create efficiency issues, as the dig team must stop excavation when the archaeologist enters the grid to inspect an excavation. Options are available for overcoming these difficulties. First, non-UXO qualified archaeologists can be deemed 'essential personnel' and be allowed access to the grid during intrusive activities. This exemption would have to be agreed up on by the Parties. Second, a live-feed camera on a tripod can be set up on each so that the archaeologist can view the excavation in progress from a safe distance. This option entails logistics and equipment requirements which may be cumbersome and hard to support in a remote location. Finally, the contractor can utilize archaeologists which are cross-trained as UXO techs. This alleviates the need for the archaeologist to be outside of the exclusion zone. A second advantage is that the cross-trained archaeologist can assist in the excavation of areas that may be culturally sensitive.

Two Common Issues of Meeting Compliance Obligations

ACR has developed methods and been able to work with land managing agencies such as the Forest Service and National Park Service in order to assist the UXO remediation mission while still meeting cultural compliance obligations. Two common issues can complicate remediation and compliance obligations. However, these issues can be resolved by working with land managing agencies, the lead agency and by adjusting field protocol. The result can maintain compliance without sacrificing efficiency and while successfully accomplishing remediation.

How to Address the Recovery of Non-Munitions Artifacts

The removal of non-munitions metal artifacts can create cultural resource compliance issues. The total removal of these artifacts may be deemed a necessary action for remediation compliance. These actions can be mitigated through the terms of the PA and / or the mitigation plan following the guidance of 36CFR800. Alternatively, non-munitions artifacts may remain in the field, in which case the issue of metallic anomaly QA/QC will have to be resolved.

Surface Non-Munitions Artifacts

If metal items need to be removed from the surface ahead of DGM data collection on grids or along transects, several options exist for minimizing the impact to cultural resources while still accomplishing the task. Assuming that MD, frag and MEC will be removed for disposal by the UXO team, what becomes of metal historic artifacts which are not munitions-related? After the artifacts have been recorded by the archaeologist assigned to the team, one option is for non-ordnance metal to simply be moved off of the transect line or out of the grid. The disadvantage to this method is that it creates concentrations of artifacts outside of their original context and thus alters the archaeological record. A second option is for archaeologists to collect and curate these items. This requires additional time as well as curation space for artifacts that may have little diagnostic value (often tin cans, wire, nails, horseshoes and the like). Space at curation facilities is limited and expensive, and consulting parties may or may not accept such an approach. A third option is for non-diagnostic artifacts to be recorded by an archaeologist and then removed for disposal along with the munitions-related artifacts. At the archaeologist's discretion, diagnostic non-munitions artifacts could still be collected for curation. This option requires consultation with the Parties.

Subsurface Non-Munitions Artifacts

The subject of non-munitions artifacts recovered from intrusive actions is similar to that of artifacts removed from the surface. There are two main differences. First, by virtue of these items being located below ground, they are likely preserved in an intact archaeological context. Removing these artifacts may constitute an adverse effect to a historic site and therefore consulting Parties may not want them to be removed. This ties in to the second difference; if non-munitions metal artifacts are not removed from the excavation, how will the anomaly excavation pass QA/QC inspection?

Although the non-munitions artifacts are recovered from what may be an intact archaeological context, the consulting Parties may still concur upon the disposal of non-diagnostic artifacts and curation of certain diagnostic or rare artifacts. Alternatively, the Parties may allow the artifacts to be set outside of the excavation (while it is still open) until the QA/QC process is complete. Afterwards, the artifacts can be placed back in the hole and reburied. This preserves the artifacts in their approximate location for future study, while allowing for successful clearance of the anomaly without redundant curation. The disadvantage of this option is that the excavated holes must remain open until the QA/QC process is complete. This creates a trip or fall hazard which may not be acceptable in unsecured areas. Finally, consulting parties may indeed push for the collection and curation of all non-munitions artifacts recovered subsurface. While this is more time consuming and ultimately requires expensive curation space, it allows for the performance of QA/QC on filled excavations.

The Issue of Impacting Sites vs. Accomplishing Remediation

ACR has been involved with projects where not impacting an eligible site was a factor. Sometimes, impacting any archaeological sites whatsoever is a concern as any site could potentially be determined eligible. But what happens when a site is a protected resource, and it is composed of exactly what the UXO team is tasked with collecting and destroying? For example, if a state defines 9 artifacts as a site and a resource is composed of 9 pieces of frag, how would this be handled? If a remediation team is tasked with avoiding sites while clearing munitions debris, frag, and MEC, it makes sense in the context of accomplishing the remediation mission to make an exception to the site avoidance stipulation. However, compliance laws don't necessarily bend simply because it makes sense. Changing rules has to be congruent with cultural resource law, land managing agencies' policies, and the PA, if applicable. ACR was faced with this dilemma on a project. ACR consulted with the land managing agency and researched previously existing ordnance and frag studies to better define the potential distribution of ordnance debris that would result from military activities.

ACR Frag Distribution Context

Where a specified quantity of historical artifacts within a discrete area constitute a cultural resource site, the presence of frag and other munitions debris could skew the definition of archaeological sites if the component parts of individual items are not considered. Much as individual glass fragments are not counted as whole bottles, pieces of frag should not be counted as individual artifacts. A more refined definition of the relationship between frag and individual artillery projectiles is important. This requires a better understanding of the minimum number of individuals represented by frag across a given area, for a specific item. For the purposes of illustration, ACR reviewed the results of existing fragmentation studies for five artillery projectile types common to World War I through World War II live fire training areas. The results of ACR's study have been accepted by the archaeologists from different consulting parties as a sufficient reason for diverging from traditional artifact count standards for site definition, but should not be confused with the frag radius standards currently used for safety plans.

A properly-functioning, individual artillery projectile of either type detonates to yield frag. Frag is expelled during detonation, producing enemy casualties in a discretely-targeted area. Nose spray (fuze pieces), side spray (body pieces), and base spray (body and/or fuze pieces) are the primary classifications of frag burst (Dehn 1980:12). Shrapnel balls, while technically not frag, are functionally similar projectiles and are not differentiated from frag in artifact counts.

The quantity of frag yielded from artillery projectile detonation is dependent on the projectile's design, as well as the projectile's orientation at the point of detonation (e.g. airburst, ground burst, subsurface detonation in loosely consolidated sediments, etc.).

It is not possible to account for the ways in which artillery fragmentation was influenced by the numerous design changes that were implemented to improve artillery effect. Specific inferences can, however, be made to define the relative volume of debris generated by the detonation of artillery projectiles common to World War I and World War II ranges, specifically with regard to 37mm HE (base-fuzed), 75mm HE, 3-in. shrapnel, 75mm shrapnel, and 155mm HE projectiles (Table 1).

Projectile Type	Air or Ground Burst	Subsurface Detonation in Loose Sediments (Sand)	Subsurface Detonation in Compact Sediments
37mm HE	4 [*]	4 [*]	≤4 [*]
3-in./75mm HE	≤5000 ^{**}	≤780 ^{**}	1 to ≤780 ^{**}
3-in. Shrapnel	305 to 360, plus nose spray ^{†***}	305 to 360, plus nose spray ^{†***}	1 to 360, plus nose spray ^{†***}
75mm Shrapnel	300 to 346, plus nose spray ^{†****}	300 to 346, plus nose spray ^{†****}	1 to 346, plus nose spray ^{†****}
155mm HE	Unknown (greater than 3-in./75mm HE) ^{‡****}	Unknown (greater than 3-in./75mm HE) ^{‡****}	Unknown (greater than 3-in./75mm HE) ^{‡****}

^{*} Based on field observations

^{**} After Dehn (1980) and Tolch (1937)

^{***} After Hamilton (1915)

^{****} Based on Rhodes (2009)

[†] Variability in shrapnel frag volume dependent on weight of balls and load compression

[‡] 155mm HE frag volumes based on historical theoretical analogies

In addition to the frag volume, (i.e. number of frag produced from each projectile), studies have also been conducted on the distance frag can travel (Crull and Swisdak 2005). Variables such as projectile velocity, as well as its orientation at the moment of detonation can influence the distance of travel. Frag at the bottom of the projectile relative to the ground, will travel much shorter distances than the frag generated from the upper portion of the projectile. Based on the data provided by Crull and Swisdak (2005), Table 2 indicates the potential *maximum* vertical and horizontal travel distances of frag from various munitions.

Projectile Type	Maximum Horizontal Fragment Range (ft.)	Maximum Vertical Fragment Range (ft.)
37mm HE	980	754
3-in./75mm HE	1702	1298
3-in. Shrapnel	1346	1071
75mm Shrapnel	1701	1297
155mm HE	2842	2169

Frag Characteristics of 37mm High Explosive Projectiles

The 37mm HE projectile, as discussed here, possesses a base fuze and contains a detonating charge. This charge is ignited when the fuze senses a dramatic change in inertia, as in impact or grazing against a target. The fragmentation characteristics of the 37mm HE projectile are poorly documented in historical literature. Based upon field observation, it appears that the 37mm HE projectile typically detonates into four distinct pieces of frag. The projectile body splits into equal thirds, and the fuze often remains intact. The frag from 37mm projectiles can travel up to a maximum of 980 ft. from the detonation area.

Frag Characteristics of 3-inch and 75mm High Explosive Projectiles

Studies conducted by N.A. Tolch in 1937 focused directly on frag counts for 75mm HE projectiles, with vertical bursts at ground level and detonations in controlled sand pits (Dehn 1980:11-14). These studies documented, in the case of ground burst shells, a yield of 5,000 pieces of frag. These were categorized based upon their effect on spruce boards and steel plate, dividing this count into 700 perforating, 900 penetrating, and 3,400 denting fragments (Dehn 1980:12). The division of frag by penetration effect is based mostly upon size, where frag with lower mass will not as readily penetrate as larger pieces. Additionally, detonation of identical projectiles in sand pits generated an average of 780 fragments which, graded through sieves, demonstrated retention of approximately 95% of the total metal mass of the 75mm HE projectile in a contained space (Dehn 1980:12). Tolch's studies summarized the maximum effective blast radius in terms of lethality, verifying the results of experiments conducted in 1933 by R.H. Kent (Dehn 1980:8-14). The frag from 3-inch and 75mm projectiles can travel up to a maximum of 1702 ft. from the detonation area.

Relatively intact, functioned (i.e., detonated or performed as designed) 75mm HE projectiles have been identified in the field. These functioned items are typically encountered below the ground surface. Items in this condition are most likely the result of incoming projectiles embedding themselves in the ground surface prior to their detonation. HE projectiles that detonate in consolidated sediments appear to produce dramatically fewer pieces of frag than those that are detonated in the air, or in loosely consolidated sediments.

Frag Characteristics of 75mm and 3-inch Low Explosive (Shrapnel) Projectiles

75mm and 3-inch shrapnel projectiles yield frag in a much different manner than HE. The projectile body is not designed to burst into frag, but is intended to function as a gun barrel for the concentration of a blast of lead or lead-filled steel shrapnel balls. This aerial blast would generate nose spray of fuze and fuze adapter frag, flash tube, and pusher plate, although this was largely ignored as an ancillary effect in artillery treatises of the period, which focused on the projection of shrapnel balls. This blast was propelled by a charge of approximately 3-ounces of black powder, insufficient to rupture a properly manufactured shrapnel projectile body. Since a shrapnel projectile body was not intended to fragment upon detonation, intact projectile bodies are frequently encountered. Fragmented shrapnel projectile bodies are most likely the result of physical impact with a hard surface, and not detonation. Shrapnel

balls were graded by weight, with 39, 42, or 45 balls per pound being the most common; a 14.5-pound 75mm shrapnel projectile contained 300, 315, or 346 solid lead balls, respectively. A 3-inch shrapnel projectile contained 305 lead-filled steel balls, graded at 42 balls per pound, or 360 solid lead balls graded at approximately 45 balls per pound (Hamilton 1915:6). The variability between the payload of lead and steel balls may be a function of malleability, as it is noted that consolidation of solid lead balls inside a the body of 75mm shrapnel projectiles resulted in a 10% increase in effective payload (Hamilton 1915). It is inferred that the figures presented above are relative, and are based upon a fully compressed payload. The frag from low explosive 3-inch projectiles can travel up to a maximum of 1,346 feet from the detonation area. The frag from low explosive 75mm projectiles can travel up to a maximum of 1,701 ft. from the detonation area.

Frag Characteristics of 155mm High Explosive Projectiles

Historical documentation generally neglects analysis of 155mm frag characteristics, focusing attention on the more prolific 75mm and 105mm projectiles. As part of his 1933 studies, R.H. Kent contrasted the 75mm HE projectile against larger projectiles in general (Dehn 1980: 8-11). Kent noted that larger projectiles would result in larger, more numerous frag of greater mass; however, no specific details pertaining to 155mm HE projectiles were provided. Additional information would be required in order to refine the current understanding of 155mm frag characteristics. The frag from 155mm projectiles can travel up to a maximum of 2,842 feet from the detonation area, and can be assumed to generate more frag than a 75mm HE projectile.

Frag Context Summary

Given ACR's research and conclusions, the land managing agency approved a change in ACR's recording protocol for the project for resources composed primarily of munitions debris and frag. Thus, ACR's protocol was that if a resource contained the minimum number of historic artifacts to qualify as a site, but consisted of more than 50% munitions debris, the resource would be categorized as an isolated resource and not a site. The resource therefore would not have to be avoided and munitions items could be collected from it.

Practices, Issues and Solutions

Given an opportunity, UXO contractors can cooperate with archaeologists to develop real-world working solutions to the complexities of complying with both UXO and cultural resource regulations.

Table 3 summarizes practices and protocol that are typical for UXO projects, but often lead to challenges in regulatory compliance. Solutions that have been accepted by consulting Parties are presented. In order to be workable, solutions must lend to the safe, compliant, efficient, well-organized, and successful remediation of UXO.

**Table 3. Practices, Difficulties and Solutions
in Regard to Archaeology and UXO**

Practice/ Protocol	Issue Caused	Solution(s)
UXO grid locations include areas within historic sites	<ul style="list-style-type: none"> • A preponderance of non-UXO cultural materials are identified and sites which contain no munitions are affected. • Grid clearance is slow and recovers few, if any, munitions • Manpower spent clearing mostly non-UXO artifacts while areas with greater potential to contain munitions are not addressed 	<ul style="list-style-type: none"> • A programmatic agreement dictating avoidance of all cultural resource sites that are not likely to contain munitions has been useful for some projects where grids can be dropped, or moved • Develop archaeological mitigation plan to address effects to sites where UXO actions are necessary • Archaeological survey of grid area prior to UXO clearance to assess whether grid will be placed in site, than can progress accordingly • Work with archaeologists to put limited resources to best use: archaeological recordings of area sites, archaeological site characterizations, and historic research could help focus resources on the most likely areas, based on historic themes • Adjust grid clearance protocol so that investigation of a grid halts after a minimum number of targets (e.g. 50) yield no ordnance-related materials • Adjust IP investigation protocol so that intrusive activity stops if only non-munitions cultural items are uncovered
UXO protocol dictates that all metal is to be removed from a grid or transect, whether or not it is ordnance-related	<ul style="list-style-type: none"> • Artifacts are removed from archaeological context, and may result in an adverse effect to cultural resource sites. 	<ul style="list-style-type: none"> • Plan for avoidance of archaeological sites, or plan for mitigation • Plan for documentation of all materials removed, and archival curation of diagnostic, non-munitions materials • Non-munitions metal set aside from intrusive probe until QA/QC process complete. Non-munitions metal returned to hole and backfilled afterward

**Table 3. Practices, Difficulties and Solutions
in Regard to Archaeology and UXO**

Practice/ Protocol	Issue Caused	Solution(s)
Requirements for archival curation of all non-munition artifacts removed by UXO contractor from surface or subsurface	<ul style="list-style-type: none"> • Time spent collecting and curating non-diagnostic items (ie wire, nails, tin can fragments) • Money and space spent curating items with little to no archival value 	<ul style="list-style-type: none"> • Lead agency consults with Parties for needs of particular site • Artifacts are collected at archaeologist's discretion. Artifacts of little historical value are disposed of • Non-munitions metal set aside from IP until QA/QC process complete. Non-munitions metal returned to hole and backfilled afterward
Programmatic agreement may stipulate avoidance of eligible sites.	<ul style="list-style-type: none"> • Intrusive probe (anomaly) excavations may change site eligibility from non-eligible to eligible, therefore intrusive actions become adverse effect to site 	<ul style="list-style-type: none"> • Plan for avoidance of all archaeological sites, or plan for mitigation • Consult with lead agency and land managing parties to grant exception to PA when MD or MEC is found on sites
Programmatic agreement may stipulate avoidance of all sites.	<ul style="list-style-type: none"> • Specific number (e.g. 10, 25, 50, etc.) of historic artifacts (including MD, MEC and frag) considered historic archaeological site, by individual state laws... so removal of MD could constitute an adverse effect to a site 	<ul style="list-style-type: none"> • Lead agency consults with parties (land managing agency, SHPO, Tribes, etc.) to make exceptions for site definitions, using information from existing frag studies • Broad impact areas can be defined as elements of a historical landscape, rather than as discrete archaeological sites
Non-UXO qualified personnel required to be outside of exclusion zone during intrusive work	<ul style="list-style-type: none"> • Lost time due to archaeologists going in and out of exclusion zone while intrusive teams stop work • UXO techs not qualified to identify archaeological deposits, especially prehistoric items • Archaeologists have no "eyes" in grid during excavation 	<ul style="list-style-type: none"> • Archaeologists deemed essential personnel requiring escort • Live-feed video camera set up at anomaly excavation so archaeologist can monitor dig from outside of exclusion zone • Archaeologists cross-trained as UXO techs, thereby allowed within exclusion zone during excavation

Summary and Conclusions

The NHPA and other cultural resource regulations have shaped the planning and implementation of Federal Undertakings since their inception. Until fairly recently, lead agencies tasked with the remediation of UXO sites were able, through the consultation process, to achieve concurrence that remediation of MEC and other related debris was the sort of action not likely to cause adverse effects to cultural resources. Necessary for public health and safety, this environmental effort was deemed practically exempt from cultural resource regulation.

Today we are facing a shortage of funds, but with increasing frequency consulting Parties will not concur with an agency's determination that a UXO project is not likely to pose risks to the integrity of cultural resources. ACR finds that this has much to do with the consulting Parties becoming educated to the methods employed in UXO remediation. Contributing to this trend is the proliferation of FUDS sites across the nation and the exposure of land managing agencies, among others, to the specifics of UXO methods. Additionally, the ever-increasing historical depth of the US military industrial complex increases the cultural interest in the types of sites that are likely to contain UXO.

With these understandings in place, it should come as no surprise that individual MEC items would be considered as archaeological artifacts. They are, after all, the residual evidence of a specific human activity across a discrete landscape and, therefore, could be construed as individual artifacts of a much greater entity; in essence, a historic archaeological site.

As agencies begin to find an increasing need for UXO projects to consider potential effects to cultural resources (that is, beyond the former conclusion that there could be no potential effects), more and more contracts will possess an archaeological component. That means archaeologists will be serving UXO clients with increasing frequency, and that means that UXO supervisors will be increasingly tasked with juggling yet one more specialty: the UXO archaeologist.

The commercial UXO industry is small, tight knit, and young. Nobody in the commercial UXO industry is on their first career. Most of the people currently involved in decision making for the industry today were involved in the inception of the very concept of the industry, its procedures, and its protocol. So, to attempt to integrate new members into teams, members whose contributions have very little to do with the actual task at hand (remediating UXO sites), the challenges are obvious.

The challenges, however, are worthwhile in light of the consequences of non-compliance with Federal law. Lost contracts, lost contract opportunities and difficult working relationships with agencies are certain consequences of not working within the regulatory environment. Yet, these are very real consequences that can and do occur when contractors attempt to bypass compliance.

These complications compound when MEC is defined as a discrete artifact type. What does this mean? While it need not mean preservation, or even conservation, the fact remains that certain processes must be observed – such as consultation pursuant to 36CFR800. Agreements must be reached in order to address such concerns with consistent methods, and that compliance must be documented by qualified archaeologists. If this requires archaeologists be present inside the exclusion zone in order to maintain compliance with one set of regulations, then solutions must be found to satisfy another set of regulations.

ACR has found that taking qualified archaeologists and cross-training them as UXO techs, while expensive, provides clients with a solution to conflicting regulatory requirements. Such specialists are capable of smoother integration into UXO teams, are adequately trained to complete the tasks required of an archaeologist on a MEC site, and are better able to help UXO techs efficiently complete their required task – remediation of UXO.

ACR has also found that archaeological methods that work well for non-UXO industries do not necessarily compliment the methods employed by UXO contractors. That being said, some practices considered to be “standard” for UXO contract work are flexible and, in fact, can be refined to achieve greater efficiency in an increasingly lean fiscal environment.

One non-standard approach where the UXO industry can appreciate greater efficiency is by utilizing the professional expertise of UXO archaeologists. By nature of archaeological methods, archaeologists identify and define archaeological sites by their type, function, context, and temporal affiliation. This data can be useful for a UXO contractor requiring additional justification to avoid an area that likely lacks MEC and MD, but will certainly contain many non-ordnance related metal objects (e.g. tin cans, barbed wire, musical instrument parts, barrel hoops, horse shoes, garter clasps, etc.). Avoidance of historical archaeological sites is, obviously, in the best interest of archaeology. However the avoidance of historical archaeological sites is also in the best interest of the contractor and the agency, who would be better served focusing limited resources on areas where the likelihood of the presence of MEC is much greater.

Looking Forward

As cultural resource compliance becomes an increasingly significant scope of UXO contracts, UXO contractors and their partners will find that they are best served by considering cultural resource issues early in the pre-bid and bidding process. By working with archaeologists experienced in the UXO industry, contractors may face fewer surprises and challenges after initiation of work. Furthermore, by presenting a unified proposal, contractors will have the opportunity to devise an approach that smartly integrates work plans, health and safety plans, document control, and communication issues.

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