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ASTSWMO POSITION ON ADVANCED GEOPHYSICAL CLASSIFICATION FOR MUNITIONS RESPONSE

The Department of Defense (DoD) developed the advanced geophysical classification for munitions response process (hereafter referred to as advanced geophysical classification, or AGC) to improve the efficiency and effectiveness of munitions cleanup.[1] AGC represents a major change in how munitions cleanup is conducted. Virtually every major element of the munitions cleanup process is affected including:

- Contracting
- Planning and Design
- Field Implementation
- Quality Assurance/Quality Control (QA/QC)
- DoD Component Oversight Role
- State Oversight Role

DoD and its partners have identified several advantages in using AGC over other technologies, including greatly improved performance at detecting and identifying munitions and explosives of concern (MEC) resulting in faster investigation and remediation; higher data quality and greater confidence under its accreditation process, which promotes State acceptance of the data; and less invasive fieldwork (fewer digs) due to the in-situ detection and classification of objects. In order for the DoD to regularly apply this technology at Munitions Response Sites (MRSs), State regulators must have an understanding and acceptance of AGC.

Background

Since 2007, DoD has made a concerted effort to establish AGC as another tool in the munitions cleanup toolbox. DoD's Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) began by working with their industry and academia partners to develop and demonstrate the technology. During its development, several State and federal led workgroups were formed to assess the potential benefits of this new technology and to provide training and guidance for how this tool should be

1 AGC is the use of data from an advanced geophysical sensor system to estimate the intrinsic properties of a buried metal object; specifically, for munitions response and unexploded ordnance (UXO) removal, to determine whether the object is a target of interest (TOI) that must be removed or other non-explosive debris (non-TOI) that can be left in the ground. Intrinsic properties include size, symmetry, aspect ratio, material composition, and wall thickness. AGC requires three components: 1) a geophysical sensor system capable of measuring EM signals from multiple aspects, 2) a model to estimate intrinsic properties of the buried item based on its polarizability decay curve or "EMI fingerprint", and 3) classification algorithms to assign likelihood that a buried item is a target of interest [SERDP-ESTCP].

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used. These workgroups include members from DoD, U.S. EPA, States, and other government and private entities to ensure that stakeholders are involved throughout the process. Among these are an ESTCP Advisory Group for AGC, the Interstate Technology and Regulatory Council (ITRC) Geophysical Classification for Munitions Response Team, the Intergovernmental Data Quality Task Force (IDQTF), AGC Subgroup; and the Munitions Response Dialogue.

Key Objectives for Gaining State Acceptance of AGC

Implementation of AGC requires careful, detailed, and scientifically sound planning by the abovementioned workgroups. Key project objectives, plans to achieve these objectives, and outcomes are described below:

1. **Demonstration of Technology and Identification of Relevant Issues**

   Activities include planning and conducting demonstrations of AGC's capabilities at a variety of MRSs to identify the types of sites where the technology works or fails to work, working closely with State and federal regulators and industry, and responding to initial questions and concerns about the technology.

   As of 2017, the ESTCP Advisory Group for AGC has developed and tested this technology, and demonstrated its use at approximately 30 MRSs across the United States. Results of these studies demonstrated that this technology is successful under most site conditions. Fact sheets for each demonstration are available on the SERDP-ESTCP website (www.serdp-estcp.org).

2. **Education**

   Several web-based training forums, tools, and guidance are available to educate and inform internal and external stakeholders. These include:

   - ITRC Resources (www.itrcweb.org):
     - *Geophysical Classification for Munitions Response Web-based Guidance (GCMR-2)*
     - *Geophysical Classification for Munitions Response Fact Sheets (GCMR-1)*
     - Live and archived web-based trainings on EPA CLU-IN (https://clu-in.org/default.cfm)
   - SERDP-ESTCP Resources (www.serdp-estcp.org):
     - *Implementing Advanced Classification on Munitions Response Sites: A Guide to Informed Decision Making for Project Managers, Regulators, and Contractors*
     - *Classification Applied to Munitions Response Fact Sheet*
     - Frequently Asked Questions
     - Demonstration Fact Sheets and program documents
     - Webinars and videos

- Defense Environmental, Safety and Occupational Health Network and Information Exchange (DENIX, www.denix.osd.mil)

3. Data Quality

Effective QA/QC is essential on each remedial response project to achieve regulatory support, and AGC is no exception. A major milestone in ensuring appropriate, reliable data was achieved with finalization of the IDQTF's *Advanced Geophysical Classification Quality Assurance Project Plan (AGC-QAPP) Template, Version 1.0*, dated March 2016 and finalized May 6, 2016. As a result of the high QA/QC standards established by the AGC-QAPP Template, DoD is currently developing an example munitions response (MR) QAPP that follows the same format as the AGC-QAPP Template. DoD has also developed and will continue to update a library of targets of interest (TOI) for use during classification.[2]

4. Site Applicability

Determinations as to which sites are appropriate for this technology will be made in concert with States during the systematic planning process and based on the development of the conceptual site model (CSM) and remedial action objectives (RAOs). The CSM should contain all current knowledge about the site such as types and quantities of MEC, and geophysical data collected to date. The CSM information will be used to specify the RAOs, which are the cleanup goals for a selected remedial action. Information in the CSM and the RAOs will determine whether or not AGC is an appropriate technology for the site. For instance, the CSM should identify if vegetation, terrain, or structures/utilities may impede the use of AGC. High density of metallic items in the subsurface may indicate that current AGC sensors may not be able to resolve the individual buried items.

The AGC-QAPP Template calls for State concurrence, therefore, if appropriately implemented the QAPP process will ensure adequate State involvement in decisions regarding use of this technology. In addition, the ITRC GCMR-2 guidance document provides independent information regarding site application of this technology.

5. Implementation

DoD implemented the Defense Advanced Geophysical Classification Accreditation Program (DAGCAP) to accredit organizations that use AGC. Accreditation is now available for Geophysical Classification Organizations (GCOs) seeking qualification for DAGCAP. DOD has also established Quality Systems Requirements (QSR) for AGC. The QSR is intended for organizations seeking to become accredited or to maintain accreditation, in accordance

2 target of interest (TOI): Any item that must be removed from a munitions response site and subsequently examined to determine whether it is hazardous or inert. Common TOI include UXO, other inert munitions that must be excavated to be identified as inert, quality control and validation seeds, and substantial components of munitions that the site manager selects for removal.

with DAGCAP. DoD has indicated that DAGCAP accreditation will ensure only those GCOs with documented quality systems that conform to the QSR, and which have been independently verified by an accrediting body can propose and use AGC.

Lessons Learned from the AGC Demonstration Projects

DoD has implemented a well-coordinated and comprehensive effort to identify and address the significant issues associated with AGC as a viable munitions response technology. With respect to the key objectives identified above, DoD has either completed the identified actions for that particular objective or is continuing its efforts. Although AGC has yet to be widely implemented at a production level, the successful demonstration projects have yielded many lessons learned. State acceptance of AGC is contingent on following activities:

- Agreement on the fundamental design and use of classification before the contracting process commences.

- Full involvement of regulators during preparation of all AGC-QAPP Template worksheets including review of Standard Operating Procedures (SOPs):
    - Rigorous remedial design that is documented in the QAPP:
        - Verify approach for detection and classification
        - Confirm munitions-of-interest and depths-of-interest
        - Ensure QAPP fully documents project
    - Detailed and implementable SOPs.

- The QA/QC programs must be rigorously adhered to in order to gain State acceptance of the data as reprocessing of data is not a practical option for most States. If possible, States should acquire independent technical support.

- The Field Team must follow AGC-QAPPs and SOPs, and variances should be documented and approved by State regulators.

- Decisions on detection and classification should be transparent:
    - Understand all decision points
    - Well documented decision trees
    - Establish decision thresholds, criteria, and standards.

- RAOs should be clearly established and measurable, to include each munitions item from the vertical CSM.

- Verification and validation requirements (instrument verification strips (IVS), validation seeds, library items, verification digs) should be established upfront.

- Decision point verification - verify DQOs are met

- Timely and meaningful communication between the contractor, DoD, and regulators is critical especially in instances of quality assurance failures. Appropriate root cause analysis and corrective actions must be taken, documented, and communicated to the project team (including regulators) when non-conforming work occurs.

Position and Recommendations

ASTSWMO recommends that States be mindful of the lessons learned from the AGC demonstration projects and work with DoD, EPA, and contractors to ensure that:

- Site conditions are appropriate for its implementation;

- State involvement in the contracting process is consistent with the role established for States in DoD's contracting policies and guidance.

- Organizations that use AGC are accredited in accordance with the DAGCAP;

- The procedures included in the AGC-QAPP Template are adhered to. This includes upfront project planning with State regulators and achieving consensus on the CSM, DQOs, and QAPP worksheet preparation;

- States remain involved during the data evaluation process (all activities and SOPs adequately performed, all QC documented, data usability review, etc.); and,

- States acceptance of this technology will be based in large part on their understanding of this technology. Therefore, States are encouraged to seek training on all aspects of AGC, including both hands-on and classroom training.

It is ASTSWMO's position that AGC for munitions response is an acceptable technology for use at MRSs. AGC has been proven successful through numerous demonstration projects and key elements are in place for its implementation on the production level including the AGC-QAPP Template and DAGCAP. Several educational tools, including ITRC and ESTCP-SERDP guidance and trainings are also available to States. Given the substantial changes involved in the transition to this technology it is anticipated that the elements identified above will be revisited and updated as the technology is implemented at the production level. Adherence to the technical project process will ensure successful transitioning to the use of AGC.

Approved by the ASTSWMO Board of Directors on January 24, 2017, in Fort Lauderdale, FL.

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