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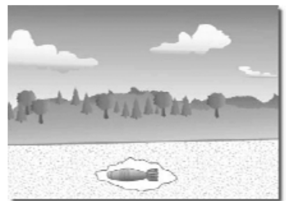
# Welcome – Thanks for joining us.
# ITRC's Internet-based Training Program

## Quality Considerations for Munitions Response Projects



Quality Considerations for Munitions Response Projects (UXO-5, 2008)

Sponsored by: Interstate Technology and Regulatory Council (www.itrcweb.org)
Hosted by: US EPA Clean Up Information Network (www.cluin.org)

This training introduces state regulators, environmental consultants, site owners, and community stakeholders to Quality Considerations for Munitions Response Projects (UXO-5, 2008), created by the ITRC's Unexploded Ordnance Team. In this document, quality is defined as "conformance to requirements." To manage quality, the quality requirements of the project must first be understood. Requirements must be precisely stated and clearly understood by everyone involved. A plan is then put in place to meet those requirements.

The UXO Team emphasizes taking a whole-system approach to designing, planning and managing a munitions response (MR) project to optimize quality. Whole-system design means optimizing not just parts, but the ***entire system*** (in this case the MR). Practically speaking, the UXO Team views MR project as a system made of processes, sub-processes, and tasks. Therefore, a process approach to planning and managing MR projects is recommended.

An MR plan properly developed using the process approach will contain quality control (QC) and quality assurance (QA) activities that need to be performed. Through the proper application of a process approach to plan and manage an MR project, the MR project should produce results of verifiable quality with sufficient QA and QC documentation for defensible decision making.

The document concludes with some real-world examples of how QA/QC planning and process control throughout an MR project can affect the results of the MR project, particularly how attention to quality during MR processes can influence follow-on processes and the project's final outcome.

This training course is intended for an intermediate audience and assumes a basic understanding of specialized processes associated with MR projects. Background information on some of the topics can be found in Munitions Response Historical Records Review (UXO-2, 2003) and Geophysical Prove-Outs for Munitions Response Projects (UXO-3, 2004), Survey of Munitions Response Technologies (UXO-4, 2006) and their associated Internet-based training courses.

ITRC (Interstate Technology and Regulatory Council) www.itrcweb.org

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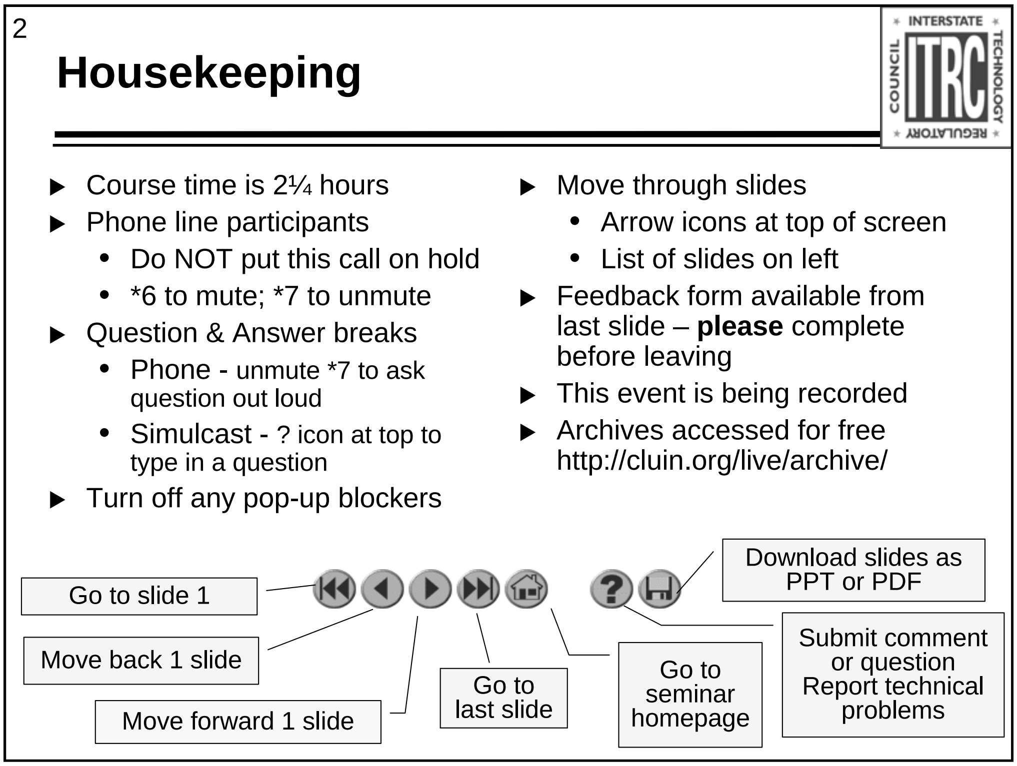


Although I'm sure that some of you are familiar with these rules from previous CLU-IN events, let's run through them quickly for our new participants.

We have started the seminar with all phone lines muted to prevent background noise. Please keep your phone lines muted during the seminar to minimize disruption and background noise. During the question and answer break, press *7 to unmute your lines to ask a question (note: *6 to mute again). Also, please do NOT put this call on hold as this may bring unwanted background music over the lines and interrupt the seminar.

You should note that throughout the seminar, we will ask for your feedback. You do not need to wait for Q&A breaks to ask questions or provide comments using the ? icon. To submit comments/questions and report technical problems, please use the ? icon at the top of your screen. You can move forward/backward in the slides by using the single arrow buttons (left moves back 1 slide, right moves advances 1 slide). The double arrowed buttons will take you to 1st and last slides respectively. You may also advance to any slide using the numbered links that appear on the left side of your screen. The button with a house icon will take you back to main seminar page which displays our agenda, instructor bios, links to the slides and additional resources. Lastly, the button with a computer disc can be used to download and save today's presentation slides.

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# ITRC (www.itrcweb.org) – Shaping the Future of Regulatory Acceptance

- Host organization
- Network
  - State regulators
    - All 50 states, PR, DC
  - Federal partners

    DOE DOD EPA
  - ITRC Industry Affiliates Program
  - Academia
  - Community stakeholders
- Wide variety of topics
  - Technologies
  - Approaches
  - Contaminants
  - Sites
- Products
  - Technical and regulatory guidance documents
  - Internet-based and classroom training

The Interstate Technology and Regulatory Council (ITRC) is a state-led coalition of regulators, industry experts, citizen stakeholders, academia and federal partners that work to achieve regulatory acceptance of environmental technologies and innovative approaches. ITRC consists of all 50 states (and Puerto Rico and the District of Columbia) that work to break down barriers and reduce compliance costs, making it easier to use new technologies and helping states maximize resources. ITRC brings together a diverse mix of environmental experts and stakeholders from both the public and private sectors to broaden and deepen technical knowledge and advance the regulatory acceptance of environmental technologies. Together, we're building the environmental community's ability to expedite quality decision making while protecting human health and the environment. With our network of organizations and individuals throughout the environmental community, ITRC is a unique catalyst for dialogue between regulators and the regulated community.

For a state to be a member of ITRC their environmental agency must designate a State Point of Contact. To find out who your State POC is check out the "contacts" section at www.itrcweb.org. Also, click on "membership" to learn how you can become a member of an ITRC Technical Team.

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## ITRC Course Topics Planned for 2010 – More information at www.itrcweb.org

**Popular courses from 2009**

- Decontamination and Decommissioning of Radiologically-Contaminated Facilities
- Enhanced Attenuation of Chlorinated Organics
- In Situ Bioremediation of Chlorinated Ethene - DNAPL Source Zones
- LNAPL Part 1: An Improved Understanding of LNAPL Behavior in the Subsurface
- LNAPL Part 2: LNAPL Characterization and Recoverability
- Perchlorate Remediation Technologies
- Performance-based Environmental Management
- Phytotechnologies
- Protocol for Use of Five Passive Samplers
- Quality Consideration for Munitions Response
- Determination/Application of Risk-Based Values
- Use of Risk Assessment in Management of Contaminated Sites

**New in 2010**

- Decision Framework for Applying Attenuation Processes to Metals and Radionuclides
- LNAPL Part 3: Evaluating LNAPL Remedial Technologies for Achieving Project Goals
- Mining Waste
- Remediation Risk Management: An Approach to Effective Remedial Decisions and More Protective Cleanups

**ITRC 2-day Classroom Training: Vapor Intrusion Pathway**

More details and schedules are available from www.itrcweb.org under “Internet-based Training” and “Classroom Training.”

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# Meet the ITRC Instructors

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**Bill Veith**
**US Army Environmental and Munitions Center of Expertise**
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**Guy Warren** is an Environmental Program Specialist with the Federal Facilities Environmental Restoration Program for the Alaska Department of Environmental Conservation (ADEC) in Anchorage, Alaska. Guy has worked for ADEC since 2006 and serves as the Federal Facility Agreement, Restoration Project Manager for the Former Adak Naval Complex and the Military Munitions Response Program Coordinator for ADEC. Guy works with other ADEC project managers to ensure the MMRP program is implemented consistently across the state. Prior to working for ADEC he served as the Environmental Director for the Native Village of Tanacross, a village in interior Alaska, and worked for over 5 years as a private consultant in Anchorage. Guy has served on the ITRC UXO team since 2007. Guy earned a Bachelors Degree in Environmental Studies from Utah State University in Logan, UT in 1998.

**Tim Deignan** is a geophysicist at Shaw Environmental & Infrastructure Group beginning in November 2009. Previously, he was the Discipline Lead for geophysics at Tetra Tech EC, Inc. in Lakewood, Colorado, where he worked from 1988 to 2009 in the environmental geophysical field. He is routinely involved in survey planning, data acquisition, processing, and analysis and interpretation of geophysical data, as well as the development of sensor and positioning systems and platforms. In performing and managing geophysical surveys for MEC projects since 1994, he has been provided the unique opportunity to interact with client, regulatory, and industry personnel in the continued development of the optimum quality processes' for MEC projects. Tim has been a member of the ITRC UXO team since 2003/2004, and has provided input for several ITRC guidance documents. He has also been an invited speaker for the SERDP/ESTCP conferences, as well as the bi-annual UXO Forum. Tim earned a bachelor's degree in geophysical engineering from the Colorado School of Mines in Golden, Colorado in 1988 and is also a registered Professional Geophysicist in the state of California.

**Bill Veith** is with the Safety and Quality Team Command for the Environmental and Munitions Center of Expertise, Huntsville, Alabama. Since 1995, he has advised senior Army Corps management at the division and district levels on ordnance explosives policy and procedure. He has a combined total of 35 years experience in the ordnance explosives/unexploded ordnance (OE/UXO) arena. He served 30 years in the military, including 25 years specifically in the EOD field where he held every active ordnance operational EOD position. He is a graduate of the Naval Explosive Ordnance Disposal School, Indian Head, Maryland.

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## ITRC Unexploded Ordnance (UXO) Team

- Formed in 1999
- Develops guidance documents
  - Help states and others gain technical knowledge
  - Promote consistent regulatory approaches for review and approval of munitions response cleanup
  - Published guidance documents
    - Including UXO-5 – basis of this training course
- Provides training to the munitions response community

The ITRC UXO team was formed in 1999. It consists of representatives from state and local regulatory agencies, federal partners including DoD and EPA personnel, and local stakeholders.

The team has published five guidance documents

Accompanying the publication of these documents, the Team also developed and offered Internet-based trainings and classroom based training on these topics. The training classes are available for viewing as archives at the ITRC web site (www.itrcweb.org) .

Currently the Team is collaborating with SERDP/ESTCP on a Frequently Asked Questions Document based on their three year pilot project on Wide Area Assessment.

Today’s training is being presented with the assumption that the audience has an introductory level understanding of Munitions Response Projects and previous participation in some of these other courses is advised.

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## Documents from the ITRC UXO Team

- UXO-1: Breaking Barriers to the Use of Innovative Technologies (2001)
- UXO-2: Munitions Response Historical Records Review (2003)
- UXO-3: Geophysical Prove-Outs for Munitions Response Projects (2004)
- UXO-4: Survey of Munitions Response Technologies (2006)
- UXO-5: Quality Considerations for Munitions Response Projects (2008)
- UXO-6: Wide Area Assessment – Frequently Asked Questions (to be published in 2010)

www.itrcweb.org

The team has published five guidance documents (Documents are available on the ITRC website – www.itrcweb.org):

1. Breaking Barriers to the Use of Innovative Technologies: State Regulatory Role in Unexploded Ordnance Detection and Characterization Technology Selection (ITRC 2001) provides an analysis of case studies that supports early and meaningful state regulatory involvement in the selection of innovative unexploded ordnance characterization technologies.
2. Munitions Response Historical Records Review (ITRC 2003) is a guide for regulators, stakeholders, and others involved in oversight of historical records review projects on munitions response sites.
3. Geophysical Prove-Outs for Munitions Response Projects (ITRC 2004) provides information on geophysical prove-outs (GPOs) and the broader topics of geophysical surveys, equipment, and methodologies currently used in munitions response actions.
4. Survey of Munitions Response Technologies (SERDP, ESTCP, ITRC 2006) provides an overview of the current status of technologies used for munitions response actions and, where possible, evaluates and quantifies their performance capabilities.
5. Quality Considerations for Munition Response Projects. The subject of this training.
6. Wide Area Assessment – Frequently Asked Questions (ITRC to be published in 2010)

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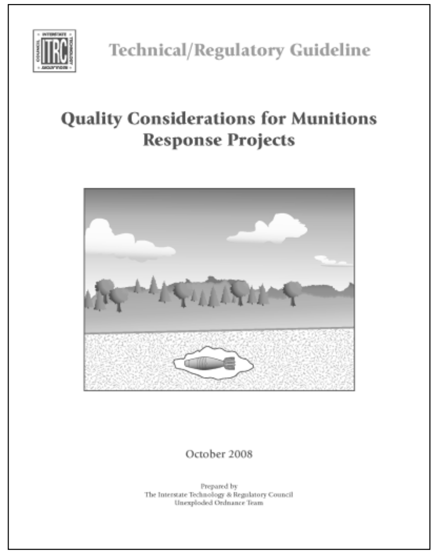
## Presentation Overview

- Module 1: Introduction to Quality
- Module 2: Applying the Process Approach to MR Project Processes
- Module 3: Case Studies


Technical/Regulatory Guideline

Quality Considerations for Munitions Response Projects

October 2008

Prepared by
The Interstate Technology & Regulatory Council
Unexploded Ordnance Team

Today's training will follow the basic outline of the Quality Considerations for Munitions Response Projects.

I will present Module 1 which provides an introduction to quality and the process approach. I will explain why this is so important on MR projects.

Module 2 “Applying the process approach to MR Project Processes” will be presented by Timothy Deignan a Registered Professional Geophysicist with Shaw Environmental

Module 3 will include a discussion of case studies and lessons learned and will be presented by Bill Veith with the USACE Huntsville Environmental and Munitions Center of Expertise.

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## What you will learn…

- Regulators' role
- How to define quality
- The whole-system process approach to quality
- How to apply the process approach to a munitions response (MR) project
- Case studies

The document and associated training session only address the detection and removal of MEC (specifically UXO and DMM).

It does not address Historical records review (**see separate ITRC guidance document**) or Munition Constituent sampling or remediation.

Note: Speak to photo. Showing the individual UXO technician performing same process in difficult conditions. While it appears that personnel are working in a random manner this is actually controlled. Getting consistent (acceptable) performance from each unit.

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# Quality Considerations for Munitions Response

## **MODULE 1**:

Introduction to Quality

No associated notes.

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## Module 1: Learning Objectives

- The Regulators Role
- To understand quality and the importance of quality in MR projects
- Gain understanding of
  - Why quality?
  - What is quality?
  - Quality concepts
  - Planning quality

There are a lot of process activities that have quality aspects in Hazardous, Toxic and Radioactive Waste (HTRW) that have direct parallels to MEC activities.  What many regulators are unfamiliar with is the particular requirements for geophysical surveys. While Geophysics has some unique aspects there are many similarities and direct parallels. Like Planning, setting DQOs, process checks, data usability review, etc.

Photo of Mortar Round at Eagle River Impact Area (Fort Richardson AK).

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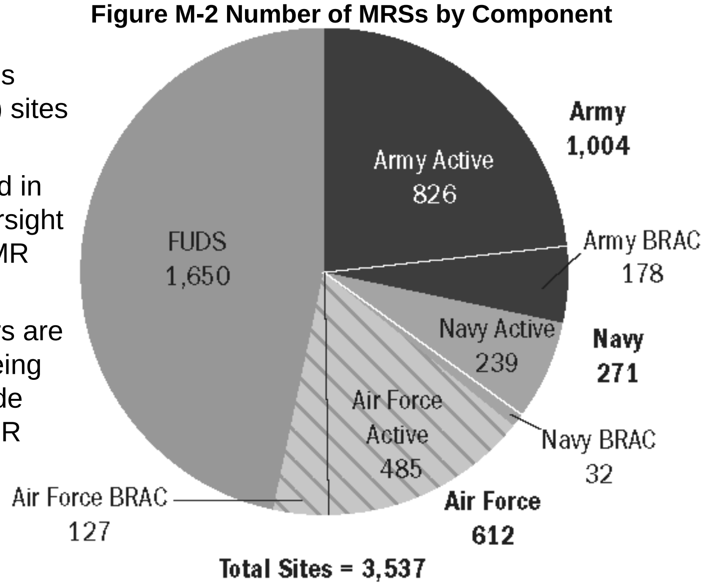
## The Regulators' Role

- 3,500 Munitions response (MR) sites nationwide
- EPA is involved in regulatory oversight of Superfund MR projects
- State regulators are increasingly being asked to provide oversight on MR projects

**Figure M-2 Number of MRSs by Component**




The FY 2007 ARC identifies over 3,500 Munition Response Sites, covering approximately 10 Million acres. These sites are located across the nation and occur in just about every state.

EPA is primarily involved in regulatory oversight of Superfund MR Projects.

EPA involvement on a case by case basis for Non-NPL sites.

For non-NPL sites, state regulatory agencies are being tasked with being lead regulator, in many cases, without EPA involvement.

In summary, SR will be sole regulator and will act as lead regulator at many of these sites.

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## The Regulators' Role (continued)

- Ensure that the project complies with pertinent state and federal rules and regulations and meets the requirements for characterization, cleanup, and/or site closure
- Regulatory concurrence depends heavily upon the quality of site characterization and cleanup efforts
- Up-front regulatory involvement is critical to achieving regulatory concurrence on MR projects

No associated notes.

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## The Regulators' Role (continued)

- The environmental regulator should:
  - Participate in defining the overall objective of the project
  - Concur with key processes necessary to realize the objective
  - Agree with process/product performance requirements
  - Agree with the quality assurance (QA) and quality control (QC) activities necessary to demonstrate requirements have been achieved

Ultimately the regulators role is to ensure that a project plan is developed that adequately describes the work to be performed and the processes and procedures that will be used to verify the work is conducted adequately.

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# Regulator Involvement – "Early and Often"

- The importance of "up-front" regulator/stakeholder involvement should not be underestimated
- It is critical for determining
  - Project objectives
  - Identifying key processes
  - Requirements
  - Establishing the data needed to support a decision

The environmental regulator must be involved in the MR planning process from the beginning to ensure that the needs of the regulator are defined adequately and addressed.

Up-front planning identifies MR approaches that work well, promotes a greater understanding of the processes involved, and ensures full agreement on QA/QC activities necessary to provide confidence in the quality of the final product.

*The up-front, whole-system process approach to planning increases efficiency and effectiveness, provides for early detection of problems, and should reduce the cost of lost time due to rework.*

What do we mean by Early and Often. Typically regulatory involvement begins when the regulatory agency receives a draft work plan. The regulator should be involved in early discussions regarding project scoping and regular project team meeting throughout the projects life.

Photo:  16-inch Naval Projectiles (Vieques PR)

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## Why Quality?

- Quality is cheaper than re-work
- Results in a satisfied customer
- Quality means not having to say “I’m sorry”

Quality is cheaper than reworking a site - rework is expensive

The added costs of quality are miniscule compared to the costs associated with not having quality.

Consequences of not achieving quality in MR Projects include:

• potential re-work of the project site, and

• completing projects without confidence that the response action was adequate to meet the future land use.

At one project site:

• work conducted in 2000, 2001, and scheduled for completion in 2004.

•During 2004 DMM were identified in an area that had been cleared during 2000 and 2001.

•Anomalies not present in previous DGM survey data

•Documentation not adequate to identify quality failure

•Prior to completing site remediation during the 2008 field season a 100% geophysical survey (and excavation of identified anomalies) of the 2000 and 2001 areas was required

Photo on left: These mortars were removed from the back of a civilian’s pickup truck. These items were picked up off a site on Adak. Lack of quality results in potential public exposure to munitions.

Photo on right: Projectile laying on ground surface. This munition has been fired (UXO) as indicated by the marks on the rotating band.

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## What is Quality?

- Like comparing apples to oranges, quality can mean different things to different people!

Quality can be subjective if it is not adequately defined.

For example: What makes a dinner high quality?

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# What is Quality? (continued)

- Conformance to requirements

**"Resistance is Futile. You Must Conform To Requirements"**

To remove any ambiguity for what "quality" means, the UXO team defines quality as "conformance to requirements".

As our Borg friend reminds us………

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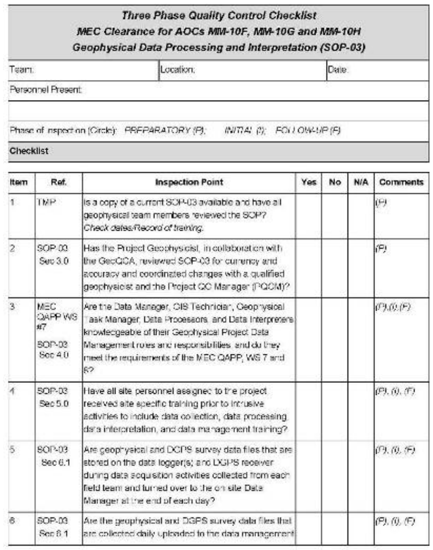
**What is Quality?**

## How Do Requirements Relate to Quality?

- A **requirement** is
  - Necessary
  - Unambiguous
  - Concise
  - Consistent
  - Complete
  - Attainable
  - Verifiable



***Three Phase Quality Control Checklist***
***MEC Clearance for AOCs MM-10F, MM-10G and MM-10H***
***Geophysical Data Processing and Interpretation (SOP-03)***

| Team: | Location: | Date: |
|---|---|---|
| Personnel Present: | | |

Phase of inspection (Circle): *PREPARATORY (P); INITIAL (I); FOLLOW-UP (F)*

**Checklist**

| Item | Ref. | Inspection Point | Yes | No | N/A | Comments |
|---|---|---|---|---|---|---|
| 1 | TMP | Is a copy of a current SOP-03 available and have all geophysical team members reviewed the SOP? *Check dates/Record of training.* | | | | *(P)* |
| 2 | SOP-03 Sec 3.0 | Has the Project Geophysicist, in collaboration with the GeoQCA, reviewed SOP-03 for currency and accuracy and coordinated changes with a qualified geophysicist and the Project QC Manager (PQCM)? | | | | *(P)* |
| 3 | MEC QAPP WS #7 SOP-03 Sec 4.0 | Are the Data Manager, GIS Technician, Geophysical Task Manager, Data Processors, and Data Interpreters knowledgeable of their Geophysical Project Data Management roles and responsibilities, and do they meet the requirements of the MEC QAPP, WS 7 and 8? | | | | *(P),(I),(F)* |
| 4 | SOP-03 Sec 5.0 | Have all site personnel assigned to the project received site specific training prior to intrusive activities to include data collection, data processing, data interpretation, and data management training? | | | | *(P), (I), (F)* |
| 5 | SOP-03 Sec 6.1 | Are geophysical and DGPS survey data files that are stored on the data logger(s) and DGPS receiver during data acquisition activities collected from each field team and turned over to the on site Data Manager at the end of each day? | | | | *(P), (I), (F)* |
| 6 | SOP-03 Sec 6.1 | Are the geophysical and DGPS survey data files that are collected daily uploaded to the data management | | | | *(P), (I), (F)* |

**Three Phases Quality Control Checklist**

A Requirement is a documented specification for a product or service.

Good requirements are…………

Make a point in this slide to refer to the “Requirements” case study that will be presented in module 3 – importance of requirements to quality.

Explain graphic. Three Phase QC checklist from a recent project on Adak that identifies the inspection points/requirement. Provides documentation that inspections were conducted and whether or not requirements have been met.

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What is Quality?

## Requirements

- May be quantitative or qualitative
- The best requirements are quantitative
- Must be clearly understood by the project team
- Measurements or observations are performed to determine “conformance to requirements”
- Non-conformance indicates a lack of “quality”

Quantitative-something can be measured

Example of quantitative requirement (measured offset from known control point) vs. qualitative requirement (monitoring the work in progress and review of personnel documentation).

A plan is then put in place to meet those requirements.

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## Quality Concepts

- Quality Assurance (QA)
  - Process oriented
- Quality Control (QC)
  - Product oriented

Quality Assurance (QA) is Process Oriented.

•QA ensures that all processes are defined and appropriate.

•QA review should focus on the process elements of a project – e.g. are requirements being defined at the proper level of detail.

•Examples of QA activities include process development, developing requirements, and process improvements.

Quality Control (QC) is Product Oriented.

•QC is the techniques or activities designed to evaluate a completed task or product.

•Focused on finding defect in specific deliverables. QC is determined by the comparison of a product against the requirements that were developed for the product before the product existed.

•Examples of QC activities include product testing and end of task inspections.

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Quality Concepts

## Quality Assurance/Quality Control

- QA and QC are powerful techniques
- The terms QA and QC are often used interchangeably in the MR industry to refer to ways of ensuring the quality of a service or product
- However, the terms have different meanings

QA and QC are powerful techniques. Both must be performed to ensure that the deliverables meet the quality requirements of the customer.

On MR projects the distinction is sometimes based on who is doing it.

• QA done by the government or independent contractor and

• QC is done by the production contractor.

For the purposes of the document and this training the UXO team has decided to use the term QA/QC to avoid any confusion regarding the distinction between the two.

There is QA and there is QC both have specific meanings. In the MR industry the two terms may be used interchangeably. However the important point is that the two evaluate different aspects of the project and the State regulator must ensure both aspects of the project are evaluated regardless of who is performing the quality monitoring.

Well planned and designed and implemented processes will produce quality results for the customer.

Photo:  Shows surface clearance teams using hand held geophysical sensors performing surface clearance.

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## Fundamental Rules of Quality

- The fundamental rule of QA/QC is to meet requirements at all times
- Anyone responsible for performing or conducting any test or activity should have authority to stop the process
- Those personnel performing quality monitoring are not the same as the personnel performing the process

Usually separate departments within an organization. Sometimes a separate independent organization is also tasked with QA/QC responsibilities.

Photo:  In this photo you can see the contractors QC team performing QC sweeps of a grid where analog clearance has occurred. In the upper right corner of the photo you can see a DGM crew mapping previously completed grids.  This project is a 40-mm projectile grenade range and prior to conducting DGM the surface clearance required rigorous QC to ensure the DGM crews did not disturb any shallow UXO.  Making sure the outputs of one process (analog clearance) are adequate for follow-on processes (Digital Geophysical Mapping-DGM).

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Quality Concepts

## Quality Assurance Project Plans (QAPP)

- Quality Management Plan (QMP)
- QAPP - Contains and describes in detail specific data requirements or other information that must be collected to demonstrate conformance to requirements
- Uniform Federal Policy (UFP) QAPP
  - Developed by EPA, DoD, and DOE
  - Encouraged for use by DoD and the component services for all environmental data collection including munitions and explosives of concern (MEC)

A quality management plan (QMP) is an organization's formal document that describes its quality system (*in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and needed interfaces for those planning, implementing, documenting, and assessing all activities conducted)*.

•DoD components have developed QMP's that describe their policy regarding quality.

•QMPs for the individual DoD components should be made available by the DoD Representative responsible for the project.

•The regulator should be familiar with the appropriate QMP to understand DoD component specific requirements and guidelines.

A quality assurance project plan (QAPP) is a formal document that describes, in comprehensive detail, the necessary QA/QC and other technical activities that must be implemented to ensure that the results of the work performed will satisfy predetermined performance requirements. The QA/QC activities and data requirements are assimilated into a document often referred to as the QAPP.

The QAPP should detail how data will be assessed, analyzed, documented, and reported, and include ways to ensure data precision, integrity, and traceability.

A suggested format for an MR QAPP is the Uniform Federal Policy QAPP Manual. The Navy has modified this format, for three projects on Adak, to incorporate MR-specific requirements; including all of the important explosive safety aspects (see section 4.5).

The UXO team recommends following EPA's DQO guidance to assist in identifying data quality objectives for MR QA/QC activities.

At the project level the QAPP describes the QA/QC functions that will be implemented by the contractor.

• A separate QA plan is developed by the government or QA organization that describes their program for monitoring project quality.

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# Planning and Managing Quality

- Whole System Process Approach
  - The UXO Team emphasizes taking a whole-system process approach to planning and managing an MR project to optimize quality

Whole-system means optimizing not just parts, but the entire system (in this case the MR). i.e. whole system

Practically speaking, we view MR as a system made of processes, sub-processes, and tasks. i.e. process approach

Therefore, we recommend a Whole System Process approach to planning and managing MR projects.

Photo: DGM survey being performed on the beach (Vieques PR).

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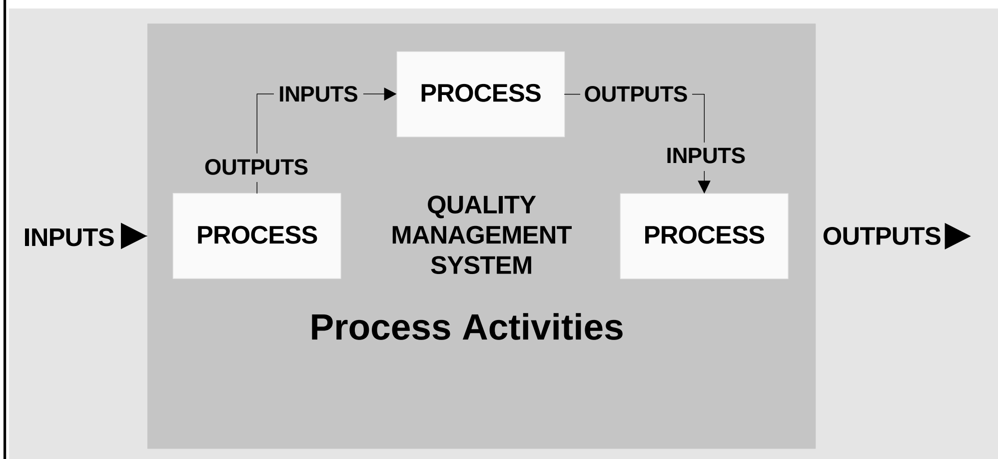
## Planning and Managing Quality

- **Whole-System** Process Approach to Quality




Sub-processes links in chain if you break the chain you have a project that does not meet requirements. And potentially the follow on processes are unable to be performed.

For example: Surface clearance, DGM, and Anomaly Resolution.

Big Picture.

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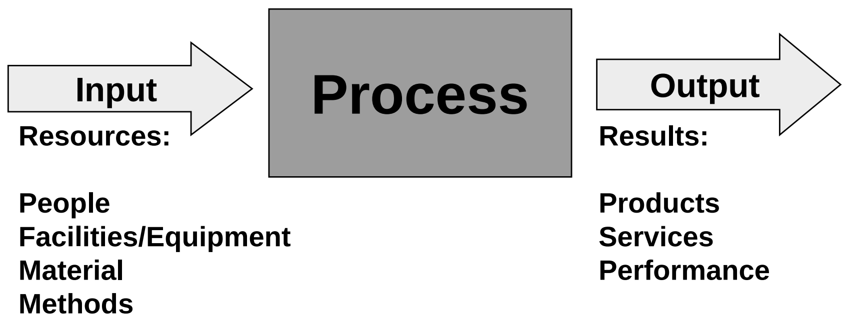
## The Process Approach

- Process – “an organized group of related activities that work together to transform one or more kinds of input into outputs that are of value to the customer” (Michael Hammer New York: Crown Business, 2001)




Important points of this definition

Process is a GROUP of activities

Activities in a process are interrelated

All activities in a process must work together

Processes exist to produce results customers care about.

A process is an activity that transforms inputs into outputs. A process is made of *people, tasks, records, documents, forms, resources, rules, regulations, reports, materials, supplies, tools, equipment, and so on*—all the things that are necessary to transform inputs into outputs.

If the Processes are adequately developed and performed then the final product will be acceptable.

Planners using a process approach to plan the project will identify QA/QC activities that need to be performed to ensure confidence in the quality of the product.

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Planning Quality

## The Process Approach

- A process approach is a powerful way to plan, organize, and manage how work processes produce value (quality) for the "customer"
- It results in a project's
  - Logical development
  - Efficient use of resources
  - Transparency of intent and direction
  - Defensibility of project results
  - Appropriate documentation

A process approach ensures that all participants understand the needs and expectations of the customer.

The process approach is central to the way quality management is addressed in this document.

*If it isn't documented it did not happen. Documentation of QC activities. Provide examples. What is meant. Clean dirt is not tangible – Project specific checklists.*

*Photo:  2.36-inch Rockets.*

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Planning Quality

## The Process Approach (continued)

- Map the entire project (e.g., flowchart)
- Produce detailed plans (e.g., flowcharts) of key processes
- Establish requirements
- Identify monitoring points
- Monitor each process (conformance to requirements)
- Document

All key processes, sub-processes, and tasks are properly planned, executed, and documented.

Identify Key Processes and flow general overall.

EM 4009 Flowcharts

Stress importance of documentation.

Photo: A member of the QC organization is checking completed excavations with an EM-61 to verify that the anomaly is “Clear”. Example of a QC check (monitoring point) on the product “cleared anomaly”. Determining that the anomaly has been cleared to below the original anomaly selection criteria (requirement).

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### Planning Quality

# The Process Approach: Flowchart

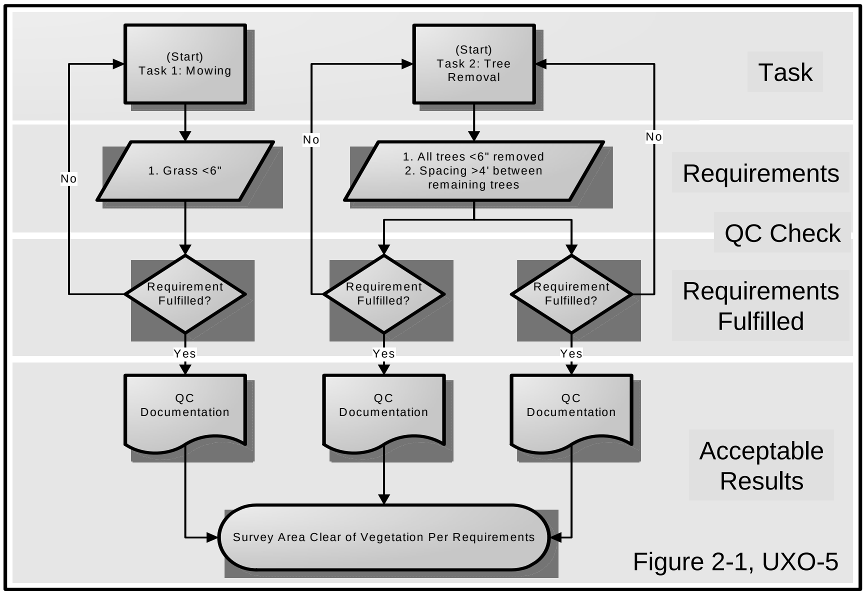

Figure 2-1, UXO-5

[Figure 2-1]

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**Planning Quality**

## The Process Approach

- Each Process should contain the following elements
  - Purpose/objective
  - Inputs
  - Resources and methods
  - Requirements
  - Controls
  - Responsibility
  - Outputs
  - Documentation

No associated notes.

Photo: UXO technician performing analog clearance.

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Planning Quality

## The Process Approach-Elements

In general, each process should contain the following elements:

- **purpose/objective**: Clear UXO/DMM and metal debris from the surface to allow follow-on DGM
- **inputs**: A map showing the boundary of the survey area. The area will be delineated using survey grade GPS
- **resources and methods**: Surface Clearance teams will be composed of five qualified personnel (1 UXO Tech III and 4 UXO Tech I or II). Personnel will use hand held analog magnetometers to identify UXO/DMM and metal debris under vegetation
- **requirements**: Survey 100% of project area, conduct and record function checks, examine all pieces of surface metal that are detected, and Remove all UXO/DMM and other metallic debris from the surface of the project site

Requirement reference Case Study in Module 3.

DGM = Digital Geophysical Mapping (further explained in module 2 if you are unfamiliar with the concept)

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Planning Quality

# The Process Approach-Elements

- **controls**: 1) Blind Seed Items placed at least two per acre. 2) Instrument test strip (ITS) used daily to verify instrument and operator. 3) GPS track log to evaluate coverage
- **responsibility**: The Surface Clearance team lead is responsible for completion of the process and correcting any deficiencies identified by Quality Control Manager
- **outputs**: The Surface of the Project site is clear of UXO/DMM hazards and metal debris in preparation for DGM
- **documentation:** Will include: Copies of the daily ITS checklist, logs of the GPS tracks, UXO/DMM accountability logs, and grid completion checklists (document recovery of Blind Seed Items) signed by Quality Control Manager

No associated notes.

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Planning Quality
## Monitoring for Quality

### Blind Seeding

- A powerful Process Monitoring Tool
- Applicable to “mag and dig”, digital geophysical mapping (DGM), and even surface removal projects


Blind Seeding is a process where UXO/DMM-like objects (blind seeds) are intentionally emplace in the MR project production area to test and validate the UXO/DMM detection process.

The validity of blind seeding as a QA/QC tool is based on the assumption that seed items will accurately mimic actual UXO or DMM expected to be found in the production area.

• If the MR production team detects the blind seeds QA/QC personnel assume the UXO/DMM detection procedures are working as planned.

• On the other hand, if the MR Production Team fails to find a blind seed this indicates that the detection process may not be adequate or the MR Production Team is not implementing the detection process adequately.

Blind Seeding is a powerful process monitoring tool that can serve to increase regulator and stakeholder confidence to a high enough level that post-remediation QC activities such as verification sampling, (see section 3.6) ***may*** not be necessary.

When used properly, blind seeding has the following benefits:

**Regulatory confidence**: Regulator confidence is increased because finding the blind seeds demonstrates that the detection program is working adequately under the actual conditions in the survey production area;

**Worker Motivation**: Site workers are continually motivated to implement the detection process properly because they know that blind seeds can be emplaced anywhere within the survey area;

**Process improvements**: Failure to find a blind seed can result in process improvements when a root cause analysis is performed to identify the reason the BSI was missed.

Photo: BSI’s can be inert or simulated ordnance or simply sections of iron pipe (photo on left). The location is selected and an excavation is advanced to the specified depth. The BSI is placed in the hole and it’s depth below ground surface and GPS location are recorded (center photo). The excavation is backfilled with attention paid to replacing vegetation to obscure the location of the BSI from production personnel (right photo). BSI requirements (BSI type, placement depth, frequency, etc.) should be specified in the project plans.

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Planning Quality

## The Process Approach: Benefits/Advantages

- Focus on the desired result
  - Start with the end in mind
- Systematically define the tasks and subtasks necessary to obtain the desired result
- Establish clear responsibility and accountability for managing key activities
- Develop requirements
- Establish monitoring activities to ensure conformance to requirements
- Identify quality issues (nonconformance) and quality improvement actions
- Report on the overall level of quality achieved (documentation)

No associated notes.

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**Planning Quality**

## The Process Approach: Process Improvement

- Identify and eliminate unnecessary redundancies
- Improve the flow (of material, teams, tasking, etc.)
- Move QC further “upstream” (away from the finished product) in the process to prevent wasteful processing of nonconformities

At one project a non-conformance was identified that ultimately lead to improvements of the process.

Production team clears anomaly and removes several pieces of fragmentation from excavation at 3-6 inches below ground surface. Hole checked with handheld magnetometer did not indicate additional items present in hole.

QC team used EM-61 to check completed hole to verify that the clearance was appropriate. They identify a remaining signature in the hole and during excavation they identify a 37 mm projectile at a depth of 16 inches (just above 11X depth). Project requirement is to remove all UXO/DMM to the 11x depth. The 11x depth is a “rule of thumb” that states that an item can be detected by common geophysical sensors to a depth equal to 11 X it’s diameter.

Root cause analysis was initiated and determined that the particular handheld magnetometer was less sensitive to buried metal objects than the sensors used in the original DGM survey and by QC (EM-61). In addition the two instruments relied on different sensor technologies (mag vs. EM).

As a result of this non-conformance (missing a “detectable” item within the clearance depth) the project team revised the procedures for verifying when a “Dig” is complete (the hole is cleared). The UXO techs are now required to check the completed hole with the same geophysical sensor used during the initial survey (and by QC) to ensure that the geophysical signature remaining at the excavation is below the original anomaly selection criteria (based on the 11X depth) for the project and this information is recorded in the project database and submitted to QC for analysis.

This is an example of moving the QC inspections further up-stream.

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Planning Quality

## Process Approach Summary

- An MR plan properly developed using the process approach will contain quality control (QC) and quality assurance (QA) activities that need to be performed and documented
- By the proper application of a process approach an MR project should produce results of verifiable "quality" with sufficient documentation for defensible decision making

Environmental regulators should ensure that each process is guided by procedures that adequately describe the methods and resources that will be used to perform the work.

The following provides an example of the level of planning detail that an environmental regulator should expect to find in an MR project plan for any process.

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## Planning Quality

# MR Process Approach Summary

*ITRC – Quality Considerations for Munitions Response Projects* *October 2008*

**Table 2-1. Example QC matrix**

| Process and manager | Inspection point | Requirement | Reference | QC action | Monitoring frequency[a] | Possible corrective actions[b] |
|---|---|---|---|---|---|---|
| **Process:** Vegetation clearance<br><br>**Manager:** Vegetation clearance team supervisors | Height of remaining grass | Grass not taller than 6 inches | SOP 1 | Measure grass height | Prior to start of analog geophysics | Direct vegetation supervisor to remow the area |
| | Diameter of remaining trees | Diameter of remaining trees larger than 6 inches | | Measure tree diameter | Prior to start of analog geophysics | Direct vegetation supervisor to remove trees smaller than 6 inches from the area |
| | Open space | Spacing between trees not less than 4 feet | | Measure spacing between trees | Prior to start of analog geophysics | Remove additional trees: submit field change request to modify the geophysical process to conform to existing conditions |
| **Process:** Analog geophysics (mag and flag)<br><br>**Manager:** Analog geophysics supervisor | Instrument Test Strip (ITS) | Installed in accordance with work plan (type and number of items, depth of placement, etc.) | SOP 2 | Verify ITS is installed in accordance with the work plan and SOP 2 | Once at start of project | Reconstruct ITS in accordance with appropriate planning documents; submit a field change request to document changes to the ITS |
| | Daily instrument checks at ITS | Operators locate all items within the ITS using handheld geophysical instrument | | Verify performance of each instrument and operator through the ITS | Initial and daily for each UXO technician | Repair or replace defective instrument; additional training for UXO technician |
| | Blind seed items | Emplace at least one blind seed per grid | | Ensure blind seeds are placed at required rate and recorded in project database | Once at start of project | Place additional blind seeds; ensure blind seed location, depth, and type are recorded in the project database |
| | Grid coverage | Each grid is divided into individual 5-foot lanes; each UXO technician sweeps the entire lane assigned | | Observe grid construction and analog geophysics operations | Once weekly per UXO technician | Additional training for UXO technician; better delineation of search lanes within grid |

**UXO-5 Table 2-1. Example QC matrix**

These examples are not intended to be all-inclusive for these processes, only to demonstrate inspection points that can be identified for these processes. A similar table is often included in the work plan or the MR UFP-QAPP as Worksheet 35 (see section 4.5 for further discussion of the MR UFP-QAPP). Real world QC matrices will be much more comprehensive and will include qualitative and quantitative inspection points (Qualitative - monitoring the work in progress and review of personnel documentation) (Quantitative - height of remaining grass and positioning accuracy).

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Planning Quality

# MR Process Approach Summary

### Examples of Quantitative Requirements

| Process and manager | Inspection point | Requirement | Reference | QC action | Monitoring frequency[a] | Possible corrective actions[b] |
|---|---|---|---|---|---|---|
| **Process:** Vegetation clearance<br><br>**Manager:** Vegetation clearance team supervisors | Height of remaining grass | Grass not taller than 6 inches | SOP 1 | Measure grass height | Prior to start of analog geophysics | Direct vegetation supervisor to remow the area |
| | Diameter of remaining trees | Diameter of remaining trees larger than 6 inches | | Measure tree diameter | Prior to start of analog geophysics | Direct vegetation supervisor to remove trees smaller than 6 inches from the area |
| | Open space | Spacing between trees not less than 4 feet | | Measure spacing between trees | Prior to start of analog geophysics | Remove additional trees; submit field change request to modify the geophysical process to conform to existing conditions |

### Example of Qualitative Requirement

| | | | | | |
|---|---|---|---|---|---|
| Grid coverage | Each grid is divided into individual 5-foot lanes; each UXO technician sweeps the entire lane assigned | | Observe grid construction and analog geophysics operations | Once weekly per UXO technician | Additional training for UXO technician; better delineation of search lanes within grid |

**From UXO-5 Table 2-1. Example QC matrix**

Monitoring frequency: It is important to note that on many projects multiple individuals or teams may be conducting an activity concurrently. Therefore specifying a monitoring frequency for the overall project may not be adequate. In these cases the monitoring frequency needs to be specified for each individual/team. For example “Once Weekly per UXO tech”.

Prior to implementing a “Possible Corrective Action” an evaluation of the root cause of the QC deficiency shall be implemented to identify the cause of the deficiency and identify the appropriate “Corrective Action”. This “Root Cause Analysis” shall be documented in the project database. This column presents possible corrective actions but the actual corrective action taken will result from a detailed analysis of the “Root Cause” of the identified QC deficiency

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Planning Quality

## Monitoring for Quality

### Monitor & Measure the Process

**Right Inputs > Correct Processes & Activities > Quality Results.**


**Right Resources:**
**Qualified People**
**Right Equipment**
**Proven Methods**

**Desired Results:**
**Quality Product**
**Customer Satisfaction**

Purpose of Monitoring

To make sure the inputs are right,

To confirm Process activities consistently work, and

Desired results are achieved.

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Planning Quality

# Monitoring for Quality

**Non-Conformance (QA/QC Failure)**

- Situations can arise in which requirements are not or cannot be met
- MR Plan should have a mechanism that formally documents the non-conformance, root cause analysis, corrective action, and approved departures



An example of mechanisms that document non-conformances is a  non-conformance reports (NCR).

NCR's documents deficiency that render the quality of an item product or process has been defined in the specifications or drawings as unacceptable or indeterminate.

Examples of Non-conformance include missing a BSI, excessive gaps in geophysical data, improperly backfilling holes, and any other failure to meet requirements specified in the approved plan.

Example:  At a project site a Non-Conformance Report (NCR) was issued by the independent QA organization when the production contractor failed to detect a BSI during Digital Geophysical Mapping (DGM).  The photo on the right shows a member of QA verifying the location of the BSI to perform a "Root Cause Analysis" (left and center photo). In this case the BSI was placed right at the edge of a steep gulley.  For this project requirements for DGM accessibility and coverage have been established (Slopes greater than 30 degrees are considered inaccessible and deviations are allowed for standing water, boulders, and exposed bedrock).  The result of the "Root Cause Analysis" determined that the seed item was placed in an in accessible location.  During placement the gulley was filled with snow and the QA technician had no way to know that the BSI was located at the edge of an in accessible area.  The corrective action in this case was for the DGM crews to better document inaccessible areas (steep slopes, standing water, etc.) on the grid DGM survey forms to include GPs coordinates for the boundaries of these areas.  Led to improvements in the process.

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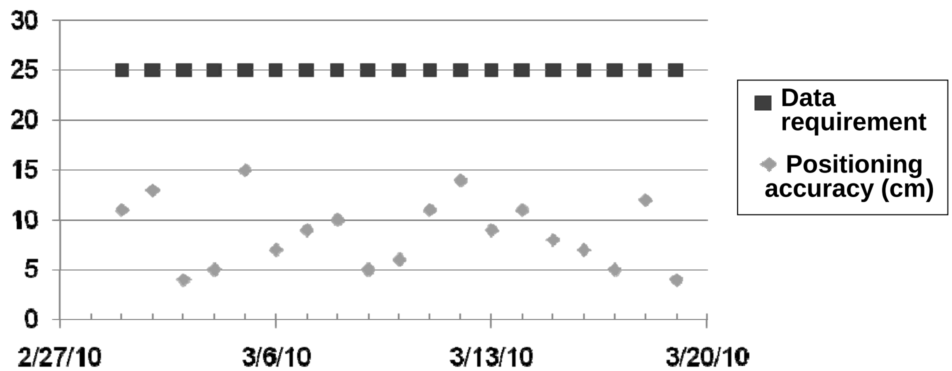
Planning Quality

## Monitoring for Quality

**Variations in QC Monitoring Data**

- **Common** cause variance
  - Result of limitations in the instrument or activity performed
  - Unavoidable, always present, and difficult to reduce




QC monitoring data from individual inspection points will usually contain variances. If you are not seeing any variance that is cause for suspicion as well.

Requirements have to take into account common cause variance.

**Common Cause Variance**: is the result of limitations in the instrument or activities performed. Unavoidable, always present, difficult to reduce. For example, suppose the positioning checks for a geophysical detector randomly vary from 4 cm to 15 cm from the reference point. Typically, 25 cm is an acceptable requirement for position accuracy. If the agreed-to positioning requirement was set by the project team at 25 cm, positioning checks—even with the variance—would meet the requirement for accuracy.

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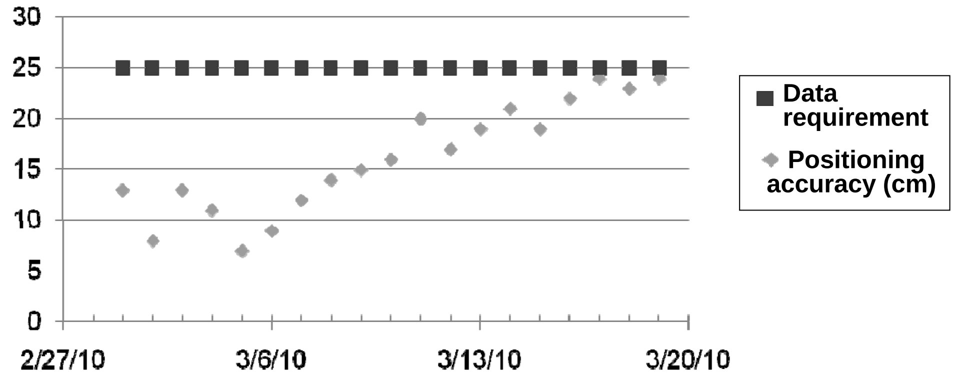
Planning Quality

## Monitoring for Quality

**Variations in QC Monitoring Data**

- **Special** cause variance
  - Variances not attributed to common cause
  - Indicate something has gone wrong or is going wrong with the process




**Special Cause Variance**: For example, assume the positioning accuracy for a navigation system has varied from 5 cm to 24 cm and has been steadily trending toward the 25-cm data requirement. Under these circumstances, a root cause analysis should be initiated to determine what is causing the degradation in navigation accuracy that is trending close to non-conformance. The root cause analysis may, for example, determine that the instrument was not properly calibrated because a substitute team member was unfamiliar with the calibration process. An appropriate corrective action in this case might be to require that all new team members and team members returning after an extended absence be trained or retrained on the calibration process.

If a higher level of accuracy is desired, a more accurate method of navigation would be required. If the monitoring requirements are too stringent they might be beyond the capability of the instruments. In this case, the requirements would have to change (approved departure) or a better positioning device would have to be used.

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## End of Module 1
## 1st Question and Answer Break

Summary

Quality is defined as “Conformance to requirements”

The UXO Team recommends using a Whole System Process approach to planning and managing MR projects to achieve quality.

We view MR as a system made of processes, sub-processes, and tasks. i.e. process approach

Whole-system means optimizing not just parts, but the entire system (in this case the MR). i.e. whole system

Each process should be broken down to individual sub-processes, tasks, and activities.

Requirements are developed for each sub-process, task and Activity.

Monitoring points are established for each requirement.

Measurements and observations are performed to evaluate project quality.

Finally Documentation is prepared that verifies procedures were followed and records the individual measurements and observations to provide a lasting record of project quality. documents “Conformance to Requirements”.

Leads to Defensible decision making.

# Quality Considerations for Munitions Response Projects

## MODULE 2:

Munitions Response Project Processes

No associated notes.

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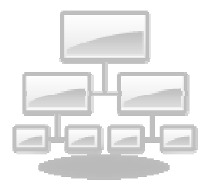
## MR Project Processes

- Six common MR processes
  - Vegetation clearance
  - Surface removal
  - Geophysical prove out (GPO)
  - Geophysical investigation
    - Digital geophysical mapping (DGM)
    - Analog (“mag and dig”) investigation
  - Anomaly resolution
  - Verification sampling



Six primary MR Project processes.

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## MR Project Processes
# Requirements

- How to ensure requirements are met?
  - Systematic approach
    - Ensure adequate controls are in place
    - Monitor processes, tasks, activities
    - Ensure conformance to requirements

DOCUMENT

Module 1 quick review (What is a requirement ?)

Project team should use a systematic approach, ensure adequate controls are in place for each process, and then monitor process/activities to ensure objectives achieved.

For the MR PROJECT, all processes are related and bound together – non-conformance in one activity generally affects many other tasks and activities.

MR Project Processes

## Vegetation Clearance

- Purpose – Clear vegetation for safe and effective implementation of follow-on MR processes
- Tasks
  - Grass mowing and mulching
  - Limb trimming and tree removal
  - Controlled burning
  - Disposal of logs, stumps, and mulch

The purpose of vegetation clearance is to prepare the project site for the safe and effective implementation of follow-on MR processes. While vegetation clearance may appear relatively straightforward, inadequate preparation of the MR site may make the implementation of follow-on processes less effective and possibly more hazardous due to poor surface visibility. Examples of some follow-on processes that may be dependent on adequate vegetation clearance are surface removal and analog or DGM survey of the work area.

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MR Project Processes

## Vegetation Clearance (continued)

- Key factors to consider
  - What type of clearance is necessary for the follow-on processes?
    - Who is the next customer?
  - How will vegetation clearance criteria be evaluated/measured?
- Controls
  - Monitor the work in progress
    - Inspect the vegetation clearance area
    - Review documentation

Like other industries where the success of the final product depends on the quality of the components that comprise it, the MR process relies heavily upon proper execution of the vegetation clearance to ensure the follow-on activities can be performed as planned. Some of the key factors and controls applied during this work phase are listed on the slide, but not necessarily all of them.

Table 2-1 and Figure 2-1 in the QAQC document provide an excellent summary of the requirements, inspection points, monitoring frequencies, and corrective actions for vegetation clearance and some of the follow-on processes.

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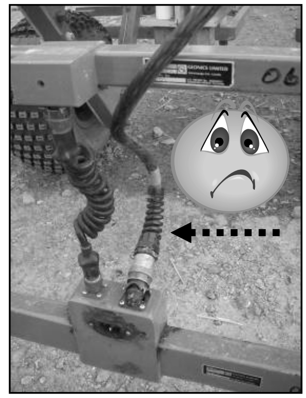
**MR Project Processes**

## Vegetation Clearance (continued)

- Cleared areas that do not meet requirements have the potential to adversely affect follow on processes, and damage equipment



Equipment damage can affect project schedule and budget

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MR Project Processes

## Surface Removal

- Purpose – May vary based on the specific objective of the MR project
- Tasks
  - Dividing the work area into units and UXO specialists walking search lanes
  - Removing metal debris and marking UXO/ discarded military munitions (DMM)
  - Documenting the removal's results

Surface removal may have various goals depending on the specific objective of the MR. For example, a surface removal may be performed to detect, identify, and remove a majority of the UXO, DMM, and metal debris from the surface of the production area to support follow-on processes (e.g., DGM) which result in the final UXO/DMM removal. Another project may use the surface removal process as the final remedial action which results in a site that is prepared for its future land use. For these reasons the overall project goals must be carefully considered and understood when designing the surface removal process.

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**MR Project Processes**

## Surface Removal (continued)

- Key factors to consider
  - Will surface removal support any follow-on work?
    - Safety of personnel
    - Concern for masking of items below the surface during geophysical investigation
  - How much and what kind of blind seeding will be used?
    - What are the criteria for success?
- Controls
  - Monitor the work in progress
    - **Inspect the surface clearance area**
    - Ensure equipment is adequate and appropriate
  - Review documentation

While it may be possible to perform a surface removal using only visual observation, geophysical sensors may be necessary to detect UXO/DMM if vegetation obscures the surface or if the UXO/DMM is difficult to visually distinguish from the surrounding soil. Typically, hand-held metal detectors or magnetometers are adequate for this task. If the vegetation is too dense or the search lane spacing is too wide (or both), the UXO specialists may have difficulty seeing and inspecting all portions of the search lane, which may result in missed UXO/DMM.

From a regulatory perspective, surface removal work that prepares a site for a follow-on DGM survey does not necessarily have to adhere to the strict QC and monitoring required if the final remedial objective includes follow-on DGM. However, these procedures may be appropriate to ensure the safety of personnel performing the follow-on processes.

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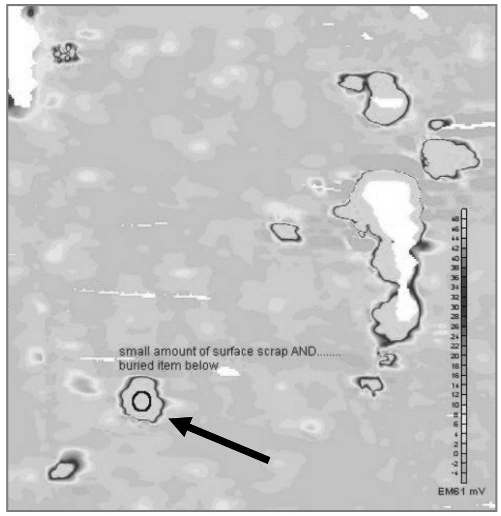
MR Project Processes

## Surface Removal (continued)

- Another simple operation that warrants attention
  - Scrap left on surface…….
  - Results in anomaly during DGM…….
  - Non-conformance during quality check by customer




Surface scrap left on the surface creates anomalies during the DGM phase of work !

Improvements necessary-insert inspection point(s) prior to DGM;

•review surface removal team(s) documentation for discrepancies

•reconnaissance of surface removal area prior to DGM

•follow SOPs for reacquire/intrusive (SOPs should address the type of condition in this example)

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MR Project Processes

## Geophysical Prove-Out

- Purpose – demonstrate/evaluate capabilities of the geophysical system on-site
- Tasks
  - Design
  - Construction
  - Implementation
  - Reporting

The GPO is performed prior to production geophysical surveys (either DGM or “mag and dig” analog geophysics) for many purposes, including demonstrating the capabilities of the geophysical system on-site. The ITRC UXO Team has developed a technical and regulatory document for GPOs, titled “*Geophysical Prove-Outs for Munitions Response Projects* (ITRC 2004)”, that the reader should refer to for more detailed information on GPOs.

As the MR industry matures, the nature and complexity of the GPO is changing. The first GPOs tested the contractor’s ability to use geophysical systems and assess the performance of a given geophysical technology used to detect site-specific UXO or DMM. Through years of tests and evaluations at standardized UXO test sites and hundreds of GPOs performed across the United States, the UXO geophysical community has developed a more comprehensive understanding of the capabilities and limitations of the commonly used geophysical systems.

For a detailed review of geophysical technologies applied to the MR process please refer to the document “*Survey of Munitions Response Technology* (ITRC, SERDP, ESTCP 2006)”.

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**MR Project Processes**

## Geophysical Prove-Out (continued)

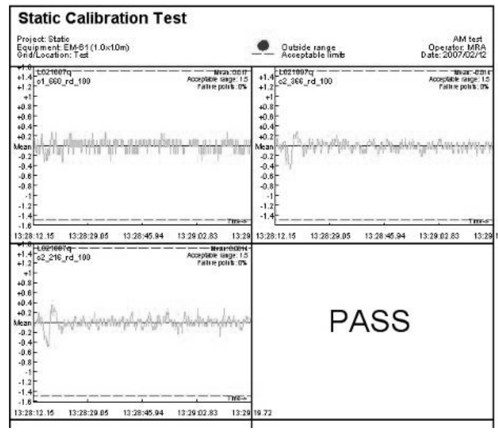
- Key factors to consider
  - What are the performance requirements for the contractor prior to or as derived from the GPO effort?
    - Noise levels, detection sensitivity, interpretation criteria
  - Can improvements be made to increase efficiency or effectiveness?
- Controls
  - Evaluate system as per criteria in work plan
  - Review GPO report/results
    - Any modifications to system or activities in order to meet objectives?

Monitoring of quality during the GPO phase will involve QA oversight to ensure that the GPO plan is followed by the contractor. The contractor should not be allowed to deviate from the GPO plan without approval. Oversight should be performed during the all phases of the GPO (design, construction, implementation, and reporting) and documentation generated by oversight personnel to show the plan was followed, and changes, if any were necessary, were approved by the project team.

**MR Project Processes**

# Geophysical Prove-Out (continued)

- Noise level requirement
  - 98 % +- 1.5 units
- DGM file check
  - 100 % meet tolerance
- Conformance to requirements
- Document




Summary is that shows how a timely **process-oriented** quality system works-what if check had been done at end of project and indicated that there was a non-conformance? Would any data need to be recollected ?

In general, critical points in the process (i.e., where a product is generated that requires a certain specification), need to be checked at frequent intervals, as opposed to less frequent intervals, in order to prevent large volumes of rework.

For each process the further upstream the inspection point the less chance faulty data will travel downstream

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**MR Project Processes**

# Geophysical Investigation

- Use of a geophysical system to detect and locate metallic objects

**DGM**

**Analog**

Geophysical Mapping refers to the use of a geophysical system to detect and locate UXO/DMM. Geophysical systems are comprised of analog or digital geophysical tools, positioning and navigation tools, deployment platforms and data management and interpretation techniques. Instrument operators are also considered components of the geophysical system when their tasks are essential to the system's performance.

There are two main geophysical processes: DGM and Analog. DGM tools are instruments that digitally record geophysical measurements where the recorded data can be geo-referenced (positioned) to where each measurement occurred. Digital geophysical tools can either be interpreted in real-time, near real-time, or any later time after data collection work is complete. Analog geophysical tools are instruments that produce an audible output, a meter deflection, and/or numeric output which are interpreted in real-time by the instrument operator.

**MR Project Processes**

## Digital Geophysical Mapping

- Purpose – Detect metallic objects and record their location for investigation
- Tasks
  - Collecting and recording geophysical sensor and position data
  - Data processing, analysis, and interpretation to identify potential UXO/DMM
  - Creating a "dig list" with adequate information to allow the "dig team" to reacquire the anomaly location and investigate the anomaly
  - Reporting of results

DGM uses a digital geophysical system to detect locate and map subsurface metallic items. If the quality of any of the system components are lacking, the overall geophysical system may not be able to locate UXO/DMM effectively. Therefore, the careful planning and integration of all aspects of the DGM process is vital to the success of the MR project.

When the geophysical sensor indicates that there is no buried metal in the ground, the MR project managers must have a high degree of confidence that the sensors are functioning correctly. To achieve this high degree of confidence, geophysicists analyze and document numerous geophysical tasks. Primary tasks include determining whether the geophysical sensor is fully functional, sufficient coverage is achieved, and the information generated by the sensor is interpreted correctly.

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MR Project Processes

## Digital Geophysical Mapping (cont.)

- Key factors to consider
  - **Is the quality process systematic and timely?**
- Controls
  - Review summary statistics for spatial sample density (coverage) and noise
  - Review blind seed data
  - **Comparison of intrusive results with geophysical results (FEEDBACK process)**

DGM product(s) represent spatial relationships and provide a permanent record of the data

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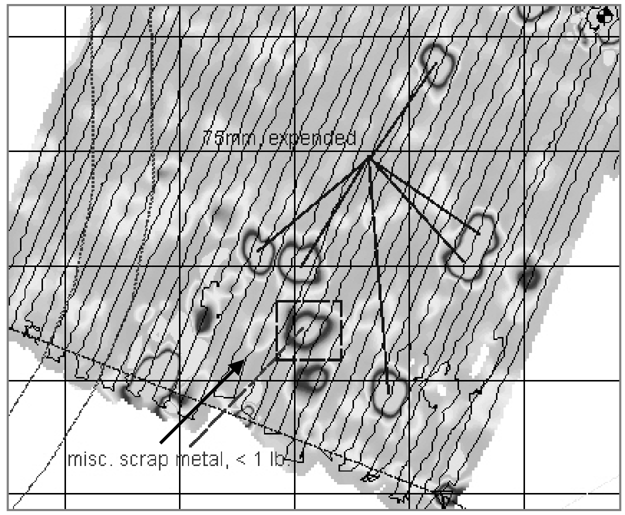
### MR Project Processes
## Digital Geophysical Mapping (cont.)

- Feedback loop
  - Geophysicist reviews intrusive results
  - Agree/disagree
  - Re-visit select locations
  - Review 2nd intrusive results
  - Agree/disagree

DOCUMENT




Because process QC elements used during this project phase, an item (although not hazardous) was identified where originally it had been designated as ~ 1 # of scrap.

Scenario/Root cause:

•Original intrusive data indicate misc scrap metal < 1 pound

•In feedback process intrusive findings do not correlate well with geophysical anomaly characteristics (also note nearby anomalies w/ similar geophysical anomaly characteristics are 75mm rounds)

•flagged for 2nd reacquire and interrogation by quality control team

•Intrusive QC team identified deeper item ~ 3 ft depth (75mm expended)

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MR Project Processes

# Analog Geophysics

- Purpose – Use of a geophysical sensor in “analog mode” to detect metallic objects and record their location for investigation
- Tasks
  - Work area is divided into search lanes
  - Each lane is surveyed by a technician using a geophysical sensor
  - Location of anomalies is marked using a pin flag, etc.
  - Anomaly locations are excavated

Analog or “mag and dig” geophysics is a process in which analog geophysical instruments are used to detect anomalies. These anomalies are detected, generally by an audible or visual signal interpreted by the operator. The anomalies are then marked, typically with a pin flag, and each marked anomaly is excavated to determine if it is UXO/DMM. The terminology “mag and dig” can be misleading since any geophysical sensor including commonly used analog magnetometers or analog electromagnetic induction (EMI) equipment can be used to detect the anomaly. Other terminology commonly used to describe this process is “mag and flag”. These terms refer to the practice of using an analog geophysical instrument to locate an anomaly, marking the location on the ground surface with a pin flag, and later excavating the flagged location to determine what is buried there.

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MR Project Processes

## Analog Geophysics (continued)

- Key factors to consider
  - Will blind seeding will be used?
  - What type, quantity, and depth(s)?
  - What actions will be taken if a blind seed item is missed?
- Controls
  - Personnel selection to ensure that only qualified personnel are used
  - **Visually monitoring performance of the work to ensure that the procedures specified in the work plan are being followed**

Equipment used to perform analog geophysics consists mostly of lower-cost hand-held magnetometers and EMI devices. The personnel used to perform analog geophysics are usually lower or entry level “sweep personnel” who receive “on-the-job” training in the operation of the geophysical sensors and are supervised by more senior UXO Technicians. The reader is referred to DDESB Technical Paper 18, *Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel* (DoD 2004)

(http://www.ddesb.pentagon.mil/TP18_122004.pdf) for more details on DoD personnel qualifications requirements.

When analog geophysics is used for the final clearance, QA personnel must constantly monitor the process to establish a high degree of confidence in the removal of UXO or DMM due to uncontrollable variables inherent to analog detection systems. For example, unlike DGM, analog geophysics does not produce a record of the survey which QA personnel may evaluate for completeness of coverage. In addition, and similar to the consideration made for surface removal, each technician clearing a search lane should be considered an individual geophysical system that needs to be monitored to ensure the level of production conforms to requirements. For example, each technician has a different level of hearing acuity and every hand-held geophysical sensor has slightly differing detection capability. For this reason, careful monitoring for compliance with the procedures in the work plan is necessary to control the numerous variables inherent to the process.

**MR Project Processes**

# Anomaly Resolution

- Purpose – Ensure all anomalies are unambiguously explained and managed post-excavation as per project requirements
- Tasks
  - Anomaly reacquisition
    - Navigate to the anomaly location, confirm presence/absence of anomaly
  - Anomaly excavation
    - Excavate anomaly and document the findings
  - Post-excavation activities
    - Inspection of Munitions Potentially Presenting an Explosive Hazard (MPPEH), Munitions and Explosives of Concern (MEC) disposal, and site restoration

Anomaly resolution occurs once the DGM process has produced a map of the site or the analog (mag and dig) geophysics process is complete and subsurface anomalies are marked with pin flags or other marking methods. The UXO technicians navigate to the anomaly location (DGM) or visually locate each pin flag (mag and dig) to excavate the anomaly. The anomaly is excavated and the results of the dig (item identification, depth, orientation, etc.) are recorded. The excavated item is identified and segregated for proper treatment/disposal and is removed and properly disposed of. The excavation is backfilled and the site is restored to the specifications required in the approved project plans.

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**MR Project Processes**

## Anomaly Resolution (continued)

- Key factors to consider
  - Is there agreement on how the intrusive results will be categorized and described?
  - Has the equipment and reacquire protocol been proven at the GPO?
- Controls
  - Check project database for consistency in results at agreed to intervals

Anomaly resolution is a “downstream” process, but specifications for the work should be agreed to prior to the project start.

**MR Project Processes**

# Anomaly Resolution (continued)

Microsoft Excel - R_DigList.xls

P2165 'NC

| 1 | ID | GridNum | TargetID | X | Y | anom_type | narrative | depth_top (in) | loc_offset | approx_wt |
|---|---|---|---|---|---|---|---|---|---|---|
| 2162 | 982 | g13 | 3 | 536971.5 | 603015.5 | NC | No Contact | 24 | 0 | 0 |
| 2163 | 1516 | h14 | 149 | 537230.2 | 603253.1 | NC | No Contact | 0 | 0 | 0 |
| 2164 | 4348 | j21 | 299 | 538618.3 | 603644.4 | NC | No Contact | 0 | 0 | 0 |
| 2165 | 348 | f13 | 13 | 537081 | 602772.9 | NC | 2.36 Rocket, | | 0 | 2.27 |
| 2166 | 2440 | i18 | 54 | 538150.8 | 603335 | NC | bolt | | 0 | |
| 2167 | 1937 | i14 | 76 | 537254.6 | 603312.9 | NC | booster | 24 | 0 | 1 |
| 2168 | 2420 | i18 | 34 | 538101.8 | 603401.3 | NC | Booster Adaptor | | 0 | |
| 2169 | 4340 | j21 | 291 | 538626.7 | 603524.9 | NC | edge of data | 0 | 0 | |
| 2170 | 2422 | i18 | 36 | 538093.9 | 603426.1 | NC | Frag | | 0 | |
| 2171 | 2431 | i18 | 45 | 538177.7 | 603374.4 | NC | gernade | | 0 | |

outside_QA

Filter Mode NUM

NC= “no contact” but items and depths described for the entry – this will provide erroneous summary statistics that can trigger quality actions, but in reality may be waste of project funds because investigation unwarranted.

Are geology and a no find the same “thing” ? What does a non-contact mean ? What is a “dry hole” ?

START WITH THE END IN MIND – determine intrusive documentation categories, rules, etc. prior to start of work, not during execution

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MR Project Processes

## Verification Sampling

- Purpose – Demonstrate that the project objective has been achieved by testing a portion of the product
  - "Standard" sample size ~ 5-20 %
- Tasks
  - Determine unit amount of product that will be tested
  - Test the product
  - Report results
  - Identify non-conforming conditions
    - Corrective actions

Also referred to as acceptance sampling

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MR Project Processes

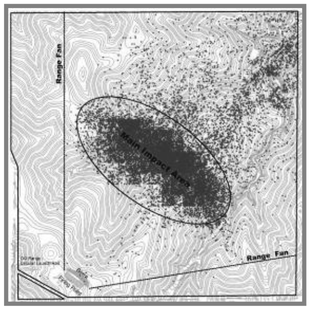
## Verification Sampling (continued)

- Key factors
  - What constitutes a non-conforming condition, and how will they be addressed?
  - **How much, *if any,* verification sampling is needed to increase confidence in the completed project?**
- Controls
  - Review results and confirm they meet agreed upon project requirements

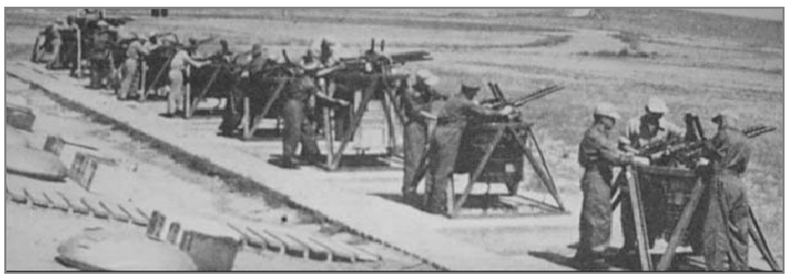
The project team needs to decide if verification sampling is necessary in order to further validate the results of the process/activity.

When a process approach to quality is implemented and non-conformance is identified, the owner of the process(es) or activities that were non-conforming should use the information to improve the process or activity (i.e., review inspection points, inspection frequency, criteria, and the overall organization of the process and activities in order to show improvement.)

# End of Module 2







A process approach to quality is optimum for MR projects.

## Quality Considerations for Munitions Response Projects

**MODULE 3**:

Case Studies

No associated notes.

## Case Studies

- Performance requirements: where is the surface of the earth?
- Lazy assumptions lead to inadequate performance requirements
- Failing to identify the needs of the customer

No associated notes.

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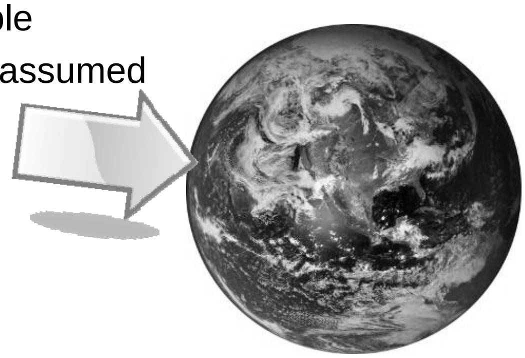
## Performance Requirements: Where is the Surface of the Earth?

- Successful MR projects have well-defined requirements
- Recall that requirements are: necessary; unambiguous; concise; consistent; complete; attainable; and verifiable
- Requirements are <u>not</u> assumed



This case study is about something that seems simple but can have great impacts on a project.

We recall from module number 1 that requirements cannot be assumed. They must be necessary, unambiguous, concise, consistent, complete, attainable, and verifiable.

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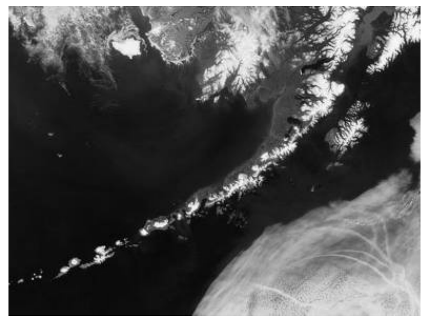
## Performance Requirements: Where is the Surface of the Earth?

- This case study looks at one particular requirement that is often assumed
- The Aleutian Islands are a chain of more than 300 small volcanic islands forming an arc in the Northern Pacific Ocean
  - During WWII, two were occupied by the Japanese in 1942. In 1943, the U.S. military retook them from Japanese control



The goal of this MR was to remove MEC from the surface of the site.

What is meant by “surface” is often assumed… “It’s the thing you walk on…”
Rule Number One: “Never Assume Anything.”

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## Background

- The Aleutian Islands are covered with tundra
  - Tundra is characterized by spongy, mat-like, low-growing dense vegetation up to 3 ft. thick
  - “Surface of the earth” takes on new complexity

Problem: The Aleutian Islands are covered with Tundra – spongy mat of dense vegetation that can be up to 3-ft thick.

The goal of this MR was to remove MEC from the surface of the site.

What is meant by “surface” is often assumed… “It’s the thing you walk on…”

Rule Number One: “Never Assume Anything.”

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## Options

- The MR Project Team, recognizing the unique conditions of Tundra, raised the question “where is the surface of the earth?”
- Three options:
  - The surface is the top of the tundra
  - The surface is the top layer of tundra that does not compress
  - The surface is the top layer of soil under the tundra

The project team was confronted with the problem of determining the “Surface of the Earth” for this particular project.

After considerable discussion the team boiled the decision down to one of 3 options.

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## Option 1 – Rejected

REJECTED

- Option 1 "**The surface is the top of the tundra**"
- Reason: Walking on the "surface" of the tundra may produce enough pressure to "disturb" the MEC that lies beneath the tundra

This option was rejected for several reasons.

The tundra is living and growing so anything located on the top when the site was active would now be buried under new growth.

If MEC were located at the very top of the tundra any disturbance such as walking could cause it to move lower in the tundra. If the top were the surface this MEC would now be "subsurface."

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## Option 2 – Rejected

REJECTED

- Option 2 "**The surface is the top layer of tundra that has sufficient density (does not compress or move under the weight of someone walking on it)**"
- Reason: Too difficult to develop a measurable standard of "Tundra Density"

How would the team measure exactly where is this point. Would it be at approximately the same distance from the very top in all places within the project site?

Would the MEC be located at this point in the tundra or would it travel further down into the growth?

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## Option 3 – Approved

APPROVED

- Option 3 "**The surface is the top layer of mineral soil under the tundra vegetation. This definition of surface is comparable to the top layer of soil on any other site with vegetation other than tundra**"
- This is an example of a Project Team defining goals, identifying processes, evaluating activities, and establishing requirements that can be verified, validated, monitored, inspected and tested

Before the MR begins

Recognizing the necessity to define "surface" the Project Team was able to agree to an unambiguous, consistent, verifiable definition that made it possible to meet project goals.

## Lazy Assumptions Lead to Inadequate Performance Requirements

- Requirements that are too lax, not appropriate to the task, or assumed may jeopardize the product's quality
- In this case study, an MR Project Team contracted a Surface Removal Team to clear all UXO and DMM from the surface of a survey area

This seem like a straight forward performance requirement. Anyone on a project team should be able to clear the surface of vegetation to allow the mapping team to perform their work.

## Background

- The MR Project Team identified surface removal as a key process of the MR project
  - Required detecting and removing surface UXO and DMM, including UXO and DMM hidden under forest vegetation
  - Because UXO and DMM may be visually obscured, the Removal Team decided to use hand-held magnetometers

The project team identified the surface removal as a key process on this project. The ground surface was covered with pine needles and other brush. This made any thing on the surface hard to see. Due to safety concerns caused by the inability to see any MEC under the surface debris, the team decided to use instruments to detect items under the vegetation layer.

# Performance Requirement

- Performance Requirement: “find and remove all surface UXO and DMM from the survey/production area.”
  - *(Finding **any** UXO or DMM on the surface anywhere in a “cleared” area, hidden or otherwise, would constitute a non-conformance)*
- The performance requirement seemed appropriate. It reflected the goal of the process, to remove all surface UXO and DMM from the survey area

Any MEC found on the surface would be a non-conformance and require a root cause analysis to find out the cause of the non conformance.

# Scrap Metal Discovered

- Following the Surface Removal Team's sweep, the QA/QC team conducted a QC check. They discovered a large piece of scrap metal on the surface.

No associated notes.

# Non-conformance?

- Was the discovery a non-conformance?
  - QA/QC Team: Yes, because the metal had not been investigated
  - Surface Removal Team: No, because the large piece of metal was not UXO or DMM, it was scrap

No associated notes.

## Review

- The Project Team halted the MR and reviewed the Surface Removal Process. The Project Team determined
  - Some requirements were assumed or not defined
  - Original requirements did not account for limitations in the equipment
  - The monitoring system for the process was inadequate. It only checked the finished product resulting in untested or unmonitored process task

No associated notes.

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# Original Process Did Not…

- Original process requirement did not take into account that hand-held magnetometers cannot discriminate between the objects that they detect
  - Any ferrous metal object that is overlooked, not detected, or not inspected is a non-conformance and should constitute a failure
- QC for the original process only evaluated the finished product
  - There was no way to confirm that the detectors were always functioning properly or if the Survey Team had indeed covered 100% of the survey area

No associated notes.

# Revise Requirements

- The Project Team had no choice but to revise the requirements and repeat the surface removal process. The revised requirements were as follows:
  - Survey 100% of the survey area
  - Examine all pieces of surface metal that were detected
  - Conduct and record mag functionality tests daily
  - Remove all items identified as UXO and DMM from the survey area

No associated notes.

# Monitoring Activities

- Monitoring activities for this process included
  - Ensure that survey lanes are properly marked
  - Verify spacing between individuals
  - Ensure that the Survey Team is producing a global positioning system (GPS) track log of the survey
  - Record results of GPS functionality tests
  - Ensure that the Survey Team is conducting magnetometer functionality tests
  - Blind seeding of scrap and surrogate munitions in the survey area
  - Conduct final QC inspection of “cleared” area

No associated notes.

## Conclusions

- The Project Team failed to consider the limitations of the detectors and how they are used
- The Project Team assumed certain levels of quality that could not be validated
- The Project Team was able to refine process requirements to ensure this process would produce, with confidence, the desired product

No associated notes.

# Failing to Identify the Needs of the Customer

- Customer requirements that are not properly identified, or assumed, may jeopardize the product's quality
- In this case study, an MR Project Team did not consult with the geophysicist to verify level of vegetation clearance required for geophysical mapping

No associated notes.

# Background

- Vegetation clearance team completed work and demobilized
- Geophysical survey team mobilized to site
- Geophysicist quickly realized clearance was not adequate for planned mapping operation
- Project team had to determine how to proceed

No associated notes.

# Options

- Option 1
  - Remobilize vegetation removal crew and redo the work
- Option 2
  - Change geophysical approach from DGM to mag and dig

No associated notes.

# Option 1 – Rejected

REJECTED

- Option 1 "**Remobilize vegetation removal crew and redo the work**"
- Reason: Time involved and additional cost of mobilization

No associated notes.

## Option 2 – Approved

APPROVED

- Option 2 “**Change geophysical approach from DGM to mag and dig**”
- Reason: Avoid remobilization costs and time

No associated notes.

## Consequences

- Failure to understand needs of the customer caused technical approach to change
- Modifying technical approach may adversely affect integrity of the project
- Will require a change in the project's quality processes

No associated notes.

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## Quality Considerations for Munitions Response: Summary and Conclusions

- MR processes are related, and output of each process becomes input for the next
- Process development affects project outcomes
- Requirements must be understood by all. They must be written down so everyone can ensure they are achieved. Never ASSUME team members understand a requirement

The MR project is a series of processes. The output of each process becomes the input for the following process. If the output does not conform to the stated requirements, it affects all follow on processes.

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## Summary and Conclusions (continued)

- Each organization has different roles in the quality process
- Not only do quality requirements need to be included to ensure a quality product, but QA/QC requirements must be documented
- Quality is only achieved when projects are well thought out, all team members contribute, quality is inserted in the process, quality procedures are enforced and documented, and all team members are satisfied

Each organization and technical discipline has to understand their roles and requirements to ensure a successful project.

Quality is not something to take lightly. The only way we can ensure the safety of future users of the property is to make every effort to achieve a quality process and document the monitoring of that process.

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## Thank You for Participating

- 2nd question and answer break
- Links to additional resources
  - http://www.clu-in.org/conf/itrc/uxoq/resource.cfm
- Feedback form – *please* complete
  - http://www.clu-in.org/conf/itrc/uxoq/feedback.cfm


Need confirmation of your participation today?

Fill out the feedback form and check box for confirmation email.

Links to additional resources:
http://www.clu-in.org/conf/itrc/uxoq/resource.cfm

Your feedback is important – please fill out the form at:
http://www.clu-in.org/conf/itrc/uxoq/feedback.cfm

**The benefits that ITRC offers to state regulators and technology developers, vendors, and consultants include:**

✓Helping regulators build their knowledge base and raise their confidence about new environmental technologies

✓Helping regulators save time and money when evaluating environmental technologies

✓Guiding technology developers in the collection of performance data to satisfy the requirements of multiple states

✓Helping technology vendors avoid the time and expense of conducting duplicative and costly demonstrations

✓Providing a reliable network among members of the environmental community to focus on innovative environmental technologies

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✓Join an ITRC Team – with just 10% of your time you can have a positive impact on the regulatory process and acceptance of innovative technologies and approaches

✓Sponsor ITRC's technical team and other activities

✓Use ITRC products and attend training courses

✓Submit proposals for new technical teams and projects