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OPERATIONAL TRAINING Part 3

# **RANGE CLEARANCE AND UNEXPLODED EXPLOSIVE ORDNANCE (UXO) ACTIVITIES MANUAL (ENGLISH)**

This publication supersedes B-GL-381-003/TS-000 dated 2008-03-15

## **WARNING**

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**Canada**





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## PREFACE

1. B-GL-381-003/TS-000, *Operations Training Part 3 — Range Clearance and Unexploded Explosive Ordnance (UXO) Activities Manual*, is issued on the authority of the Chief of the Defence Staff as a directive that applies to employees of the Department of National Defence and an order that applies to officers and non-commissioned members of the Canadian Forces.
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3. This is a bilingual publication, tumble-bound. The French title is *Entraînement opérationnel Partie 3 — Manuel sur le nettoyage des champs de tir et des activités UXO*.
4. The *Operational Training Safety Series*, B-GL-381, is published in three parts:
  - a. Part One — *Training Safety*. This publication covers all aspects of range utilization and training safety.
  - b. Part Two — *Range Construction and Maintenance*. This publication deals with the technical aspects involving safety for range construction and maintenance.
  - c. Part Three — *Range Clearance and UXO Activities Manual*. This publication deals with responsibilities, organization and procedures for range clearance/UXO activities by military and civilian contractors.
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## **CHAPTER 1 INTRODUCTION**

### **SECTION 1 GENERAL**

#### **101. BACKGROUND**

1. Over the years, large tracts of range and training areas (RTAs), on current Department of National Defence (DND)/Canadian Forces (CF) sites as well as legacy sites, have become affected by unexploded explosive ordnance (UXO) of various natures and in unknown quantities from live munitions firing. These areas must be cleared periodically to render them safe for manoeuvre, to restore them to their original state, to permit development, or to return them to their original owners. The principle of clearing ranges or UXO affected sites to a level acceptable for the intended use must be the dominant factor in any range clearance/UXO activity. Even after a range clearance/UXO activity it is impossible to certify that an area is totally free of UXO.

2. Range clearance operations, particularly for the Army, have in the past been treated as land-mine clearance operations incorporating similar techniques and safety procedures. Before the 1970s, range clearances were conducted in response to an incident or to fulfil a military requirement. Environmental awareness, knowledge and stewardship by either DND or the public were not as significant as it is today. These clearances usually involved field engineers and ammunition specialists supervising other military personnel. Surface sweeps picked up scrap metal/fragments and identified surface UXO. The UXO was then destroyed and subsurface searches conducted using manual prodding or mine detectors as required.

3. Following the 1970s, range clearance requirements changed as DND started to become involved in the return of leased/expropriated land to the original owners or the public. This, coupled with rising public and DND awareness of environmental concerns, raised both the profile and interest in range clearance/UXO activity methods and results. The first major range clearance/UXO activities in this new era of awareness were again conducted using only military personnel. However, decreasing military personnel strengths and increasing operational commitments led to a change from sole reliance on military resources to the current practice of contracting out major range clearance/UXO activities. The use of a third party contractor also had the positive effect of increased individual and public confidence that the range clearance/UXO activity was not biased or unduly influenced by a government agency. The move to contracted services has also shifted involvement from almost exclusively field/operations staff to a shared responsibility and involvement of both operations and infrastructure staffs.

4. Technological advances in the fields of electronic/remote sensing, geophysical analysis and Geographic Information Systems (GIS) have also led to a more science-based approach to range clearance/UXO activities. Procedures particular to range clearance/UXO activities have sufficiently evolved so that they can now be consolidated into one publication.

#### **102. AIM**

1. This publication provides guidance to all personnel concerned with the conduct and supervision of range clearance/UXO activities.

### 103. INTERPRETATION OF GUIDELINES, PROCEDURES AND REGULATIONS

1. This manual is issued on the authority of the Chief of the Defence Staff (CDS) as a directive that applies to employees of the DND and an order that applies to officers and non-commissioned members of the CF.
2. In instances where interpretations of the guidelines and procedures in this publication or the regulations in the references suggest various alternative methods of application, the method that most closely meets the highest interest of safety shall be adopted. Throughout these documents several types of clauses (such as: mandatory, advisory, and permissive) will be encountered. They are defined as follows:
  - a. **Mandatory Clauses.** Those containing the word “shall”. These clauses shall be observed at all times unless otherwise authorized by NDHQ/Directorate Ammunition and Explosive Regulation (DAER);
  - b. **Advisory Clauses.** Those containing the word “should”. These clauses shall be followed except when such a course is impractical for operational or safety reasons; and
  - c. **Permissive Clauses.** Those containing the word “may”. These clauses shall be within the discretionary powers of the designated authority specified in the Operation Order for military range clearance activities or contract Statement of Work (SOW)/Statement of Requirement (SOR) for contracted range clearance/UXO activities.

### 104. SCOPE

1. **General.** The reduction of the UXO risk on UXO affected sites can be accomplished through the following actions:
  - a. **Explosive Ordnance Disposal (EOD) Response.** The EOD response constitutes the DND/CF initial action to all unforeseen defence explosive ordnance (EO) items found within Canada. Procedures and guidelines contained in this manual are for planned range clearance/UXO activities and are not to be used for EOD operations and activities. EOD policies, procedures and guidelines are contained in appropriate DND/CF policy and guidance documents (QR&Os, CFAOs, DAODs, various instructions, etc.).
  - b. **Post-Firing Range Sweeps.** Post-firing range sweeps are part of normal CF range usage and maintenance and are conducted by the military. This manual does not cover post-firing range sweeps and consequently procedures, formations and personnel qualifications herein were not developed to apply to these sweeps. Details on post-firing range sweeps are contained in Chapter 1 Annex B of B-GL-381-000/TS-000 *Operational Training Part 1 — Training Safety* and in Range Standing Orders for the applicable range. Good post-firing sweeps and maintenance of records, however, will reduce the amount of UXO and facilitate future range clearance/UXO activities.
  - c. **Range Clearance/UXO Activities.** The four range clearance/UXO tasks/activities can be done by military or contracted resources and consist of:
    - (1) UXO Avoidance;
    - (2) Range/UXO Surveys;

- (3) Range/UXO Clearances; and
- (4) Residual Risk Audits/Assessments.

2. **Manual Scope.** This manual concentrates on planning, preparation and conduct of range clearance/UXO activities. Organizations and procedures for specific types of range clearance/UXO activities are specified in this publication. Although the focus of this manual is directed towards RTAs and sites on land, the procedures and guidelines contained in the manual can be used for underwater sites in conjunction with, but subordinate to, military and Canadian Standards Association (CSA) approved diving procedures and safety regulations. As well, the procedures and guidelines in the manual are directed towards conventional munitions only. Chemical, Biological, Radiological and Nuclear (CBRN) UXO issues fall under the mandate and policies of the Director ( ) of Strategic Analysis (D Strat A) for chemical/biological weapons/UXO and Director General Nuclear Safety (DGNS) for radiological/nuclear material. If CBRN/suspected CBRN UXO is found, procedures outlined in Annex C are to be followed.

3. **Manual Layout.** Range clearance/UXO activities may employ either military or contracted resources and are conducted as a result of periodic range maintenance, changes of land use criteria, or when the UXO risk/hazard exceeds the acceptable level for the site's declared usage. The overall concepts in this chapter and those in Chapter 4 are common to both military and contracted range clearance/UXO activities. As well, common guidelines and direction for handling CBRN/suspected CBRN UXO and scrap generated from both military and contracted range clearance/UXO activities are contained in Annexes C and D to Chapter 1 respectively. Also, sample generic clearance depth guidelines to assist in planning range/UXO clearances are provided in Annex E to Chapter 1. Chapter 2 is written for military use but many of the detailed procedures can be used as guidelines to prepare and/or evaluate contracted range clearance/UXO activities. Chapter 3 provides further guidelines for the conduct of contracted range clearance/UXO activities.

## 105. RESPONSIBILITIES

1. **General.** The overall NDHQ OPI for DND/CF range clearance/UXO activities policy and technical advice within Canada and the 370 km (200 nautical mile) Canadian Economic Exclusion Zone is Assistant Deputy Minister (Infrastructure and Environment) (ADM(IE)). ADM(IE) exercises this authority and provides functional direction and guidance through the Directorate of Real Property Plans (DRPP) 5 - ADM(IE) Range and Training Area Coordinator (RTA Coord) for policy issues and, for technical issues, through the Directorate of Environmental Engineering Management (DEEM) 2 (DND/CF centre of excellence for DND sites and contracted range clearance/UXO activities).with input from Subject Matter Experts (SMEs) such as the Directorate of Real Property Management (DRPM) 2 - DND UXO and Legacy Sites Program (UXO Legacy Sites Program), DAER, CF EOD and others.

2. **DND Range Clearance/UXO Activity Responsibilities.** Within DND, the responsibility for range clearance/UXO activities on current DND sites rests with the organizations that have been designated custodianship and control of DND sites by the CDS. Responsibility for legacy sites rests with DRPM 2 - UXO Legacy Sites Program as detailed in the ADM(IE) Standard 1606-4000.1-S01-020 *Assignment of Responsibility for Managing Legacy Site Responsibilities*.

3. **On-site Command and Control Responsibilities.** For each military range clearance operation the Military Commander will be designated by name/position by the military authority ordering the range clearance operation. For each contracted range clearance/UXO activity, the Contractor Project Leader will be designated by name in the contractor's accepted Work Plan.

The Military Commander/Contractor Project Leader is responsible for conducting the operation safely and efficiently.

4. Additional responsibilities related to range clearance /UXO activities in Canada are contained in ADM(IE) Standard 1606-4000.1-S02-020, *Technical Instruction for UXO Activities* and the publications, documents and references listed at Annex A.

## 106. UXO COORDINATION

1. **General.** The limited resource available to DND/CF and the limited capacity of the Canadian UXO industry requires coordination of UXO activities within DND/CF.
2. **Coordination of DND Range Clearance/UXO Activities.** The UXO Sites Sub Committee (UXOS SC) is the main mechanism for coordinating DND/CF UXO activities. The UXOS SC is chaired by DRPP, with members representing Environmental Chiefs of Staff (ECSs), Canada Command, Judge Advocate General, ADM(Public Affairs), ADM(IE)/Director General Environment/Director General Real Property/Director General Military Engineering, ADM(Finance & Corporate Services) (ADM(Fin CS)), ADM(Material), DAER, Chief of Military Personnel (CMP), CFEOD, DND/CF Legal Advisor, and Defence Construction Canada (DCC).
3. **DND Contracted Range Clearance/UXO Activities Reporting.** As the authority for DND/CF range clearance/UXO activities policy and for its expertise in contracted UXO activities, ADM(IE), through the UXOS SC, collects and monitors information on planned contracted range clearance/UXO activities work for both legacy and DND sites. The ECS/L1 organizations that have been designated custodianship and control of sites conducting the range clearance/UXO activities report information on their UXO activities annually as part of their Sustainable RTA Management Plan (SRTAMP) in accordance with ADM(IE) Standard 1606-4000.1-S01-024 *Sustainable Range and Training Area Management* and can provide intermediate updates for Category A, B and D sites contracted UXO clearance activities to the UXOS. These reports can be taken directly from the CF Range Information System (CFRIS) or for those not using CFRIS, through individual submission of copies of Annex B.

## 107. UXO SITE RISK RATING/ASSESSMENT

1. **DND UXO Site Risk Rating/Assessment.** Explosive Risk Rating for UXO shall conform to the Risk Management of Ammunition and Explosives for the DND/CF guidance as approved by DAER. The responsibility for assigning a UXO risk rating to a particular UXO site rests with the ECS/Level 1 (L1) responsible for the site. Risk on a UXO site is a factor of the type, duration and intensity of human interaction combined with the type, condition, depth and sensitivity of the defence EO on the site. Other characteristics such as the potential for UXO migration, soil conditions, climate, topography and geology/bathymetry can also impact the level of risk at a specific site. For Category C sites, DRPM 2 - UXO Legacy Sites Program shall complete the Record of Legacy Site Risk Management (RLSRM) in accordance with the UXO Legacy Sites Program Legacy Sites Management Framework process. Appropriate measures to reduce the risk commensurate with the end-use plan for a site shall be undertaken. The UXOS SC will remain the DND/CF forum through which ECS/L1s can raise risk concerns or request assistance from the DND/CF UXO community to obtain a broader consensus on the UXO risk level at a particular site.

## 108. TERMINOLOGY

1. This publication is primarily written using established DND/CF terminology. In general, it is DND/CF policy to adhere to the DND/CF Defence Terminology Bank (DTB) and A-AD-121-

F01/JX-000, *DND/CF Manual of Abbreviations* as well as NATO standard terms and definitions. Amplification of DTB and NATO terms, as well as additional terms and definitions for this publication, are contained in the glossary and the provided list of abbreviations. It is important that all personnel are familiar with and use recognized terminology to avoid confusion. This becomes even more critical when dealing with other government agencies or civilian contractors. Therefore, during the planning and conduct of range clearance/UXO activities by civilian contractors, extra care must be taken to ensure all terms are understood. The use of non-DND/CF terminology is deemed appropriate only when it is necessary to facilitate the mutual understanding of a foreign agency or contractor with comparable DND/CF terms.

2. The term “suspected UXO” is used in the manual to represent and highlight any item that cannot be positively identified as not being UXO. As a rule, UXO and/or suspected UXO are to be handled and treated in the same manner until positive identification is obtained.

## 109. REFERENCES

1. A list of publications, documents and references that must be read in conjunction with this manual is at Annex A.

## 110. DND CATEGORIES OF SITES

1. DND has, based on the categorization of DND/CF sites given in ADM(IE) Standard 1606-4000.1-S01-024, categorized UXO sites as follows:

- a. **Category A—Active DND UXO Sites.** Active sea/land/air RTAs currently within the DND inventory (whether owned or leased) that are or are suspected to be affected by UXO.
- b. **Category B—Inactive DND UXO Sites.** Inactive sea/land/air RTAs that remain within the DND inventory (whether owned or leased) that have or are suspected to have been affected by UXO.
- c. **Category C—Legacy UXO Sites.** A site on land or offshore (inland waterways or within the 370 km (200 nautical mile) Canadian Exclusive Economic Zone (EEZ)) that has or is suspected to have resulted in a UXO affected area where:
  - (1) the property has left the DND inventory (whether owned or leased);
  - (2) past CF or foreign military activity (training or operational) has occurred; and/or
  - (3) past federal government activities related to defence explosive ordnance (EO) has occurred.
- d. **Category D—Special Status UXO Sites.** Sites on land or offshore, determined on a case-by-case basis, with a UXO hazard caused or created by a variety of known (e.g. current/routine training, operations, etc.) or unknown reasons (e.g. recent shipwrecks/air crashes, scrap dumps, etc.), but for which DND has lead agency responsibility to rectify on behalf of the Government due to the nature of the circumstances.

## 111. DND CLASSIFICATION OF DANGEROUS AREAS

1. A dangerous area is defined as any land or water on or in which live firing of weapons, explosives or pyrotechnics has taken place or occurred as a result of operations, training,

research and development, tests and evaluations, and/or ammunition and explosive disposal or accident. As per B-GL-381-001/TS-000 *Operational Training Part 1 - Training Safety*, DND/CF has classified ranges and training areas into the following four types of dangerous areas depending on the degree of UXO risk:

- a. **Type 1—High Risk/Extremely Dangerous.** Areas that have a high degree of UXO and where the probability of encountering UXO is extremely high (e.g. impact areas dedicated to artillery/mortar, armour, anti-armour and air-to-ground live firing practices) and where manoeuvre training is very restricted.
- b. **Type 2—Medium Risk/Dangerous.** Areas that have some degree of UXO and where the probability of encountering UXO is extremely high (i.e. impact areas where the primary purpose is or was manoeuvre training but where UXO producing munitions is or was previously authorized).
- c. **Type 3—Moderate Risk/Moderately Dangerous.** Areas contiguous to Type 1 and 2 areas where there is no assurance that the areas are free from UXO.
- d. **Type 4—Low Risk/Limited Danger.** Areas where it is or was extremely unlikely that UXO producing munitions may have been used or landed during range practises or training exercises (small arms ranges, dry training areas, domestic sites, etc.).

2. **Classification Process.** In order to properly classify a UXO affected area, a thorough research of the history of the RTA is required to determine the impact/danger areas, the types of weapons fired and the nature and probable quantities of ammunition expended. All avenues, including current and archival records from DND/CF, other federal, provincial and local government agencies as well as anecdotal evidence from current and past RTA employees and local residents should be exploited. As per B-GL-381-001/TS-000 *Operational Training Part 1 - Training Safety*, it is DND/CF policy to classify dangerous areas as Types 1 through 3 as soon as adequate research can be completed. Where an area is in doubt, the higher risk classification shall be applied. When a property cannot be classified with confidence due to inadequate records as to the location of impact areas, ranges or exercise/training area, the area will initially be classified Type 1 – High Risk/Extremely Dangerous. Such blanket classifications frequently lack credibility and should be considered only as the first step towards a thorough classification.

## SECTION 2 PRINCIPLES OF RANGE CLEARANCE/UXO ACTIVITIES

### 112. TYPES OF RANGE CLEARANCE/UXO ACTIVITIES

1. **General.** The four types of range clearance/UXO activities, as described in paragraphs below, reduce or remove the effect or risk of UXO.
2. **UXO Avoidance.** UXO avoidance does not remove the UXO threat but reduces UXO risk by employing measures to avoid encounters with UXO. Intrusive work and/or handling of suspected UXO is not part of UXO avoidance activities. The techniques employed to locate suspected UXO are similar to those used during range/UXO surveys/clearances. These UXO avoidance measures may include:
  - a. **Institutional Controls.** Heightening awareness to warn people of dangers through signage and/or education/communications programs.

- b. **Physical Controls.** Restricting access through fencing/barriers, patrolling, access control, etc.
  - c. **Avoidance Actions.** Using detection equipment to locate suspected UXO and re-routing planned activity to avoid UXO.
3. **Range/UXO Surveys.** Range/UXO surveys assist in delineating and quantifying the UXO problem on a site in order to determine what further action(s) may be required to reduce UXO risk to an acceptable level. A variety of survey techniques may be used, and the survey may include intrusive investigations to determine and/or confirm the extent, types and nature of UXO.
4. **Range/UXO Clearance.** A range/UXO clearance is employed when UXO avoidance is not practicable to reduce/remove UXO risk. A range/UXO clearance of a site involves locating, exposing, positive identification and removal/disposal of suspected UXO and munitions scrap (MS) to a level commensurate with the intended use of the site.
5. **Residual Risk Audits or Assessments (RRA).** An RRA reassesses the residual UXO risk at a site following some form of UXO activity. An RRA is normally conducted at periodic intervals, when some significant change in use of the site is contemplated or following a significant incident that raises some doubt about the effectiveness of a previous clearance/UXO activity. Residual risk assessments are normally conducted on Category A, B and D sites as part of the ongoing sustainable RTA measures. For Category C sites, residual risk audits are a formal process by DRPM 2 - UXO Legacy Sites Program to verify whether the risk level at a site is commensurate with the stated usage. The methodologies used to conduct RRAs may include UXO surveys.

### 113. CLASSIFICATION OF RANGE/UXO CLEARANCE LEVELS

1. **General.** Range/UXO clearances were formerly classified into three distinct levels depending on the depth below the surface which clearing was conducted. These former levels have been superseded by just two levels, surface or subsurface. The depth of the clearance is dependant on and determined by the intended use of the site. For UXO clearance underwater, surface clearance encompasses suspected UXO and MS/non-munitions scrap (NMS) on river/lake/sea beds, and subsurface includes items below the river/lake/sea bed.
2. **Surface Clearance.** Surface clearances are conducted to locate, remove or destroy all surface UXO and remove MS, NMS and hard target material visible on the surface of the site. The benefits of a surface clearance must be considered in terrain where brush or undergrowth prevents a clear view of the ground. The possibility of erosion, topographic change or frost action exposing buried items near the surface, thus requiring further clearance, must also be considered. A surface clearance is normally a precursor to subsurface clearance. Surface clearance procedures are described in Chapter 2 for military clearance and Chapter 3 for contracted clearance.
3. **Subsurface Clearance.** Subsurface clearances are conducted to locate, remove or destroy all subsurface UXO and remove (as required) MS, NMS and hard target material below the surface of the site. There is no set depth for a subsurface clearance. The site is cleared to a depth that is deemed safe for the intended use of the site (the norm for military manoeuvre areas has usually been 45 cm). Sample generic clearance depth guidelines, for planning purposes only, are available in Annex E. Subsurface clearance procedures are described in Chapter 2 for military clearance and Chapter 3 for contracted clearance.

## 114. QUALIFICATIONS

1. **General.** Qualifications of both military and civilian personnel engaged in range clearance/UXO activities work for DND/CF are governed by DAER, whose policies and Ammunition and Explosives Instructions (A&EI) supersede the guidance provided in this manual.
2. **Military.** The approved list of military occupations and qualifications accepted for CF military personnel involved in range clearance/UXO activities are described in Chapter 2 Annex A.
3. **Contracted Civilian.** DRPM 2 - UXO Legacy Sites Program, on behalf of the UXOS SC, maintains a list of all civilian qualifications and equivalent military qualifications for former CF/foreign military personnel as currently approved by DAER for UXO work in Canada. If a contractor has personnel they believe are qualified by a means not currently covered by the approved qualification list, they may submit résumés and justification for these personnel to DRPM 2 - UXO Legacy Sites Program for review and a decision by DAER. An outline of expected range clearance/UXO activities duties and the qualifications required is contained in Chapter 3 Annex A. This Annex includes both UXO personnel working in the exclusion/danger zone on the site as well as the Geophysical, Quality Control and other specialized non-UXO qualified personnel specified in the range clearance/UXO activity SOW/SOR/contract.

## 115. SAFETY AND TRAINING

1. **Safety.** Whether military or contracted personnel perform the work, safety of those involved in range clearance/UXO activities is of paramount importance. Range clearance/UXO activities can only be carried out safely when all personnel are aware of safety requirements and are trained to know their job and remain alert. Accidents are caused by ignorance of task, lack of common sense, or inattention. Accident/incidents involving any explosive items shall be reported and investigated through the chain of command for military range clearance or in accordance with provisions in Chapter 3 and the SOW/SOR for contracted UXO activities.
2. **Responsibilities.** Safety is the responsibility of all personnel involved in the task but particular emphasis falls on the chain of command/management. The Military Commander/Contractor Project Leader has overall responsibility for the safe and efficient conduct of the operation. However, personnel at all levels have an individual responsibility to ensure not only that safety is maintained, but also that unsafe acts or conditions are reported and corrected immediately. The Military Commander/Contractor Project Leader must be satisfied that preliminary training and ongoing refresher training is adequately administered and that all personnel are capable of completing their tasks safely. It is of utmost importance that the Military Commander/Contractor Project Leader establishes an environment where personnel remain alert, and avoid boredom and fatigue associated with heavily UXO affected areas or prolonged range clearance/UXO activities.
3. **Safety Requirements and Procedures.** The minimum safety requirements and basic safety procedures for range clearance/UXO activities are provided in Chapter 2 for military range clearance and Chapter 3 for contracted UXO activities. These are only the minimum requirements. Common sense and experience must prevail at all times. These chapters also detail the minimum acceptable qualifications for personnel employed in range clearance/UXO activities. As a general rule, an appropriately qualified UXO person shall escort any non-UXO qualified personnel in areas that are or are suspected of being affected by UXO unless the:
  - a. area has been surface cleared;



- b. activities being undertaken by the non-UXO qualified personnel are non-intrusive or do not entail the physically handling of UXO; and
  - c. the assessed residual UXO risk permits un-escorted movement in the area.
4. **Hazards of Electromagnetic Radiation to Ordnance (HERO).** Electro-magnetic radiation from electro-magnetic, radio frequency emitter or electrostatic sources may prematurely initiate electro-explosive/electrically initiated explosive devices (EED/EIED). For range clearance/UXO activities, steps must be taken to identify the possible presence of EED/EIEDs during the planning and precautions to limit the hazard must be taken during the execution of range clearance/UXO activities. Further details related to HERO can be found in C-09-153-001/TS-000 *Ammunition and Explosives Safety Manual, Volume 1, Storage and Transportation* (to be replaced by C-09-005, *Ammunition and Explosives Safety Manual* series).
5. **Safety Distances.** The minimum safety distances commensurate with the assessed potential blast and fragmentation risk and measures proscribed in DND/CF explosive safety manuals and Chapters 2 (for military clearance) and 3 (for contract UXO activities) shall be adhered to during any UXO intrusive investigative, handling/moving or destruction procedures.
6. **Training.** Whether the work is being done with military or contracted personnel, training before a range clearance/UXO activity is mandatory for all personnel involved. Training must be given by appropriately qualified personnel and should include the widest possible variety of training aids and techniques. Training must include initial training before commencing the work as well as ongoing refresher training throughout the operation/project. This is particularly important on legacy sites and any other site where UXO from the 1960s or earlier are likely to be encountered. Details regarding planning, preparation and conduct of training are contained in Chapter 2 for military range clearance and Chapter 3 for contracted UXO activities.

## 116. RECORDING AND REPORTING OF RANGE CLEARANCE/UXO ACTIVITIES

1. **General.** Each ECS/L1 organization designated custodianship and control of and DRPM 2 - UXO Legacy Sites Program for Category C sites will dictate the type and methodology for recording and reporting their range clearance/UXO activities. As a minimum, the Annual Range and Training Area UXO Report (Annex B) or equivalent information from the CF Range Information System (CFRIS) must, in accordance with ADM(IE) Standard 1606-4000.1-S01-024, be included as part of the ECS/L1 SRTAMP being submitted to ADM(IE) for Category A and B sites and any Category D sites on which elements of the ECS/L1s routinely train. An information copy of Annex B or the CFRIS equivalent is also to be sent to DAER. Updates on range clearance/UXO activities should be briefed to the UXOS SC. Further details are provided in Chapter 2 for military range clearance and Chapter 3 for contracted UXO activities.
2. **Conceptual Site Model (CSM).** The introduction of sustainable range programs for DND/CF Category A and B sites and the Legacy Sites Database will require the establishment and maintenance of a CSM for all sites. A CSM is a layered compilation of geo-referenced information pertaining to a site (topographic, demographic, hydrologic, UXO, environmental, vegetation, infrastructure, etc.) that provides an overview of the site. The Site UXO Model (SUM) captures a geo-referenced record of all UXO and other items found, identified and removed or left on the range for the CSM. It also includes any other data (in text and graphics) found, discovered or learned during the operation. The information contained in the SUM will facilitate future range clearance/UXO activities, and assist in range maintenance and residual risk audits/assessments (RRA) for the site. The SUM should preferably be in an electronic format and in an approved DND GIS tools, standards and architecture..

3. **GIS.** Any GIS shall use ADM(Information Management) accepted and supported tools in a standardized GIS warehouse that meets Chief of Force Development approved DND/CF GIS standards and guidelines (see CF Interoperability Standards list)..

## **117. ENVIRONMENTAL, ARCHAEOLOGICAL, HISTORICAL, CULTURAL AND ABORIGINAL CONSIDERATIONS**

1. **General.** Environmental, archaeological, historical, and cultural issues pertaining to range clearance/UXO activities shall be incorporated into all phases of the activity whether conducted by military or contracted resources and on any DND category of site. Aboriginal concerns and consideration, where applicable and appropriate, shall also be incorporated.

### **2. Environmental**

- a. **Environmental Issues/Assessments.** An environmental assessment (a screening or comprehensive study) will normally be required prior to the commencement of UXO clearance activity in accordance with the *Canadian Environmental Assessment Act* (S.C. 1992, c.37), DAOD 4003-2, *Environmental Assessment* and/or provincial/municipal regulations or as due diligence. For DND Category A and B sites, the local DND/CF Environmental Officer must be consulted to determine the requirement for a screening or comprehensive study environmental assessment prior to the commencement of range clearance activity. Findings and recommendations from the environmental assessment will be incorporated into the range clearance/UXO activity. Any conflicts between planned range clearance/UXO activity and the environmental assessment may require a decision by higher authorities before commencing work. As well, any collection of samples to test for energetic material, if required, shall be done in accordance with environmental regulations and current practices. Any discoveries during the conduct of a range clearance/UXO activity regarding an actual or potential environmental concern shall be reported immediately as follows:
  - (1) For military range clearance activities this will be done through the chain of command in accordance with existing CF regulations.
  - (2) For contracted range clearance/UXO activities the following shall apply:
    - (a) **DND Sites.** The contractor shall, unless prescribed differently in contract documentation, immediately inform the local DND/CF Point of Contact specified in the SOW/SOR, the Contracting Authority (CA) and the DND On-Site Representative (On-Site Rep).
    - (b) **Legacy Sites.** The contractor shall immediately inform the CA, the DND PM (through the DND On-Site Rep) and the appropriate municipal/provincial/federal agency in accordance with existing statutes and regulations. The DND Project Manager and the CA shall, unless prescribed differently in contract documentation, also be informed if the legally required action stemming from the finding will impact on the cost/schedule of the project.
- b. **Environmental Sample Collection.** The collection on samples for energetic material testing/analysis may be undertaken to determine the baseline contamination level for these environmental contaminant at specific sites. This may be of particular importance on Legacy sites in order to provide a complete

picture of the site. Any collection of samples for energetic material testing/analysis must be included in the Operation Order (for military) or SOW/SOR (for contracted work) and conducted in accordance with the prevailing standards and practices for environmental sampling protocols.

3. **Archaeological, Historical and Cultural.** Many DND/CF range and legacy sites may contain areas that have significant archaeological, historical or cultural value. Any issues of archaeological, historical or cultural importance found during the review of range/site information shall be incorporated into planning to ensure these items are safeguarded in accordance with existing DND/CF regulations for DND/CF sites or municipal/provincial/federal regulations for legacy sites. Care must be taken to identify and mitigate these issues prior to commencing work. As with environmental issues, any findings that may be of archaeological historical or cultural significance during the conduct of a range clearance/UXO activity shall be reported as detailed for environmental issues.

4. **Aboriginal.** Particular care must be taken when dealing with possible aboriginal concerns where the land is/was leased, expropriated, or possibly subject to a land claim. Consideration must be given to whether or not it is necessary to consult with potentially affected Aboriginal groups regarding proposed UXO projects. Consultation is legally required where the Crown has real or constructive knowledge of the potential existence of Aboriginal or treaty rights and contemplates conducting a proposed UXO project that could have an adverse impact on potential or existing Aboriginal or treaty rights. Further information on the duty to consult Aboriginal groups can be obtained from the Director Infrastructure and Environment Issues Management (DIEIM) or the ECS/L1 Aboriginal Advisor. Legal advice on the duty to consult Aboriginal groups can be obtained from the DND/CF Aboriginal Legal Advisory Section. For DND/CF sites, the local AJAG or DJA can facilitate contact with the appropriate resource. Any findings that may be of Aboriginal significance during the conduct of a range clearance/UXO activity shall be reported as detailed for environmental issues.

## 118. SECURITY AND CONTROLLED GOODS PROVISIONS

1. **General.** Whether military or contracted personnel perform the range clearance/UXO activities work, security remains the responsibility of the Commander (for military) or DND/CF Project Authority (for contracted work). The security requirements must be determined during the planning stages and appropriate measures put in place to ensure the integrity of equipment, resources and information is maintained in accordance with National Defence Security Instructions and all other relevant laws and regulations.

### 2. Responsibilities

- a. **Military.** The chain of command is responsible to ensure only those personnel with the appropriate security clearances and the need have access to or handle classified items or information related to those items that may be found on RTAs.
- b. **Contracted Work.** UXO, being military ammunition, falls under Group 2 of the Export Control List provisions of the Controlled Goods Regulations under the *Defence Production Act* (R.S. 1985, c.D-1). As such, the DND/CF Project Authority must ensure that the appropriate security considerations are annotated in the Security Clearance Checklist (SRCL) (i.e. Paragraph 5.a. of the SRCL is checked) prior to release of the Request for Proposal (RFP) so the specific Controlled Goods clauses can be included in the RFP by the Contracting Authority. The DND/CF Project Authority must also ensure that the contractor is registered with the Public Works and Government Services (PWGSC) Controlled

Goods Directorate and the company and its personnel have the required security clearances prior to the contract unless exempted under ADM(IE) Standard 1606-4000.1-S01-023 *The Identification and Communication of Security Requirements for Realty Projects* paragraph 1.6 as follows:

*“1.6 Risk must also be managed in a manner sensitive to the economy of resources: an uncritical application of security controls to realty projects can create an illusion of security, while needlessly diverting resources and efforts away from other priorities. In and of themselves, the following activities do not trigger security requirements:*

- h. the intrusive investigation of potential unexploded explosive ordnance, the destruction in situ of UXO to generate munitions scrap, and the screening of munitions scrap up to Level Three, provided that these activities are conducted under oversight of a DND representative who is either a DND employee, a CF member, or a DCC employee.”*

3. **DND/CF Controlled Goods Qualification/Training Requirements.** Any DND/CF representative (either a DND employee, a CF member, or a DCC employee) controlling, handling and/or disposing of UXO (i.e. as related to examining, possessing or transferring of Controlled Goods) or providing oversight/direct supervising of such activities shall have completed the current Controlled Goods training qualification in accordance with DAOD 3003-1 *Management of Controlled Goods* and the Controlled Technology Access and Transfer (CTAT) Office E-Learning Training Program. Details on the CTAT E-Learning program can be found at - [http://admmat.mil.ca/dgiip/ctat/en/training\\_development\\_e.asp](http://admmat.mil.ca/dgiip/ctat/en/training_development_e.asp).

### **SECTION 3 COMMON MILITARY/CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES PROCEDURES/GUIDELINES**

#### **119. GENERAL**

1. Some range clearance/UXO activities, whether conducted by military resources or contracted out, are required to follow common procedures and guidelines due to legislative or other DND/CF policy/regulatory imperatives. These common procedures/guidelines are listed below and are contained in Annexes to this chapter.

#### **120. CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND NUCLEAR (CBRN) UXO/MATERIAL HANDLING PROCEDURES/GUIDELINES**

1. Procedures to be followed if CBRN or suspected CBRN UXO or material is found on any site, regardless of the DND/CF site Category, is contained in Annex C.

#### **121. RANGE/UXO SCRAP HANDLING PROCEDURES/GUIDELINES**

1. The procedure for handling MS, NMS or hard target material that is generated from any range clearance/UXO activity is contained in Annex D. Annex D includes specific detailed procedures for the removal/handling of hard targets and hard target material at Appendix 1 to Annex D, the packaging and transportation of MS at Appendix 2 to Annex D and initial planning information for the preparation of MS for de-militarization in Appendix 3 to Annex D. Detailed information on the preparation of MS for de-militarization will be added once the DAER approved process, procedures, criteria and standards for MS de-militarization are promulgated

**122. SAMPLE GENERIC CLEARANCE DEPTH GUIDELINES TO BE USED FOR PLANNING PURPOSES**

1. Sample generic clearance depth guidelines are provided for range/UXO clearance planning purposes in Annex E. The guidance and samples provided are to be used for planning range/UXO clearances only and are not to be used or quoted as DND/CF approved standards.

INTERIM 12 Apr 2011



## ANNEX A TO CHAPTER 1

### RANGE CLEARANCE/UXO ACTIVITY PUBLICATIONS, DOCUMENTS AND REFERENCES

1. The following publications, documents and references, though not all-inclusive, should be consulted for range clearance/UXO activities:
  - a. *National Defence Act*, R.S.C. 1985, c.N-5, as amended.
  - b. *Explosives Act*, R.S. 1985, c.E-17, as amended.
  - c. *Defence Production Act*, R.S. 1985, c.D-1, as amended.
  - d. *Canadian Environmental Assessment Act*, S.C. 1992, c.37, as amended.
  - e. *Transportation of Dangerous Goods Act*, 1992, c.34, as amended.
  - f. *Transportation of Dangerous Goods Regulations*, SOR/2001-286.
  - g. *Controlled Goods Regulations*, SOR/2001-32.
  - h. *Defence Controlled Access Area Regulations*, SOR/86-957.
  - i. *Export Control List*, SOR/89-202
  - j. A-LM-007-009/AV-000, *Environmental Assessment and Review Process Manual*.
  - k. B-GL-381-001/TS-000, *Operational Training Part 1 — Training Safety*.
  - l. C-02-040-010/BB-004, *Drivers' Manual for Dangerous Goods*.
  - m. C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual - Destruction of Duds and Misfired Ammunition on CF Ranges and Training Areas*.
  - n. C-09-153-001/TS-000, *CF Ammunition and Explosives Safety Manual, Volume 1, Storage and Transportation* is being replaced by a series of manuals as follows:
    - (1) C-09-005-001/TS-000, *Ammunition and Explosives Safety Manual – Volume 1 – Life Cycle Safety*,
    - (2) C-09-005-002/TS-000, *Ammunition and Explosives Safety Manual – Volume 2 – Storage*,
    - (3) C-09-005-003/TS-000, *Ammunition and Explosives Safety Manual – Volume 3 – Transportation*,
    - (4) C-09-005-004/TS-000, *Ammunition and Explosives Safety Manual – Volume 4 – De-militarization and Disposal*,
    - (5) C-09-005-005/TS-000, *Ammunition and Explosives Safety Manual – Volume 5 – Deployed Operations*,
    - (6) C-09-005-006/TS-000, *Ammunition and Explosives Safety Manual – Volume 6 – Naval Vessels*,
    - (7) C-09-005-007/TS-000, *Ammunition and Explosives Safety Manual – Volume 7 – Certification of Ammunition, Explosives and Accessories for Service Use*, and
    - (8) C-09-005-008/TS-000, *Ammunition and Explosives Safety Manual – Volume 8 – Construction Standards*.
  - o. C-09-008-001/FP-000, *Destruction of Surplus, Obsolete and Deteriorated Ammunition*.

- p. C-09-008-003/FP-000, *Ammunition and Explosives Procedural Manual – Explosive Ordnance Disposal - Disposal of Stray Ammunition.*
- q. A-GG-040-006/AG-001, *DND Explosives Safety Program.*
- r. A-GG-040-006/AG-002, *DND Ammunition or Explosives Accidents/Incidents/Defects/ Malfunctions Reporting..*
- s. Range Standing Orders for the range/training area.
- t. DND/CF policy and guidance documents (QR&Os, CFAOs, DAODs, Ammunition and Explosives Instruction (A&EI), NDHQ Instructions, Standards, CANFORGENs, etc.) concerning range clearance/UXO activities, EOD and ammunition as listed below:
  - (1) A&EI 03/07, *Ammunition and Explosives Storage Licenses*
  - (2) A&EI 04, *Transportation of Ammunition and Explosives Recovered during Domestic Operations Change 2;*
  - (3) A&EI 05, *Transportation of Munitions Scrap Change 2;*
  - (4) A&EI 06, *Removal of Hard Targets from CF Ranges and Training Areas Revision 1;*
  - (5) A&EI 07, *Ammunition and Explosives Accident/Incident Investigation and Reporting;*
  - (6) A&EI 08, *Plastic Coated Tape, Explosives Safety Hazard – Electrostatic Discharge;*
  - (7) A&EI 09 *Crimping of Non-Electric Blasting Caps – Procedures and Protective Equipment;*
  - (8) A&EI 11, *Demilitarization;*
  - (9) A&EI 14, *Mitigation of Blast and Fragmentation Effects Utilizing Sandbags;*
  - (10) A&EI 15, *Recognized Civilian Qualifications Applicable to Ammunition and Explosives Employment Change 2;*
  - (11) A&EI 16, *Small Quantities Distance Tables Change 1;*
  - (12) A&EI 17, *Civilian Qualifications Expiry Criteria;*
  - (13) A&EI 21, *Containment Vessel Siting and Storage Instructions;*
  - (14) ADM(IE) Standard 1606-4000.1-S02-020 *Technical Instruction for Unexploded Explosive Ordnance Activities;*
  - (15) ADM(IE) Standard 1606-4000.1-S01-020 *Assignment of Responsibility for Managing Legacy Site Responsibilities;*
  - (16) ADM(IE) Standard 1606-4000.1-S01-023 *The Identification and Communication of Security Requirements for Realty Projects;*
  - (17) ADM(IE) Standard 1606-4000.1-S01-024 *Sustainable Range and Training Area Management;*
  - (18) DAOD 3002-0, *Ammunition and Explosives;*
  - (19) DAOD 3002-1, *Certification of Ammunition and Explosives;*



- (20) DAOD 3002-4, *Ammunition or Explosives Accident, Incident, Defect or Malfunction Reporting*;
- (21) DAOD 3003-0, *Controlled Goods*;
- (22) DAOD 3003-1, *Management of Controlled Goods*;
- (23) DAOD 4000-0, *Infrastructure and Environment Governance* (To be Issued);
- (24) DAOD 4000-1, *Infrastructure and Environment Governance Implementation* (To be Issued);
- (25) DAOD 4003-0, *Environmental Protection and Stewardship*;
- (26) DAOD 4003-2, *Environmental Assessment*
- (27) DAOD 8000-0, *Explosive Ordnance Disposal*;
- (28) DAOD 8000-1, *Explosive Ordnance Disposal Instructions*;
- (29) CANFORGEN 147/09, *Screening of Munitions Scrap*;
- (30) CANFORGEN 106/07, *Civilian Equivalent Qualifications for Contracted Range and UXO Clearance*;
- (31) CANFORGEN 119/99, *Munitions Scrap from Range Clearance*; and
- (32) CANFORGEN 126/10, *DND UXO and Legacy Sites Program*.
- u. Directorate of Strategic Analysis (D Strat A) Policy Guidance: *Procedures for Reporting and Destroying Chemical Weapons Discovered at DND/CF Facilities*.
- v. DAOD 4002-1, *Nuclear Technology Regulation and Control*.
- w. B-GS-138-001/FP-001, *Nuclear Emergency Response*.
- x. Nuclear Safety Orders and Directives (NSODs).
- y. DAOD 6110-0, *Defence Terminology*.
- z. DAOD 6110-1, *Defence Terminology Programme*.
- aa. Defence Terminology Bank.
- bb. A-AD-121-F01/JX-000, *DND/CF Manual of Abbreviations*.
- cc. Project Approval Guide.
- dd. Financial Administration Manual.
- ee. User manuals for the type of weapon or ammunition suspected to have been used on the range.
- ff. US EOD Bulletins on the Identification Guide to Ordnance (for military operations).
- gg. *Federal and Provincial Blasters Handbook* (CIL).
- hh. Canadian Standards Association (CSA) CAN/CSA-Z 275.2-04, *Occupational Safety Code for Diving Operations*.
- ii. Canadian Standards Association (CSA) CAN/CSA-Z 275.4-02, *Competency Standards for Diving Operations*;

- jj. Federal/Provincial/Municipal regulations governing explosives handling, use, storing and transportation, dangerous goods, equipment operation, work place safety, etc. (for contracted clearances).
  - kk. Historical and archival records for the site(s) (as available).
  - ll. Range clearance/UXO activities procedures, SOPs and sample documents are available from the Directorate of Environmental Engineering Management (DEEM) 2 and Directorate of Real Property Management (DRPM 2) - DND UXO and Legacy Sites Program (UXO Legacy Sites Program).
2. Due to the changing nature of explosive safety issues, use only the latest iteration/amendment of the above. A complete list of most current versions can be obtained from Directorate of Real Property Plans 5 - ADM(IE) RTA/UXO Coordinator, Directorate of Ammunition and Explosives Regulation, DEEM 2 or DRPM 2 - UXO Legacy Sites Program.

**ANNEX B TO CHAPTER 1**  
**ANNUL RANGE AND TRAINING AREA UXO REPORT**

<b>Originating ECS/Level 1:</b> _____ (CMS, CLS, CAS, CMP, ADM(Fin CS), ADM(IE), CANSOFCOM)			<b>Reporting Base:</b> _____ (Base, Wing, Installation, ASU)		<b>Reporting Period:</b> _____ (FY – Constant 01 Apr-31 Mar)	
<b>(1) Range/Area:</b> _____ (Name/Designation)		<b>Category:</b> _____ (A-D)		<b>Type:</b> _____ (1-4)	<b>Location:</b> _____ (Map reference/UTM Grids)	
<b>Range Use Details</b>			<b>Range/UXO Clearance Details</b>			<b>Issues/Remarks/Comments</b>
<b>Impact/Target Area</b> (Name)	<b>Ordnance</b> (Type, Name, Lot #)	<b>Rounds Fired</b> (Number)	<b>Locations</b> (UTM Grids)	<b>Level</b> (Surface/ Sub-Surface)	<b>UXO Disposed</b> (Number)	
<b>(1) Range/Area:</b> _____ (Name/Designation)		<b>Category:</b> _____ (A-D)		<b>Type:</b> _____ (1-4)	<b>Location:</b> _____ (Map reference/Grids)	
<b>Range Use Details</b>			<b>Range/UXO Clearance Details</b>			<b>Issues/Remarks/Comments</b>
<b>Impact/Target Area</b> (Name)	<b>Ordnance</b> (Type, Name, Lot #)	<b>Rounds Fired</b> (Number)	<b>Locations</b> (UTM Grids)	<b>Level</b> (Surface/ Sub-Surface)	<b>UXO Disposed</b> (Number)	

**NOTES**

- Repeat for each distinct range/training area controlled by the Reporting Base.



## ANNEX C TO CHAPTER 1

### CBRN OR SUSPECTED CBRN UXO/MATERIAL PROCEDURES

#### 1C01. GENERAL

1. **General.** Over the years, a wide variety of defence explosive ordnance (EO) has been used on current and former DND/CF ranges and training areas (RTAs). Some may have included items containing Chemical, Biological, Radiological or Nuclear (CBRN) material and although every effort has been made in the past to rid current and former RTAs of this material, some may be encountered during range clearance/UXO activities.

#### 1C02. AIM

1. The aim is to outline procedures for the handling and disposal of CBRN/suspected CBRN UXO/material found during range clearance/UXO activities.

#### 1C03. CBRN MATERIAL GUIDANCE

##### 1. Chemical Weapons/UXO

- a. Canada is a signatory to the Chemical Weapons Convention (CWC) that bans the development, production, stockpiling, and use of chemical weapons.
- b. The CWC is administered by the Organisation for the Prohibition of Chemical Weapons (OPCW) located in The Hague, Netherlands. The Canadian Minister of Foreign Affairs, as the Canadian National Authority (CNA) for the CWC, is responsible for the implementation of the CWC in Canada. Within DND, the Directorate of Strategic Analysis (D Strat A) is DND's focal point for administration of the obligations of the CWC, while in Strategic Joint Staff, the Directorate of Arms Control Verification is responsible for ensuring that the OPCW Inspection Team, their assistants and the Requesting State's Observer (if any) are properly escorted at all times while on DND property. Defence Research and Development Centre (DRDC) Suffield is the primary Canadian research, development and training establishment in chemical and biological defence and hosts the Canadian National Single Small Scale Facility (CNSSSF).
- c. Under the CWC, any chemical weapons discovered after Canada's initial declaration in 1997 shall be reported, secured and destroyed in accordance with the CWC provisions. Details on Canada's obligations under the CWC are contained in D Strat A Policy Guidance: *Procedures for Reporting and Destroying Chemical Weapons Discovered at DND/CF Facilities*.

##### **Note**

**Although the title of the D Strat A Policy Guidance is directed toward items "discovered at DND/CF facilities" the provisions and procedures apply equally to items located during range clearance/UXO activities on non-DND/CF facilities/areas**

2. **Biological Weapons/UXO.** Canada is a signatory to the Biological and Toxins Weapons Convention (BTWC). Under the BTWC, Canada is obligated to destroy or divert to peaceful purposes, all biological agents, toxins, weapons, equipment and means of delivery. Unlike the CWC however, the BTWC does not contain compliance and verification mechanisms. Therefore, Canada does not have international obligations to report any discovered BW weapons, only to destroy it as soon as it comes into our possession. However, for the sake of

transparency, DND ( D Strat A) would report it to the Non-Proliferation and Disarmament division at the Department of Foreign Affairs and International Trade (DFAIT).

#### Note

**If can not be determined whether an item is chemical or biological in nature, treat it as a suspected chemical UXO**

3. **Radiological and Nuclear Material/UXO.** Canada deployed nuclear weapon systems between 1963 and 1984. These systems remained in the custody of United States military personnel while deployed in Canada. All the nuclear weapons were withdrawn from Canada, with the exception of a few BOMARC training missile bodies remaining as historical displays. There should be no concern for radiological/nuclear suspected weapons on current or former DND/CF facilities/areas. DND/CF direction and guidance on radiological/nuclear material handling and reporting comes from the Director General Nuclear Safety (DGNS) and is contained in DAOD 4002-1, *Nuclear Technology Regulation and Control*, B-GS-138-001/FP-001, *Nuclear Emergency Response* and Nuclear Safety Orders and Directives (NSODs).

#### 1C04. QUALIFICATIONS

1. Only appropriately qualified designated DND/CF personnel shall handle and/or destroy CBRN/suspected CBRN UXO material found during range clearance/UXO activities. As with any UXO related activity, the number of personnel within a danger/exclusion zone should always be the minimum required to conduct the task safely.

#### 1C05. PROCEDURES FOR CHEMICAL/BIOLOGICAL UXO

2. **General.** The outline procedures shall be followed unless specifically amended by the appropriate authority.

3. **Chemical/Biological Conventions Obligations.**

- a. **CWC.** A summary of obligations for reporting, recovering, storage and destruction of discovered items under the CWC is contained in the D Strat A Policy Guidance.
- b. **BTWC.** A summary of obligations for reporting, recovering, storage and destruction of discovered items under the BTWC is available from D Strat A.

4. **Generic Procedures.** Upon discovery of any chemical or biological/suspected chemical or biological UXO item during a range clearance/UXO activity, the DND/CF Site Authority shall:

- a. submit an initial report in accordance with reporting criteria below;
- b. **NOT** initiate destruction operations until advised by D Strat A:
  - (1) That the proposed destruction operation and methodology have been approved; and
  - (2) whether or not on-site verification will take place;

#### Note

**If an item is judged to pose an EXTREME HAZARD TO OPERATIONS in accordance with the Assessment Criteria provided below, the DND/CF Site Commander/Project Authority may destroy it as soon as operationally feasible without prior approval**

- c. provide updates as more information becomes available, and provide pictures and/or video to properly document the situation;
- d. secure the item, in the event of an onsite verification mission by the OPCW, by moving it, if safe to move (STM), to a secure storage location at the facility pending arrival of the Inspection Team or, if not STM, secure it in accordance with facility procedures at the site where the item was discovered; and

**Note**

**For items located during range clearance/UXO activities on non-DND/CF facilities/areas, CF EOD procedures in C-09-008-003/FP-000 *Ammunition and Explosives Procedures Manual EOD – Disposal of Stray Ammunition* for securing the item shall be followed**

- e. submit, upon completion of the destruction operation, after-action reports in accordance with reporting criteria below.
5. **Reporting.** As the CWC has the most stringent reporting regime, the reports from the D Strat A Policy Guidance for CW Discovered at DND/CF Facilities will be used as the template for chemical or biological UXO/material.
- a. **Initial Report.** Upon discovery of any chemical or biological /suspected chemical or biological UXO, the DND/CF facility commander/DND/CF UXO Project Authority shall immediately submit an Initial Report as per the sample format below by electronic mail and must follow up by a person-to-person telephone contact to the action addressees contained in the D Strat A Policy Guidance for CW Discovered at DND/CF Facilities.

**Note**

**E-Mail addresses may change over time. D Strat A will issue a letter annually (and when changes warrant it) with updated contact information for the purpose of reporting discovered CW/BW. Planners of range clearance/UXO activities where there is a possibility of encountering chemical or biological material should confirm with D Strat A that they are in possession of the most current contact information.**

- (1) **Chemical Weapon/UXO Sample Format.** A sample format for a chemical weapon/UXO Initial Report is contained in Figure 1C-1 below.

**Note: To be sent via e-mail. Current e-mail addresses will be promulgated annually by D Strat A**

TO: D Strat A Chemical Weapons Analyst  
SJS ACV

CC: CFICC  
DFAIT -National Authority for the Chemical Weapons Convention  
BCDRC XO

SUBJECT: DISCOVERY OF A CHEMICAL WEAPON(S) AT {Identify DND/CF Facility or Legacy Site (as appropriate)} – INITIAL REPORT

DATE: (DAY / MONTH / YEAR)

SENDING UNIT: (SENDING UNIT)

1. Type of discovery: {SUSPECTED / CONFIRMED (select appropriate if known)}

## CHEMICAL WEAPON

### 2. Detailed information:

- a. type of item (container, munitions or equipment), original purpose, probable date of manufacture
- b. condition of item
- c. presence / absence of explosive or energetic substances
- d. suspected chemical warfare agent fill (if any)
- e. location of discovery, including geographic coordinates if available
- f. date and time of discovery
- g. if item has been moved, where it is being stored; if item cannot be moved, how it is being secured
- h. hazard assessment (NO HAZARD / HAZARDOUS / EXTREME HAZARD) and justification for assessment
- i. proposed destruction methodology (DELIBERATE / EMERGENCY)
- k. detailed description of destruction methodology
- l. facility point of contact:
  - (i) Name / Title
  - (ii) Telephone number
  - (iii) Facsimile number
  - (iv) E-mail address

### 3. Remarks: (if any)

**Figure 1C-1: Sample Chemical Weapon/UXO Initial Report Format**

- (2) **Biological Weapon/UXO Sample Format.** The biological weapon/UXO Initial Report format is the same as a chemical weapon/UXO Initial Report (Figure 1C-1) with different addressees and references to chemical weapons replaced by biological weapons. Figure 1C-2 contains a sample format.

**Note: To be sent via e-mail. Current e-mail addresses will be promulgated annually by D Strat A**

TO: DAPC D Strat A Biological Weapons Analyst  
SJS ACV

CC: CFICC  
BCDRC XO

SUBJECT: DISCOVERY OF A BIOLOGICAL WEAPON(S) AT *{Identify DND/CF Facility or Legacy Site (select as appropriate)}* – INITIAL REPORT

DATE: (DAY / MONTH / YEAR)



SENDING UNIT:	(SENDING UNIT)
1.	Type of discovery: BIOLOGICAL WEAPON
2.	Detailed information: <i>{as per Chemical Weapon/UXO Initial Report (Fig 1C-1) with references to chemical weapons replaced by biological weapons}</i>
3.	Remarks:

**Figure 1C-2: Sample Biological Weapon/UXO Initial Report Format**

- b. **After Action Report.** All reports shall be assigned an appropriate security classification.
- (1) **Immediate After-Action Report.** As soon as the destruction operation is complete, an Immediate After-Action Report must be forwarded to the same addressees as the Initial Reports:
    - (a) that updates or amends (if necessary) the Initial Report,
    - (b) indicates that the destruction operation is complete,
    - (c) advises of any variance from the proposed/approved destruction methodology, and
    - (d) advises whether any chemical/biological warfare agent was detected; and
  - (2) **Final After-Action Report.** In the interest of transparency, a detailed Final After-Action Report incorporating high-quality photographic and videotaped records of all destruction operations with two copies of all hard copy reports, photographs and videotapes must be forwarded to same addressees as the Initial Reports within 30 days of completion of a destruction operation. The Final Report highlights and updates or amends (if necessary) the information contained in the Initial Report and the Immediate After-Action Report. It also includes:
    - (a) confirmation (by analytical or field expedient means) of the contents, if any, of any container or munitions destroyed, and
    - (b) a copy of all relevant facility documentation concerning the destruction operation, including still photographs of the item before and after the operation.
- c. **Additional Reports and Actions.** The reports required by this Annex do not obviate the need for additional reports and action if the circumstances of the incident so warrant. These may include, but are not limited to: CF EOD PRELREP reporting; DND/CF UXO/Ammunition/Explosives Accident/Incident reporting; Labour Canada, Natural Resources Canada (NRCan) reporting; Coroners Inquest, civilian police, insurance and/or other provincial/municipal reporting requirements.
6. **Hazard Assessment.** An assessment of the risk posed by the discovered chemical or biological/suspected chemical or biological UXO item shall be completed in accordance with the criteria given below. This assessment will also be used to determine whether destruction must be done immediately or it has to wait for official approval.
- a. **Hazard Assessment Criteria**

- (1) **NO HAZARD TO OPERATIONS.** Any container or munitions that is suspected of containing, or known to contain, a chemical or biological warfare agent, is not leaking, and is verifiably free of explosives and energetic material, will normally be judged to pose NO HAZARD TO OPERATIONS. Any chemical or biological munitions that is verifiably empty both of chemical or biological warfare agent and of explosives or energetic material, and any non-munitions equipment meeting the definition of a chemical/biological munitions, would normally fall into this category;
  - (2) **HAZARD TO OPERATIONS.** Any container or munitions that is suspected of containing, or known to contain, a chemical or biological agent, and is either leaking chemical or biological agent **OR** is suspected of containing, or is known to contain, explosives or energetic material, would normally be judged to pose a HAZARD TO OPERATIONS; or
  - (3) **EXTREME HAZARD TO OPERATIONS.** Any container or munitions that is judged to pose a HAZARD TO OPERATIONS that is discovered in close proximity to active DND/CF facilities or buildings, civilian property, or ongoing training or operations, and must be destroyed without delay in order to protect military or civilian personnel or the public, would normally be judged to pose an EXTREME HAZARD TO OPERATIONS.
- b. **Hazard Assessment Status Changes.** If for any reason the facility decides to alter the Hazard Assessment status of the item after submission of the initial report, DAPC Pol is to be notified immediately, with justification provided for the change. Examples of a change in status could include:
- (1) NO HAZARD upgraded to HAZARD (e.g. if a previously stable munitions, stored pending deliberate destruction, began leaking);
  - (2) HAZARD downgraded to NO HAZARD (e.g. if a munitions thought to contain explosives was subsequently found to be free of explosives); or
  - (3) HAZARD upgraded to EXTREME HAZARD (e.g. if a previously stable and unmovable chemical munitions discovered close to troops or facilities was determined to be leaking).

**Note**

**No provision is made for downgrading items from EXTREME HAZARD to HAZARD, as it is assumed that any item posing an EXTREME HAZARD would be destroyed as soon as operationally feasible**

- c. **Emergency Criteria.** If an item is judged to pose an EXTREME HAZARD TO OPERATIONS, the DND/CF Site Commander/Project Authority may destroy it as soon as operationally feasible, if necessary without prior approval from the OPCW for chemical weapons/UXO and from the Non-Proliferation and Disarmament division of DFAIT for biological weapons/UXO. In such circumstances, it is imperative that Initial Report addressees be informed as soon as possible that an emergency destruction operation is underway. The information required in the Initial Report must be provided as soon as possible, along with justification for the decision to designate the item an EXTREME HAZARD. Upon completion of the destruction operation, after-action reports must be submitted.

7. **Chemical/Biological Destruction Operations.** Only approved DND/CF destruction procedures shall be used. The destruction operations will normally be either:
- a. **Deliberate Destruction.** Deliberate destruction entails the draining and neutralization of any chemical/biological warfare agent under controlled conditions, followed by decontamination and destruction of the container in accordance with approved deliberate destruction procedures can be done. In all cases care should be taken to reduce the risk of contamination of the surrounding areas. Use of engineered controls/protective enclosures should be considered to reduce the fragmentation or the spreading the agents/material during destruction. Any item judged to pose NO HAZARD to operations will normally be subject to deliberate destruction; or
  - b. **Emergency Destruction.** Emergency destruction entails the destruction under controlled field conditions of the item in accordance with approved emergency destruction procedures. Any item judged to pose either a HAZARD or an EXTREME HAZARD TO OPERATIONS will normally be subject to emergency destruction.
8. **Collecting Chemical/Biological Agent Samples**
- a. **Chemical Weapons/UXO.** For chemical weapons/UXO, samples containing Schedule 1 chemicals can be withdrawn for activities not prohibited under the CWC from any container or munitions that is judged to pose NO HAZARD TO OPERATIONS or that is judged to pose a HAZARD TO OPERATIONS if DRDC Suffield judges that it can be done safely. The samples may only be transferred to the CNSSSF with prior authorization from the CNA.
  - b. **Biological Weapons/UXO.** For biological weapons/UXO, if approved by the Non-Proliferation and Disarmament division of DFAIT, samples may be withdrawn for activities not prohibited under the BTWC or other international agreements from any container or munitions that is judged to pose NO HAZARD TO OPERATIONS or that is judged to pose a HAZARD TO OPERATIONS if DRDC Suffield judges that it can be done safely. The samples may only be transferred to the location approved by the Non-Proliferation and Disarmament division of DFAIT.

## 1C06. PROCEDURES FOR RADIOLOGICAL/NUCLEAR MATERIAL

- 1. **General.** The outline procedures shall be followed unless specifically amended by the appropriate authority.
- 2. **Generic Procedures.** Upon discovery of any radiological or nuclear/suspected radiological or nuclear material during a range clearance/UXO activity, the DND/CF Site Authority shall:
  - a. submit an initial report in accordance with reporting criteria below;
  - b. **NOT** initiate destruction operations until advised by DGNS:
    - (1) that the proposed destruction operation and methodology have been approved, and
    - (2) whether or not on-site verification will take place;

### Note

**If an item is judged to pose an EXTREME HAZARD TO OPERATIONS in accordance with the Assessment Criteria below, the DND/CF Site Commander/Project Authority may destroy it as soon as operationally feasible without prior approval**

- c. provide updates as more information becomes available, and provide pictures and/or video to properly document the situation;
- d. secure the item, in the event of an onsite verification mission, by moving it, if safe to move (STM), to a secure storage location at the facility pending arrival of the Inspection Team or, if not STM, secure it in accordance with facility procedures at the site where the item was discovered; and

**Note**

**For items located during range clearance/UXO activities on non-DND/CF facilities/areas, CF EOD procedures in C-09-008-003/FP-000 *Ammunition and Explosives Procedures Manual EOD – Disposal of Stray Ammunition* for securing the item shall be followed**

- e. submit, upon completion of the destruction operation, after-action reports in accordance with reporting criteria below.
3. **Reporting.** As the CWC has the most stringent reporting regime, its reports will be used as the template for all other CBRN material.
- a. **Initial Report.** Upon discovery of any radiological or nuclear /suspected radiological or nuclear UXO, the DND/CF facility commander/DND/CF UXO Project Authority shall immediately submit an Initial Report as per the sample format below by electronic mail (or if necessary, by facsimile) and must follow up by a person-to-person telephone contact to the action addressees.

**Note**

**E-Mail addresses may change over time. Planners of range clearance/UXO activities where there is a possibility of encountering radiological or nuclear material should confirm with DGNS for the most current format and addressees to be used prior to commencing work. When in doubt contact the CFICC**

- (1) **Radiological/Nuclear Material Sample Format.** If radiological/nuclear material is discovered, it shall be reported to CFICC and DGNS. CFICC and DGNS will notify other agencies as required. The format for a radiological/nuclear material Initial Report is the same as the chemical or biological weapon/UXO Initial Report (Figures 1C-1 and 1C-2) with different addressees and references to chemical or biological weapons replaced by radiological/nuclear (as appropriate and if known) material(s). A sample format is contained in Figure 1C-3.

TO:	CFICC
CC:	DGNS D Strat A SJS ACV
SUBJECT:	DISCOVERY OF RADIOLOGICAL/NUCLEUR MATERIAL(S) AT {Identify DND/CF Facility or Legacy Site (select as appropriate)} – INITIAL REPORT
DATE:	(DAY / MONTH / YEAR)
SENDING UNIT:	(SENDING UNIT)

1. Type of discovery: {*SUSPECTED / CONFIRMED (select appropriate if known)*}  
RADIOLOGICAL/NUCLEAR MATERIAL
2. Detailed information: {*as per Chemical/Biological Weapon/UXO Initial Report (Fig 1C-1 and 1C1-2) with references to chemical/biological replaced by radiological/nuclear material*}
3. Remarks:

**Figure 1C-3: Sample Radiological/Nuclear Material Initial Report Format**

- b. **After Action Report.** All reports shall be assigned an appropriate security classification.
  - (1) **Immediate After-Action Report.** As soon as the destruction operation is complete, an Immediate After-Action Report must be forwarded to the same addressees as the Initial Reports:
    - (a) that updates or amends (if necessary) the Initial Report,
    - (b) indicates that the destruction operation is complete,
    - (c) advises of any variance from the proposed/approved destruction methodology, and
    - (d) advises whether any radiological or nuclear material was detected; and
  - (2) **Final After-Action Report.** In the interest of transparency, a detailed Final After-Action Report incorporating high-quality photographic and videotaped records of all destruction operations with two copies of all hard copy reports, photographs and videotapes must be forwarded to same addressees as the Initial Reports within 30 days of completion of a destruction operation. The Final Report highlights and updates or amends (if necessary) the information contained in the Initial Report and the Immediate After-Action Report. It also includes:
    - (a) confirmation (by analytical or field expedient means) of the contents, if any, of any container or munitions destroyed, and
    - (b) a copy of all relevant facility documentation concerning the destruction operation, including still photographs of the item before and after the operation.
- c. **Additional Reports and Actions.** The reports required by this Annex do not obviate the need for additional reports and action if the circumstances of the incident so warrant. These may include, but are not limited to: CF EOD PRELREP reporting; DND/CF UXO/Ammunition/Explosives Accident/Incident reporting; Labour Canada, NRCan reporting; Coroners Inquest, civilian police, insurance and/or other provincial/municipal reporting requirements.
4. **Hazard Assessment.** An assessment of the risk posed by the discovered radiological or nuclear /suspected radiological or nuclear material shall be completed in accordance with the criteria given below. This assessment will also be used to determine whether destruction must be done immediately or it can wait for DGNS approval.
  - a. **Hazard Assessment Criteria**
    - (1) **NO HAZARD TO OPERATIONS.** Any container or munitions that is suspected of containing, or known to contain, radiological or nuclear

material, is not leaking, and is verifiably free of explosives and energetic material, will normally be judged to pose NO HAZARD TO OPERATIONS. Any radiological or nuclear munitions that is verifiably empty both of radiological or nuclear material and of explosives or energetic material, and any non-munitions equipment meeting the definition of a radiological or nuclear munitions, would normally fall into this category;

- (2) **HAZARD TO OPERATIONS.** Any container or munitions that is suspected of containing, or known to contain, radiological or nuclear material, and is either leaking radiological or nuclear material **OR** is suspected of containing, or is known to contain, explosives or energetic material, would normally be judged to pose a HAZARD TO OPERATIONS; or
  - (3) **EXTREME HAZARD TO OPERATIONS.** Any container or munitions that is judged to pose a HAZARD TO OPERATIONS that is discovered in close proximity to active DND/CF facilities or buildings, civilian property, or ongoing training or operations, and must be destroyed without delay in order to protect military or civilian personnel or the public, would normally be judged to pose an EXTREME HAZARD TO OPERATIONS.
- b. **Hazard Assessment Status Changes.** If for any reason the facility decides to alter the Hazard Assessment status of the item after submission of the initial report, DGNS is to be notified immediately, with justification provided for the change. Examples of a change in status could include:
- (1) NO HAZARD upgraded to HAZARD (e.g. if a previously stable munitions, stored pending deliberate destruction, began leaking);
  - (2) HAZARD downgraded to NO HAZARD (e.g. if a munitions thought to contain explosives was subsequently found to be free of explosives); or
  - (3) HAZARD upgraded to EXTREME HAZARD (e.g. if a previously stable and unmovable chemical munitions discovered close to troops or facilities was determined to be leaking).

**Note**

**No provision is made for downgrading items from EXTREME HAZARD to HAZARD, as it is assumed that any item posing an EXTREME HAZARD would be destroyed as soon as operationally feasible**

- c. **Emergency Criteria.** If an item is judged to pose an EXTREME HAZARD TO OPERATIONS, the DND/CF Site Commander/Project Authority may destroy it as soon as operationally feasible, if necessary without prior approval from DGNS. In such circumstances, it is imperative that Initial Report addressees be informed as soon as possible that an emergency destruction operation is underway. The information required in the Initial Report must be provided as soon as possible, along with justification for the decision to designate the item an EXTREME HAZARD. Upon completion of the destruction operation, after-action reports must be submitted.

5. **Radiological/Nuclear Material Destruction Operations.** Only approved DND/CF destruction procedures shall be used. The destruction operations will normally be either:

- a. **Deliberate Destruction.** Radiological/nuclear material should be removed under controlled conditions before the destruction of the container. In all cases care should be taken to reduce the risk of contamination of the surrounding areas. Use of engineered controls/protective enclosures should be considered to reduce the fragmentation or the spreading the agents/material during destruction. Any item judged to pose NO HAZARD to operations will normally be subject to deliberate destruction; or
  - b. **Emergency Destruction.** Emergency destruction entails the destruction under controlled field conditions of the item in accordance with approved emergency destruction procedures. Any item judged to pose either a HAZARD or an EXTREME HAZARD TO OPERATIONS will normally be subject to emergency destruction.
6. **Collecting Radiological/Nuclear Material Samples.** For radiological/nuclear material, if approved by DGNS, samples may be withdrawn for activities not prohibited under international agreements from any container or munitions that is judged to pose NO HAZARD TO OPERATIONS or that is judged to pose a HAZARD TO OPERATIONS if DGNS judges that it can be done safely. The samples may only be transferred to the location approved by DGNS.

#### 1C07. PROCEDURES FOR CONVENTIONAL UXO

1. **Conventional UXO Destruction.** Any conventional UXO/suspected UXO shall only be disposed of according to standard operating procedures only once it has been identified that no chemical/biological agent or radiological/nuclear material is present. If, at any time during the course of handling or destroying the item it is suspected of containing a chemical/biological agent or radiological/nuclear material, one of following two courses of action shall be followed:
- a. **Suspend Destruction Operation.** If the destruction operation supervisor judges it safe to do so, the destruction operation shall be suspended and the item(s) secured. The procedure described for initial discovery shall be followed, pending receipt of approval from the appropriate authority as follows:
    - (1) **Chemical Weapons/UXO.** OPCW (through D Strat A) for destruction or an indication of the intentions concerning on-site verification,
    - (2) **Biological Weapons/UXO.** The Non-Proliferation and Disarmament division of DFAIT (through D Strat A) for destruction or an indication of intentions concerning on-site verification, or
    - (3) **Radiological/Nuclear Material.** DGNS for destruction or an indication of intentions concerning on-site verification.
  - b. **Continue Destruction Operation.** If the destruction operation supervisor judges it unsafe to suspend the destruction operation, the procedure described at Emergency Criteria shall be followed and the munitions destroyed according to approved emergency destruction procedures. Upon completion of the destruction operation, the facility will submit after-action reports.





## ANNEX D TO CHAPTER 1

### RANGE/UXO SCRAP HANDLING PROCEDURES

#### 1D01. GENERAL

1. Scrap found during range clearance/UXO activities consists of munitions scrap (MS), non-munitions scrap (NMS) and hard targets/hard target material. In order to reduce the risk to other range clearance/UXO activities workers and to ensure public safety, proper procedures for handling, screening, storing, transporting and accounting for these items is essential.

#### Note

**UXO/suspected UXO shall be handled separate from scrap material**

#### 1D02. AIM

1. The aim is to provide guidelines and procedures for the handling, screening, storage, transportation, disposal and accounting for MS, NMS and hard target material resulting from range clearance/UXO activities using military or contracted resources.

#### 1D03. GUIDELINES

1. **General.** The handling, screening, storage, transportation, disposal and accounting for MS, NMS and hard target material occur amongst many of the levels or teams during a range clearance/UXO activity. The normal activities would include the following parts:

- a. **Work Initiation/Start-Up.** This is a common element conducted prior to the commencement of any other range clearance/UXO activity and shall be conducted daily to ensure a safe and effective work environment.
- b. **Scrap Collection.** Scrap collected during range clearance UXO activities must be kept separate from each other by type and be clearly identified. Scrap collection containers are used to collect scrap and to temporarily store it:
  - (1) **Level One Scrap Collection Containers.** Level One MS and NMS collection containers must be kept separate from each other and shall be clearly identified as to their contents. Hard target material, if small enough, may be collected with MS. Large items will be collected separately. The containers should also permit visual examination of items without dumping the contents. A plastic pail is ideal for this purpose as the container is easy to carry and load, contents can be easily seen and emptied, and they are economical and reusable.
  - (2) **Scrap Collection Area(s) Containers.** Areas where scrap is to be sorted before removal from a site for further screening, storage or disposal will require large metal storage containers. MS, NMS and hard target material (if collected separately from MS) containers must be kept separate from each other and shall be clearly identified as to their contents. These containers must be secured to prevent the mixing of unscreened scrap and reduce the risk of explosive hazards being inadvertently added. Containers storing MS must comply with the appropriate explosives content directions specified in the Scrap Storage paragraph below.

- c. **Scrap Screening.** Proper screening of MS, NMS and hard target material is essential to ensure UXO are not unnecessarily handled and to minimize exposure of personnel to explosive hazards. The screening of material found during range/UXO clearance activities is normally conducted at three levels ranging from initial screening on finding an item to screening at an intermediary point through to final screening prior to long-term storage or further de-militarization processing and subsequent disposal. These three levels normally equate to at least three different persons visually inspecting each item. The requirement for three separate visual inspections of each item may be reduced to two levels/inspections (i.e. Level Two and Level Three) for stock piles of scrap if the reduction in the number of inspections does not jeopardize the safety of workers or reduce the confidence in the subsequent level of risk from the scrap. All MS that is fuzed or cannot be visually inspected or physically probed to confirm the contents as empty or safe, shall be treated as suspected UXO and be perforated in two locations (intentionally directed to attack both the initiation system and main filling) prior to proceeding to Level Two screening. Only approved procedures and accounting processes in accordance with this Annex shall be used.
- d. **Scrap Storage.** Storage of any MS, NMS, hard target material and suspected UXO items which are safe to move (STM) found during range clearance/UXO activities shall be in accordance with DND (on DND sites) or Natural Resources Canada (NRCAN) (on Legacy sites) regulations. It is important that different natures of items as well as those at different levels of screening be stored in separate securable approved sites/containers to ensure safety and accountability of the items. UXO which is STM and MS not screened to Level Three shall be stored in appropriately licensed storage areas/containers to a Maximum Credible Event of 10 kg (MCE). MS screened to Level Three does not require storage in a licensed area/container but must be stored in a secured area which ensures that no items may be added to the screened MS. Hard target material containing explosive residue or not screened to Level Three in accordance with Appendix 1 shall be stored as per MS that has not been Level Three screened. Hard target material that has been Level Three screened in accordance with Appendix 1, is to be stored as per but separate from MS that has been Level Three screened.

**Note**

**On DND sites either DND or NRCAN regulations can be invoked**

- e. **Scrap Transportation.** The following shall apply for the transportation of MS, NMS and hard target material:

**Note**

**UXO/suspected UXO shall be transported separate from scrap material**

- (1) **Range/UXO Site.** Care must be taken to ensure only inert material is loaded onto clearly identified transport vehicles. MS, NMS and hard target material should, if practicable, be transported in separate vehicles.
- (a) **MS Vehicle.** MS vehicles should have restricted access to the cargo/scrap area (e.g. covered by vehicle tarp) to allow controlled loading from the rear. MS identified on site will be removed to the MS vehicle after a Level Two screening is completed prior to loading. When full or the task is completed, the MS vehicle will be

dispatched on an uninterrupted trip to the secure MS off-loading point for Level Three screening.

- (b) **NMS Vehicle.** The vehicle may be loaded once the appropriate level of screening is completed and, when full or the task is completed, the screened NMS may proceed to an approved scrap disposal site.
  - (c) **Hard Target Material Vehicle (if separate from MS).** The vehicle can be loaded after each appropriate level of screening given in Appendix 1. Until Level Three screening has been completed, the same provisions for the MS vehicle will apply.
  - (d) **Single Scrap Vehicle.** When impractical to have separate vehicles, a single vehicle may be used. However, it is imperative the vehicle contain separate, clearly identified containers for MS, NMS and hard target material. All scrap shall again be screened and divided into appropriate MS and NMS categories in the secure scrap off loading point.
- (2) **Off Work Site/Public Roads.** The following shall apply for the transportation of MS, NMS and hard target material off the range clearance /UXO activity work site and on public roads:
- (a) **MS.** MS shall be Level Three screened and certified safe transportation on public roads prior to transportation in accordance with the direction in Appendix 2.
  - (b) **NMS.** Once all appropriate levels of screening are completed, the NMS may be transported in any vehicle suitable for the load.
  - (c) **Hard Target Material.** Once all appropriate levels of screening are completed in accordance with Appendix 1, the hard target material is deemed to be de-militarized and may be transported in any vehicle capable of carrying the load.
- f. **Scrap Disposal.** The following shall apply for the transportation of MS, NMS and hard target material:

#### Note

**UXO/suspected UXO shall be disposed of separate from MS, NMS and hard target material as detailed in UXO handling procedures. Only DND/CF EOD personnel are authorized to transport suspected live EO/UXO on public roads in accordance with A&EI 04 Change 1 *Transportation of Ammunition and Explosives Recovered during Domestic Explosive Ordnance Disposal Operations***

- (1) **MS.** MS shall not be buried nor placed in pits on the RTA/site. MS that has not undergone a DAER approved de-militarization process must be stored at an approved DND/CF MS storage facility pending a final DAER approved de-militarization process. MS compounds will be clearly signed and access to stored MS must be controlled so that the collected MS remains completely free of explosive hazards and prevents the inadvertent addition of UXO. The moratorium in CANFORGEN 119/99 *Munitions Scrap from Range Clearance* on the disposal of MS through commercial means remains in effect unless MS has been certified as meeting the DAER approved process, procedures, criteria and standards

for MS de-militarization. Information for the planning for preparations for MS de-militarization is contained in Appendix 3.

- (2) **NMS.** Once all appropriate levels of screening are completed, the NMS may proceed to an appropriate commercial waste disposal site in accordance with established federal, provincial or municipal guidelines/regulations for waste disposal.
- (3) **Hard Target Material.** Once the hard target material has been processed and documented in accordance with the criteria set out in Appendix 1, it is deemed to be de-militarized and may be disposed through commercial means in accordance with Appendix 1.
- g. **Quality Control/Quality Assurance (QC/QA).** It is essential that the contractor's QC Plan and the project QA include the appropriate checks after and during each screening level.
- h. **Accountability/Tracking.** In order to maximize the safety and reliability of the range clearance/UXO activity process, an auditable accounting trail shall be enforced from the UXO grid/cell location through to the final disposal of the items. Each level and transfer point along the chain of custody shall be identified using the appropriate documentation and sign-off procedures. Documentation based on the sample UXO Identification, Scrap Accounting/Tracking, Scrap Chain of Custody and Daily Diary forms, in hard/paper and/or electronic/PDA formats, provided in Annex F to Chapter 3 may be used. Specific direction as to the level, type and frequency of accounting/tracking is provided in the Operations Order (for military) or SOW/SOR (for contracted work).

2. **Safety.** Every effort shall be made to prevent accidents or incidents involving UXO. Safety considerations shall include those required for the designated military and contracted civilian UXO personnel to dispose of the UXO as well as those required to ensure the safety of the public and property. Aside from normal work place safety requirements and those detailed in A&EI 07 *Accident/Incident Investigation and Reporting* for military operations and A&EI 07, Annex D to Chapter 3 and the SOW/SOR for contracted UXO activities, specific UXO safety measures related to UXO disposal for the following locations shall be used as additional safety guidance for contracted UXO disposal activities:

- a. **DND/CF Sites.** RTA Standing Orders and C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas*; and
- b. **Outside DND/CF Sites.** Local/Provincial/Federal explosive/workplace safety regulations, Annex F to Chapter 3 and C-09-008-003/FP-000, *Ammunition and Explosives Procedural Manual – Explosive Ordnance Disposal – Disposal of Stray Ammunition*.

3. **Explosives Related Accident/Incident Reporting/Investigation.** The reporting and investigation of any explosives related accident or incident during any UXO disposal activity shall be reported in accordance with A&EI 07, A-GG-040-006/AG-002 *DND Ammunition or Explosives Accident/Incident/Defect/Malfunction Reporting* and Annex D to Chapter 3 (for contracted UXO work only).

4. **Security.** Strict security precautions are to be taken to ensure the safe handling and custody of all ammunition, explosives, UXO or associated scrap, both in transit and storage. For range clearance/UXO activities on DND sites, whether by military or contracted means, all

pertinent DND/CF regulations are to be applied. For contracted UXO activities on legacy sites, NRCan regulations and licensing requirements will pertain for storage of UXO and explosives. UXO and MS, being military ammunition, fall under Group 2 of the Controlled Goods provisions of the *Defence Production Act* (R.S. 1985, c.D-1). As such, the Project Authority must ensure that the appropriate security considerations are annotated in the Security Clearance Checklist (SRCL) prior release of the Request for Proposal. The contractor **shall not** handle or move UXO/suspected UXO unless exempted under ADM(IE) Standard 1606-4000.1-S01-023 *The Identification and Communication of Security Requirements for Realty Projects* paragraph 1.6 and directed in the SOW/SOR.

5. **Work Plan and SOPs.** These guidelines and procedures are to form the basis for the operation SOPs (for military activities) and be included in the contractor's Work Plan and SOPs (for contracted work). They are to be amplified as necessary to meet local requirements.

#### 1D04. PERSONNEL

1. **General.** As indicated above, the handling, screening, storage, transportation, disposal and accounting for MS, NMS and hard target material can occur during varying times and work activities depending on the nature and conditions of the site. As with any UXO related activity, the number of personnel within a danger/exclusion zone should always be the minimum required to conduct the task safely.

2. **Qualifications.** At each level and phase of the procedure, only those personnel meeting the UXO qualifications contained in Annex A to Chapter 2 (for military operations) or in Annex A to Chapter 3 (for contracted work), shall fill the positions involved in the procedures described here.

3. **Team Composition.** Team compositions for military operations are contained in Chapter 2 Annex A. The organization of the contractor's teams will depend on the planned methodology. Some personnel may be employed in more than one position provided they have suitably qualifications/experience and completion of the work in a safety and effective manner is not jeopardized. Documentation to support such compliance may be provided in the detailed proposal documents. As a minimum, the team should comprise of the following capabilities:

- a. **Site Management.** Aside from the management requirements for the MS screening activity and equipment/technologies being used, a senior UXO leader qualified appropriately for the task must be present.
- b. **Work Site/Activity Supervision.** Appropriate supervision of the MS screening activity and equipment/technologies must be in place. Sufficient UXO Technician Supervisors (UXOTs) will be required commensurate with the site layout/Work Plan activities, number of UXO Technicians (UXO TECHs)/UXO Assistants (UXOAs) employed and the span of control.
- c. **Work Site/Activity Safety.** Sufficient appropriately qualified safety supervision/monitoring personnel shall be used to ensure all safety aspects are adhered to. This includes providing a UXO Safety Officer (UXOSO) capability as well as other safety related issues.
- d. **Work Site/Activity Quality Control (QC).** Appropriate QC of the MS screening activity and equipment/technologies must be in place. A UXO Quality Control Specialist (UXOQCS) capability will be required.
- e. **Work Activities**

- (1) **Equipment Operation.** Only personnel duly trained and qualified to operate specific equipment shall be employed on that equipment.
- (2) **MS Screening/Inspections.** Screening shall be done only by UXO qualified personnel and be done as proscribed in this Annex.
- (3) **Other Activities.** All other activities shall be manned with personnel with qualifications commensurate with their role/task.

**Note**

**No person not UXO qualified shall touch, handle, or move UXO/suspected UXO. No Person shall handle MS without having UXO qualified personnel present**

**1D05. PROCEDURES**

1. **General.** The following procedures shall be followed unless specifically amended by the appropriate authority:

- a. **Work Initiation/Start-Up Procedures.** These common procedures are outlined in Steps 1 through 4 below.
- b. **MS Procedures.** Procedures for handling, screening, storage, transportation, disposal and accounting for MS are outlined in Steps 5 through 23 as follows:
  - (1) **Level One Screening.** The initial screening level occurs where the item is found. Procedures are provided in Steps 5 through 9. All MS that is fuzed or cannot be 100% visually inspected or physically probed to confirm the contents as empty or safe, shall be treated as suspected UXO and be destroyed in situ or perforated in two locations (intentionally directed attack both the initiation system and main filling) prior to proceeding to Level Two screening.
  - (2) **Level Two Screening.** The second screening level occurs at an intermediary point before being loaded on the scrap vehicle(s) and prior to proceeding to Level Three. Procedures are provided in Steps 10 through 15.
  - (3) **Level Three Screening.** The third screening level occurs prior to being sent for long-term storage or being subjected to any further de-militarization process and final disposal. Procedures are provided in Steps 16 through 23.

**Note**

**These three levels normally equate to at least three different persons visually inspecting each item**

- c. **NMS Procedures.** Procedures for handling, screening, storage, transportation, disposal and accounting for NMS are outlined in Steps 5 through 23.
- d. **Hard Target Procedures.** Procedures for handling, screening, storage, transportation, disposal and accounting for hard target material are contained in Appendix 1 and are outlined in Steps 5 through 23.
- e. **UXO Handling Procedures.** Procedures for handling, storage, transportation, disposal and accounting for/tracking UXO/suspected UXO are detailed in UXO handling procedures contained in Chapter 2 for military operations and for

contracted UXO activities, in Annex E to Chapter 3 and amplified in the SOW/SOR and accepted Work Plan/SOPs. Ensure appropriate safety distances commensurate with the assessed risk for blast and fragmentation are adhered to prior to commencing any handling and/or movement UXO/suspected UXO.

- f. **CBRN/Suspected CBRN UXO/Material Procedures.** Any UXO item that contains or is suspected to contain CBRN material shall be handled in accordance with DND/CF policies and regulations. If CBRN UXO or suspected CBRN UXO is found, the procedures outlined in Annex C are to be followed.

#### Common Work Initiation/Start-Up Procedures

Step 1	The authority to commence work is coordinated and scheduled through site-specific SOPs, Range Standing Orders/Daily Range Orders, and military Operations Order (for military) or SOW/SOR/Work Plan (for contracted work) as applicable prior to commencement of work
Frequency	Daily
Instructions	None

Step 2	The Team Commander (Comd)/Leader (Ldr) will conduct a general work and safety briefing and address specific topics prior to commencement of work
Frequency	Daily
Instructions	<ol style="list-style-type: none"> <li>1. Specific topics to be covered as a minimum: <ol style="list-style-type: none"> <li>a. general health and safety rules;</li> <li>b. safety procedures;</li> <li>c. confirmation that adequate PPE is available and worn;</li> <li>d. review task allocations (screeners, visual sweeper, electronic sweeper, UXO recognition, etc.) and methods;</li> <li>e. review boundaries, marking and rate of work, etc;</li> <li>f. review documentation and chain of custody procedures;</li> <li>g. coordination with non-UXO qualified personnel and their activities (equipment operations, drivers, etc.);</li> <li>h. review hazards and actions/drills/SOPs ("Do's and Don'ts", what to do if UXO is found, etc.);</li> <li>i. review any environmental, archaeological, cultural, or other concerns that may affect the task; and</li> <li>j. any other significant information required for the day's task.</li> </ol> </li> </ol>

Step 3	Conduct equipment checks/calibration.
Frequency	Daily and as specified.
Instructions	Manufacturers operation instructions shall be followed, defects/discrepancies documented, and non-serviceable equipment isolated.

Step 4	The Team Comd/Ldr will notify the superior chain of command/supervisors that the team is ready to commence Range/UXO activity.
Frequency	Daily
Instructions	None

#### Level One Screening Procedures

Step 5	Action on finding an item
Frequency	As required
Instructions	<p>1. Upon finding an item, appropriately qualified sweepers/searchers may pick up items of MS, NMS or hard target material which they <b>POSITIVELY KNOW TO BE HARMLESS AND SAFE</b>. If not appropriately qualified or any doubt exists as to whether item is harmless and safe to move, the appropriately qualified UXO personnel shall be consulted.</p> <p style="text-align: center;"><b>Note</b></p> <p><b>Positive identification is achieved by the confirmation of a minimum of two data points (permanent in nature) in any configuration such as, documented and confirmed physical features, known and measured physical characteristics/dimensions, permanent markings (stamped, engraved, embossed, cast etc). Colour coding and or legible markings denoting the nomenclature may be indicators of proper identification, however they shall not be solely or in conjunction with each other relied upon to make a positively identification. Colour coding and less permanent type markings may fade over time and/or have been re-marked incorrectly</b></p> <p>2. Large items or partially buried scrap shall be treated as suspect and if not appropriately qualified or any doubt exists as to whether item is harmless and safe to move, the appropriately qualified UXO personnel shall be consulted. These items shall only be moved if it can be positively identified that no UXO are either under, by or concealed in the item. Intrusive work may be required to verify that no UXO are under or concealed within the item.</p>



	<p>3. UXO/suspected UXO or scrap containing or suspected of containing explosive residue shall be appropriately marked and left for the appropriately qualified personnel designated in the accepted Work Plan/SOPs to action. <b>UXO OR SUSPECTED UXO SHALL NOT BE HANDLED OR MOVED</b> by anyone other than those appropriately qualified and designated in the Operation Order (for military) or accepted Work Plan/SOPs (for contracted work).</p>
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Step 6	Collection of MS, NMS and hard target material
Frequency	As required
Instructions	<p>1. Once positively identified as harmless and safe to move (STM), the MS, NMS or hard target material shall be placed in the appropriately clearly marked personnel scrap collection containers. MS and small hard target material may be collected in the same container but NMS shall be collected in a separate container. The containers shall be numbered and clearly identified as to the general nature of their contents (MS, NMS, etc.) The containers should also permit visual examination of items without dumping the contents. A plastic pail is ideal for this purpose as the container is easy to carry and load, contents can be easily seen and unloaded, and they are economical and reusable.</p> <p>2. Live/suspected live SAA should be collected separately.</p> <p>3. Once positively identified as harmless and STM, larger items, particularly large hard target material, may be collected separately and moved to the grid/cell consolidation (Level Two Screening) point.</p> <p>4. If there are a large quantity of single nature items on a particular site (SAA, aluminum tail fins, etc.), the initial collection may undertake a preliminary sorting by collecting the items in separate containers that are appropriately marked and identifying the contents.</p>

Step 7	Movement to the consolidation (Level Two Screening) point
Frequency	As required
Instructions	<p style="text-align: center;"><b>Note</b></p> <p><b>All MS which cannot be positively identified, is fuzed or cannot otherwise be 100% visually inspected or physically probed to confirm the contents as being empty or safe, shall be treated as suspected UXO and be perforated in two locations (intentionally targeting both the initiation system and main filling) prior to proceeding to Level Two screening</b></p> <p>1. Containers shall only be moved to the consolidation/Level Two Screening point with the permission of the Sweep/Search Team</p>

	<p>Comd/Ldr.</p> <p>2. Containers shall be placed in the appropriate separate locations for MS, NMS, hard target material (if collected separately from MS) and live/suspected live SAA for each grid/cell.</p> <p>3. If there is a large quantity of single nature items on a particular site that has been collected in separate containers, these containers may be sub-divided within the appropriate cell/grid MS, NMS and hard target material locations.</p>
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Step 8	MS, NMS and hard target material accounting and tracking
Frequency	As required
Instructions	<p>1. The Sweep/Search Team Comd/Ldr shall accounted for and track the MS, NMS and hard target material from their grids/cells using the appropriate Scrap Accounting/Tracking Form (Note – Sample documentation based on the sample Scrap Accounting/Tracking and Scrap Chain of Custody forms for contracted UXO work contained in Annex F to Chapter 3, in hard/paper and/or electronic/PDA formats, may be used).</p> <p>2. Accounting and tracking will be by container and provide as much detail as to the nature of the container's contents that is practicable.</p> <p>3. The Scrap Accounting/Tracking Form shall remain with the containers listed on the form and be passed on to the next screening level along with the containers.</p>

Step 9	Repeat Steps 5 through 8 as required until the task is completed.
Frequency	As required
Instructions	None

### Level Two Screening Procedures

Step 10	Preparation for screening at the consolidation (Level Two Screening) point.
Frequency	As required
Instructions	<p>1. The appropriately qualified personnel shall:</p> <p>a. Ensure that the containers or larger individual items received are accompanied with the appropriate Scrap Accounting/Tracking Form;</p> <p>b. Spread the contents of each container segregated by type</p>

	<p>(MS, NMS, hard target material) for a particular grid/cell (larger items, particularly large hard target material may be separately screened on the vehicles or in a separately designated area); and</p> <p>c. Visually scan the contents and containers to verify that no UXO/suspected UXO or live/suspected live SAA is present.</p> <p>2. If any UXO/suspected UXO or live/suspected live SAA are present, the following shall occur:</p> <p>a. Cease operations in the Screening Area and evacuate personnel to a safe distance in accordance with the Operations Order (for military) or accepted Work Plan/SOPs (for contracted work).</p> <p>b. Initiate the appropriate UXO Identification Form to account for/track the items (Note – Sample documentation based on the sample UXO Identification Form in Annex F to Chapter 3, in hard/paper and/or electronic/PDA formats, may be used).</p> <p>c. Immediately report the incident to the Range Clearance Safety Organization (for military) or UXOSO and UXOQCS (for contracted work) for further investigation and corrective action as appropriate.</p> <p>d. If positively identified and if it is STM the item, the appropriately qualified personnel designated in the Operations Order (for military) or accepted Work Plan/SOPs (for contracted work) shall remove each item to the designated holding area(s) for UXO/suspected UXO or live/suspected live SAA.</p> <p>e. If not STM, evacuate the area to the known safety distance for the item in question and safely dispose of item in accordance with the Operations Order (for military) or accepted Work Plan/SOPs (for contracted work).</p> <p>3. UXO/suspected UXO or scrap containing or suspected of containing explosive residue removed to the designated holding area(s) for UXO/suspected UXO or live/suspected live SAA shall be appropriately marked and left for the appropriately qualified personnel designated in the accepted Work Plan/SOPs to action. <b>UXO OR SUSPECTED UXO SHALL NOT BE HANDLED OR MOVED</b> by anyone other than those appropriately qualified and designated in the Operations Order (for military) or accepted Work Plan/SOPs (for contracted work).</p>
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Step 11	Screening of MS, NMS and hard target material
Frequency	As required

Instructions	<p>1. The appropriately qualified personnel shall visually inspect each item of MS, NMS or hard target material from each of the containers to ensure there are no visible traces of explosive residue.</p> <p style="text-align: center;"><b>Note</b></p> <p><b>Positive identification is achieved by the confirmation of a minimum of two data points (permanent in nature) in any configuration such as, documented and confirmed physical features, known and measured physical characteristics/dimensions, permanent markings (stamped, engraved, embossed, cast etc). Colour coding and/or legible markings denoting the nomenclature may be indicators of proper identification, however they shall not be solely or in conjunction with each other relied upon to make a positively identification. Colour coding and less permanent type markings may fade over time and/or have been re-marked incorrectly</b></p> <p>2. Larger items, particularly large hard target material may be screened separately and moved to a designated collection site.</p> <p>3. If any UXO/suspected UXO or live/suspected live SAA are present follow procedures in Step 10 paragraph 2.</p> <p>4. If there is any visually evident explosive residue adhering to an item the following shall occur:</p> <ol style="list-style-type: none"> <li>a. The item shall be treated as a suspected UXO as per Step 10 paragraphs 2 and 3 and, if STM, separated from the remainder of the scrap; and</li> <li>b. If STM, remove each item to the designated holding area(s) for scrap containing or suspected of containing explosive residue for further evaluation by the appropriately qualified personnel designated in the Operations Order (for military) or accepted Work Plan/SOPs (for contracted work).</li> </ol> <p style="text-align: center;"><b>Note</b></p> <p><b>The minimum required standard for Level Two screening on any given site is one set of eyes. This does not negate the discretionary use of additional screeners when large volumes of MS are to be Level Two screened or for safety reasons in extraordinary circumstances</b></p> <p>5. The Level Two Screener shall not work alone and should be augmented by a second Level Two Screening qualified person. If this is not possible, an assistant qualified at least to the CMD Basic (for military) or UXO Tech (for contracted work) level shall be present for safety and consultative purposes.</p>
Step 12	Sorting of MS, NMS and hard target material

Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. Items visually identified as MS, NMS or hard target material that does not contain or suspect to contain explosive residue, shall be sorted into separate Level Two screened containers/piles and be secured for transport to or action at the next level of screening.</li> <li>2. Further sorting into component (SAA, tail fins, etc.), ammunition type (carrier projectiles, specific type and calibre (81mm mortar, 155mm artillery, rockets, bombs, etc.), etc.) or other designations (steel, brass, wood, etc.) within the MS, NMS or hard target categories may be done when directed in the Operation Order (for military) or the SOW/SOR (for contracted) where there are large quantities of specific items.</li> <li>3. Containers shall be marked with the type of contents, date of filling, which grid/cell the items are from and who conducted the screening.</li> </ol>

Step 13	Movement to the Level Three screening point
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. Containers/large items shall only be moved to the Level Three point with the permission of the Level Two Screening Team Comd/Ldr.</li> <li>2. Containers/large items shall be placed in the appropriate separate locations for MS, NMS, hard target material (if collected separately from MS) and live/suspected live SAA for each grid/cell.</li> </ol>

Step 14	Screened material accounting and tracking
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. The Level Two Screening Team Comd/Ldr shall account for and track the MS, NMS and hard target material from their grids/cells using the appropriate Scrap Accounting/Tracking Form.</li> <li>2. Accounting and tracking will be by container and provide as much detail as to the nature of the container's contents that is practicable.</li> <li>3. The Scrap Accounting/Tracking Form shall remain with the containers listed on the form and be passed on to the next screening level along with the containers/large items.</li> </ol>

Step 15	Repeat Steps 10 through 14 as required until the task is completed.
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Frequency	As required
Instructions	None

### Level Three Screening Procedures

Step 16	Preparation for screening at the Level Three screening point.
Frequency	As required
Instructions	As per Step 10 for Level Two Screening Procedures.  <b>Note</b> <b>MS to be stored locally that is only Level Two Screened must be stored in an approved licensed explosive location/container</b>

Step 17	Screening of MS, NMS and hard target material
Frequency	As required
Instructions	<p>1. As per Step 11 for Level Two Screening Procedures but with the appropriately qualified Level Three Screener. Each item must be 100% inspected by a Level Three Screener.</p> <p><b>Note</b></p> <p><b>The required standard for Level Three screening on any given site is one set of eyes. This does not negate the discretionary use of additional screeners when large volumes of MS are to be Level Three screened or for safety reasons in extraordinary circumstances</b></p> <p><b>Note</b></p> <p><b>Only the Level Three Screener who personally inspected the scrap shall sign the DND 2286 (Level Three MS screening certificate for the items they have screened)</b></p> <p>2. The Level Three Screener shall not work alone and should be augmented by a second Level Three Screening qualified person. If this is not possible, an assistant qualified at least to CMD Basic (for military) or UXO Tech (for contracted work) level shall be present for safety.</p>

Step 18	Sorting of MS, NMS and hard target material
Frequency	As required
Instructions	<p>1. <b>MS.</b> Items visually identified as MS should, if quantities warrant and as directed in the Operations Order (for military) or SOW/SOR (for contracted work), be sorted into separate MS containers/piles and be</p>

	<p>secured for transport or storage as follows:</p> <ol style="list-style-type: none"> <li>Those MS items that do not contain or suspect to contain explosive residue and are not readily recognizable as an ammunition item; and</li> <li>Those MS items that do not contain or suspect to contain explosive residue but are readily recognizable as an ammunition item.</li> </ol> <p style="text-align: center;"><b>Note</b></p> <p><b>MS items, whether or not readily recognizable as an ammunition item, that may contain or are suspected to contain explosive residue (items with sealed areas that prevent visual confirmation that explosive residue is not present) shall be treated as a suspected UXO as per Step 10 paragraphs 2 and 3</b></p> <ol style="list-style-type: none"> <li><b>NMS.</b> Items visually identified as NMS that do not contain or suspect to contain explosive residue, shall be sorted into separate NMS containers/piles and be secured.</li> <li><b>Hard Target Material.</b> Items visually identified as hard target material that do not contain or suspect to contain explosive residue, shall be sorted as per Appendix 1.</li> <li>Further sorting into components (SAA, tail fins, etc.), ammunition types (carrier projectiles, specific ammunition type and calibre (81mm mortar, 155mm artillery, rockets, bombs, etc.), etc.) or other designations (steel, brass, wood, etc.) within the MS, NMS or hard target categories may be done if required or there are large quantities of specific items.</li> </ol>
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Step 19	Processing screened material containers
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li><b>MS.</b> MS containers shall be: <ol style="list-style-type: none"> <li>Weighed;</li> <li>Assigned a unique MS collection container number which collectively tracks all previous documentation;</li> <li>Sealed shut with a tamper-proof or other means to identify any unauthorized opening;</li> <li>Marked as per Appendix 2 and, if directed in the Operations Order (for military) or SOW/SOR (for contracted work), clearly indicate if further treatment/de-militarization of the contents is required.</li> </ol> <p style="text-align: center;"><b>Note</b></p> <p><b>MS to be stored locally may be stored in locally approved sealable containers. MS to be transported at the CANOSCOM designated</b></p> </li> </ol>

	<p><b>DND/CF MS Storage facility shall be packaged as per Appendix 2</b></p> <p>2. <b>NMS.</b> NMS shall be weighed and placed in appropriate containers separate from the MS area.</p> <p>3. <b>Hard Target Material.</b> Hard target material shall be processed in accordance with Appendix 1.</p>
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Step 20	Screened material accounting and tracking
Frequency	As required
Instructions	<p>1. The Level Three Screener who personally inspected the scrap shall sign the DND 2286 (Level Three MS screening certificate) for the items they have screened.</p> <p>2. The Level Three Screening Team Comd/Ldr shall account for and track the MS, NMS and hard target material from their grids/cells using the appropriate Scrap Accounting/Tracking and Scrap Chain of Custody forms (Note – Sample documentation based on the sample Scrap Accounting/Tracking and Scrap Chain of Custody forms for contracted UXO work contained in Annex F to Chapter 3, in hard/paper and/or electronic/PDA formats, may to be used).</p> <p>3. Accounting and tracking will be by container and provide as much detail as to the nature of the container's contents that is practicable.</p> <p>4. The Scrap Accounting/Tracking Form, once completed, shall be passed to the Operations CP (for military) or UXOQCS (for contracted work) for inclusion in the final report(s).</p>

Step 21	Disposal of screened material.
Frequency	As required
Instructions	<p>1. <b>MS.</b> The moratorium into disposal of MS through commercial means contained in remains in effect until a DND/CF de-militarization process, procedures, criteria and standards for MS have been approved by DAER and promulgated. All MS must be stored at an approved DND/CF facility. Transportation to a DND/CF facility shall be in accordance with Appendix 2. Only a DAER approved de-militarization process shall be used if the moratorium is lifted. Sample guidelines and sample procedures to assist in preparing MS for a DAER approved de-militarization process are contained in Appendix 3. Regardless whether the MS is sent to storage or de-militarization, its movement shall be tracked using the appropriate Scrap Chain of Custody Form.</p> <p>2. <b>NMS.</b> NMS, as directed in the Operation Order (for military) or SOW/SOR (for contracted work), may be disposed of through normal commercially accepted waste/scrap procedures after it has been</p>



	<p>accounted for and tracked using the appropriate Scrap Accounting/Tracking and Scrap Chain of Custody forms.</p> <p>3. <b><u>Hard Target Material.</u></b> Appropriately screened hard target material shall be disposed of in accordance with Appendix 1.</p>
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Step 22	Repeat Steps 15 through 21 as required until the task is completed.
Frequency	As required
Instructions	None

Step 23	The Team Comd/Ldrs will notify the superior chain of command that the team has completed its task and request authorization to leave the site.
Frequency	As required at the end of the day or task
Instructions	The Team Comd/Ldr will provide the chain of command a de-brief of the day's work including any documentation, lessons learned and any other significant information pertaining to the task.

#### 1D06. CONCLUSION

1. The procedures above are generic in nature and are provided as guidelines to the procedures for the conduct of handling, screening, storage, transportation, disposal and accounting for MS, NMS and hard target material resulting from range clearance/UXO activities using military or contracted resources. These guidelines must be read in conjunction with the references and the direction provided in the Operations Order (for military) or SOW/SOR (for contracted work). Specific site and task/project conditions and requirements, as well as the most current regulations, must be applied when planning or conducting any UXO activity.



## APPENDIX 1 TO ANNEX D TO CHAPTER 1

### REMOVAL AND HANDLING OF HARD TARGETS AND HARD TARGET MATERIAL

#### 1D101. GENERAL

1. **General.** Range clearance/UXO activities will normally generate scrap items consisting of munitions scrap (MS), non-munitions scrap (NMS) and hard targets/hard target material. In order to reduce the risk to other range clearance/UXO activities workers and to ensure public safety, proper procedures for handling, screening, storing, transporting and accounting of scrap is essential. Just as important is the requirement to ensure that no UXO or MS inadvertently leaves the range area prior to final inspection and certification.

2. **Background.** CF ranges and training areas (RTAs) accommodate large numbers of hard targets of various types and ranges of condition. When a hard target reaches the end of its useable life, there remains a requirement to safely remove and certify it "Free from Explosives" (FFE) prior to final disposal. The majority of hard targets currently in place have been fired upon by the full spectrum of current and vintage CF and foreign military ammunition for decades resulting in extensive structural damage and a greatly increased risk to UXO in the form of defence EO and explosive residue in and around the targets. Individually, UXO present a substantial risk and hazard. These risks and hazards are greatly increased when high UXO saturation levels are encountered in and around hard targets. To further complicate the task of clearing in the vicinity of hard targets, there have been other activities that add to the complexity of the task such as:

- a. the filling of hard targets with concrete or other inert materials has been used to extend the useable life of hard targets. Although this practice is economical from a hard target life expectancy perspective, it has exacerbated an already hazardous clearance process, increasing the risk to personnel, tasked to clear, remove and certify these targets; and
- b. in cases where hard targets were not sealed or became accessible through damage may have led to the disposal of UXO, MS and NMS inside the target. These unauthorized practices would only further increase the risk and difficulty involved in clearing the hard target.

#### 1D102. AIM

1. The aim is to provide specific guidance and procedures for the safe removal, certification and final disposal of hard targets and hard target material during range maintenance and range clearance/UXO activities. Ideally, where the clearance process has been completed properly, the consignee of the scrap need only be concerned with the recovery of metals and useable by products.

#### 1D103. SCOPE

1. **General.** The scope of this guidance is limited to the removal and handling of hard targets and hard target material as approved by DAER and supersedes Ammunition and Explosive Instruction (A&EI) 06, *Removal of Hard Targets from CF Ranges and Training Areas, Revision 1*. The handling of MS and NMS is contained in Annex D.

2. **Applicability**

- a. This guidance is applicable to all:

- (1) DND/CF Ammunition facilities;
    - (2) RTA custodians managing land borne hard targets on Category A, B or D sites;
    - (3) UXO activities on Category C sites and Category D sites not used for training routinely by an Environmental Chief of Staff/Level 1;
    - (4) Canadian Expeditionary Forces Command training for operations; and
  - b. This guidance is not applicable for floating or moored hard targets under the control of the Chief of Maritime Services (CMS) which are subject to appropriate CMS regulations.
3. **Definitions.** The following definitions are provided to clarify the use of the terms hard target and hard target material for range clearance/UXO activities:
- a. **Hard Target.** Hard target is defined in B-GL-381-001/TS-000, *Operational Training Part 1 – Training Safety*. However, for the purposes of hard target removal and handling procedures, a hard target is defined as: “a light skinned/armoured vehicle or steel plate(s) located above the high water mark that has been utilized as a stationary target on a DND/CF RTAs and as such has been impacted by UXO or non-UXO producing ammunition, the result of which is damage to the target with the potential to contain, hide or be in proximity to UXO, MS and/or NMS.” A hard target may also include steel and other similar materials used as targets during demolition research, training or trials/evaluation.
  - b. **Hard Target Material.** Hard target material includes both the main hard target element and those parts/fragments of the main hard target element that have been broken off during the impact/effects of the ammunition. Hard target material may be used in conjunction with hard target to differentiate/highlight between the main target element and the fragments.
4. **Hard Target Life Cycle.** Hard targets on DND/CF RTAs have always been identified as MS due to the inherent possibility of the presence of defence EO or explosive residue. However, it must be recognized that there lies a distinct life cycle difference between a hard target and an ammunition article or UXO. To facilitate disposal, this difference and a deviation from this historical association is necessary. A hard target is manufactured inert for a specific purpose and contains no inherent explosive materials whereas an item of ammunition is manufactured to contain explosive material from conception. Once fired, ammunition will leave a level of explosive residue at the target that, if in sufficient quantity, could pose an explosive risk. A hard target must be fired upon by the ammunition to impart any level of explosive residue on the hard target/hard target material. Once the explosive residue has been cleared away or reduced to a safe level where the associated explosive risk is acceptable, it leaves with negligible amounts of explosive residue and is deemed inert. Therefore, once a hard target/hard target material has been Level Three scrap screened, adequately reduced in size and structure (i.e. de-militarized or rendered innocuous or ineffectual for military use) and certified by a qualified person in accordance with International Traffic in Arms Regulations (ITAR)/Controlled Technology Access and Transfer (CTAT) requirements/documentation, it may be considered as inert and shall no longer be defined as MS nor subject to the MS imitations and MS disposal restrictions.

**Note**

**UXO/suspected UXO shall be handled separate from MS, NMS and hard target material as detailed in UXO procedures**

## 1D104. PERSONNEL

1. **General.** As indicated above, the handling, screening, storage, transportation, disposal and accounting for MS, NMS and hard target material can occur during varying times and work activities depending on the nature and conditions of the site. As with any UXO related activity, the number of personnel within a danger/exclusion zone should always be the minimum required to conduct the task safely.
2. **Qualifications.** At each level and phase of the procedure, only those personnel meeting the qualifications approved by DAER and proscribed in Annex A to Chapters 2 and 3 for military and contracted UXO work respectively. Only those appropriately qualified shall fill the positions involved in the procedures described in Annex D or here.
3. **Team Composition.** Team compositions will depend on the planned methodology. Some personnel may be employed in more than one position provided they have suitably qualifications/experience and completion of the work in a safety and effective manner is not jeopardized. Documentation to support such compliance may be provided in the Operation Order for military work and detailed proposal documents for contracted work.

## 1D105. PROCEDURES

1. **General.** The procedures below shall be followed unless specifically amended by the appropriate authority.
2. **Hard Target Removal.** There are a number of considerations related to the clearance, certification and removal process that need to be addressed in the development of a safe procedure. These considerations are encompassed in the following chronological steps and are considered the minimum requirement:
  - a. **Reconnaissance.** Normally an Ammunition Technical Officer (ATO) or MOSID 00169 Ammo Tech Supervisor (QL6A Sgt or above) shall provide subject matter expert (SME) advice to the DND/CF custodian and key stakeholders of current DND/CF RTAs, including those active RTAs which are cleared by contracted UXO clearance resources. Where Air Weapons Ranges are involved, it will be necessary to obtain SME assistance from CAS/1 CAD Command ATO, so as to identify unique differences and requirements associated with those ranges. Where contracted UXO services are involved, the DND Project Manager shall provide the SME. The SME shall be present during the conduct of a detailed reconnaissance of each target in order to ascertain UXO saturation, identify safety considerations and make recommendations during the initial planning.
  - b. **Planning.** The clearance plan will be developed and an Operations Order (for military operations) or in the case of a contracted UXO activity, a Statement of Work (SOW)/Statement of Requirement (SOR) and Work Plan, will be written ensuring all necessary resources have been identified and that suitably qualified personnel are available. The clearance, whether contracted or military in nature shall be conducted in accordance with the provisions in this manual. To ensure that target components are not resold or left in a scrap yard, which may require future recertification, a destination consignee, preferably a smelting facility, should be identified as early as possible in the planning process. For continuity, it is important that the personnel who undertake the reconnaissance should also participate in the planning phase.

- c. **Approach.** An approach path shall be cleared leading up to and around the target. It must be suitably wide and to a depth which will enable heavy equipment to pass and permit such vehicles and personnel, ample space within which to safely manoeuvre. Where possible the approach path should avoid areas of difficult terrain.
- d. **UXO Destruction.** Qualified UXO Destruction Teams as defined at Chapter 2 Annex A for military personnel or appropriately qualified designated contracted UXO personnel identified in Chapter 3 Annex A for contracted UXO activities shall conduct the destruction of UXO.
- e. **Target Mitigation.** Once the approach and perimeter has been cleared, it will be necessary to clear the exterior and interior of the hard target. In order to safely and effectively clear the target itself, it will be necessary to gain access to the interior cavity. Saturation of UXO in and around the target combined with the tight spaces of the target cavity must be recognized and respected by clearance teams. To that end, the following mandatory procedure and target considerations are to be observed:
  - (1) All activities related to the clearance of a hard target shall be conducted with all non-essential personnel outside the fragmentation distance of the most dangerous item fired on the range or training area in accordance with C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas*. Alternatively or when the fragmentation distance cannot be achieved, non-essential personnel must be under hard cover.
  - (2) The exterior surfaces of the hull/body shall be thoroughly inspect and cleared prior to opening and the entry of personnel.
  - (3) Access to the target cavity shall be gained by remote or explosive means. Cutting torches are not authorized at this point due to the possibility that UXO may exist within the structure. Ideally this is achieved by removing the upper portion and one side of the target. Where this proves to be too difficult then an opening large enough to permit safe ingress and egress of personnel, necessary tools and equipment will be made.
  - (4) Prior to disturbing the hard target (moving or tumbling), the cavity shall be cleared and screened to Level Three and after each movement. Where UXO are encountered, they shall be destroyed utilizing approved destruction methods prior to tumbling or moving of the hard target. Extended work periods inside the target are to be avoided and frequent breaks and rotation of personnel are to be instituted.
  - (5) The target shall be moved remotely. Tumbling may be necessary so as to expose the footprint and terrain below or due to target size and shape. Moving the hard target intact is an alternative method and may be used when the danger of UXO is minimal or ease of movement permits. The hard target must be moved using an armoured vehicle capable of stopping any fragments from a potential UXO (i.e. Level 4 at a distance of 25 m for items up to 155 mm in size) or moved by remote means from under cover. Contracted civilian heavy equipment may be used if it has been properly armoured commensurate with the required standards identified in STANAG 4569, *Protection Levels for Occupants of Logistic*

*and Light Armoured Vehicles* or capable of stopping the largest known fragment from the UXO to be destroyed.

- (6) For cement or inert filled targets, it may be necessary to break up the filler to exposed hidden UXO. In some cases additional tumbling may suffice, in others explosive charges may be required.
- (7) If the target is easily moved, remove it to a safe distance and location where disassembly through mechanical means (cutting torch, abrasive water cutting etc) may take place. Target pieces should each be of a size that is easily handled by commercial lifts and forklifts.
- (8) If the target is not easily moved it should be disassembled utilizing explosive means while still located in the impact/hazard area. Explosive disassembly will ensure that if UXO are hidden inside that none of the dismantling staff will be unduly put at risk during the cutting process.
- (9) If using explosive means to disassemble vehicle components, sufficient wait times should be observed between detonation and approach in the event a UXO is subjected to explosive influences. An effective method would be to prepare and detonate near the end of the day with an overnight wait time before re-approach.
- (10) The ground below the target shall be cleared to at least the size of the visible footprint. Special care must be taken to ensure that no UXO have become hung-up underneath the target after it was moved.
- (11) In all cases, the hard target shall be systematically dismantled at a designated safe location on or near the range where if necessary, UXO destruction operations can continue should they become necessary.
- (12) The MS and NMS from the target area shall be removed as it accumulates to the designated scrap collection area only after utilizing the procedures detailed in Annex D.

3. **MS, NMS and Hard Target Material Scrap Screening.** Scrap screening and final certification shall be conducted in accordance with Annex D as outlined below. Once the scrap has been properly screened and certified it may be safely transported on public roads from the range. The packaging and transportation MS shall comply with the directions set out in Appendix 2. When no pre-arranged scrap disposal location has been determined the nearest supporting ammunition facility shall be the temporary repository.

- a. **Work Initiation/Start-Up Procedures.** These common procedures are outlined in Steps 1 through 4 of Annex D.
- b. **MS Procedures.** Procedures for handling, screening, storage, transportation, disposal and accounting for MS are outlined in Steps 5 through 23 of Annex D.
- c. **NMS Procedures.** Procedures for handling, screening, storage, transportation, disposal and accounting for NMS are outlined in Steps 5 through 23 of Annex D.
- d. **Hard Target Procedures.** Target Scrap shall be treated as in the same manner as MS until Level Three screened and certified. However once certified in accordance with ITAR/CTAT regulations (including a completed Certificate of De-Militarization), it will be considered demilitarized to the extent that it may be transported by commercial carrier direct to the consignee from the range or suitable holding facility. Where the hard target is in such condition that permits

its re-use on another active DND/CF RTA and has undergone proper clearance, screening and certification, it may be re-located and its life extended in the interest of training when no other suitable target exists. The final clearance in the form of third level scrap screening shall not be contracted out. Procedures for handling, screening, storage, transportation, disposal and accounting for hard target material are outlined in Steps 5 through 23 of Annex D.

4. **Hard Target/Hard Target Material Disposal Procedures.** Hard targets/hard target material ceases to be MS once they have been processed in accordance with the procedures above. It is therefore not longer subject to the moratorium imposed in CANFORGEN 119/99, *Munitions Scrap from Range Clearances* and may be moved via commercial carrier direct to the end consignee as "Scrap Ferrous Class 307 (A) steel & iron". Scrap which contains contaminants of mixed metals, and other non ferrous debris shall be classified as "Scrap Contaminated Class 307 (B) ferrous & non ferrous".

5. **Accountability/Tracking.** In order to maximize the safety and reliability of the Range/UXO process, an auditable accounting trail shall be enforced from the range or UXO grid/cell location through to the final disposal of the items. Each level and transfer point along the chain of custody shall be identified using the appropriate documentation and sign-off procedures. Documentation based on the sample UXO Identification, Scrap Accounting/Tracking, MS De-Militarization Treatment Accounting/Tracking, Scrap Chain of Custody and Daily Diary forms, in hard/paper and/or electronic/PDA formats, provided in Annex F to Chapter 3 may be used. In accordance with ITAR/CTAT regulations a Certificate of De-Militarization must be completed. Further information is available on the CTAT Handbook site - [http://dgmssc.ottawa-hull.mil.ca/matnet/English/Engineering+and+Maintenance\\_e/SupplInfo/Controlled+Technology+and+Transfer+CTAT+Handbook\\_e.htm](http://dgmssc.ottawa-hull.mil.ca/matnet/English/Engineering+and+Maintenance_e/SupplInfo/Controlled+Technology+and+Transfer+CTAT+Handbook_e.htm) . In addition, a signed and dated Level Three Screening certification in a sealed clear plastic sleeve/envelope must be included within and on all vertical sides of each container going for disposal. A sample certification is contained in Figure 1D1-1 below. Specific direction as to the level, type and frequency of accounting/tracking is provided in the Operation Order for military activities or the SOW/SOR for contracted work.

<p><b>CERTIFIED THAT THE CONTENTS OF THIS CONTAINER HAVE UNDERGONE LEVEL THREE SCREENING/VERIFICATION AND ARE SUITABLE FOR FINAL DISPOSAL TO PUBLIC SALE OR CONSUMPTION</b></p>	
Inspector/Verifier: _____	Signature: _____
Date: _____	

**Figure 1D1-1: Sample Level Three Screening Certificate for Hard Target Material Disposal**



## APPENDIX 2 TO ANNEX D TO CHAPTER 1 PACKAGING AND TRANSPORTATION OF MUNITIONS SCRAP

### 1D201. GENERAL

1. **General.** Secure packaging and transportation of munitions scrap (MS) in appropriate containers, along with proper and complete documentation is essential to maintaining the integrity and confidence in the screened MS that has been certified safe for transportation on public roads. The authorized method for transportation of MS on public roads to a designated DND storage site is contained in Part 7, Section 2 of C-09-005-003/TS-000, *Ammunition and Explosive Safety Manual – Volume 3 – Transportation*.

### 1D202. AIM

1. The aim is to delineate the responsibilities, process and procedures for the packaging and transportation of Level Three screened MS to allow the safe and efficient movement on public roads to a designated DND/CF de-militarization or storage site.

### 1D203. SCOPE

1. **Applicability.** This Appendix applies to all DND/CF personnel and to any parties contracted by DND/CF to handle, store, transport and/or otherwise manages MS recovered during range clearance operations/UXO activities, conducted by the military or by contracted resources, on any DND/CF Category A, B, C or D site.

### 1D204. SPECIFICATIONS FOR THE PALLETIZATION OF MUNITIONS SCRAP

1. **General.** Level Three screened MS shall be secured in appropriate containers to prevent unauthorized addition or removal items from the screened MS. The type of container may vary depending on where it is stored and being transported to but the markings, documentation and need for screening integrity remains constant.

- a. **MS Containers Destined for the CANOSCOM Designated DND/CF MS Storage Facility or Transport on Public Roads.** In order to meet the Transport Canada Safety and Security for an Equivalency Certificate SU 10046 for transportation on public roads requirements and to allow for safe and efficient storage of MS at a CANOSCOM designated MS storage facility, the MS container specified in Part 7, Section 2 of C-09-005-003/TS-000 is the only authorized method in which MS shall be transported to a CANOSCOM designated MS storage facility or moved on public roads. Unless provided as Government Furnished Equipment by CANOSCOM, each wooden container will be constructed as per the MS container construction specifications.
- b. **MS Containers for Local Storage or Other DND/CF MS Ammunition Facility and not being Transported on Public Roads.** Containers other than the wooden pallets detailed Part 7, Section 2 of C-09-005-003/TS-000, may be used provided:
  - (1) the container material is durable and precludes easy access to the MS (steel drums/boxes, etc.),
  - (2) loaded containers are sealed with approved tamper-proof security seals,
  - (3) loaded containers are not being transported on public roads,

- (4) the approved receiving storage site agrees to accept the method of packaging/container, and
- (5) all items are re-screened by a Level Three Screener on transfer to the approved wooden container prior to transportation on public roads and/or shipment to a CANOSCOM designated MS storage facility.
- (6) **Container Marking.** Each MS container shall have stencilled in black letters no less than 2.54 cm (1 inch) high, the following markings:
  - (a) Description of contents (to include Stock Code, if applicable),
  - (b) Weight (not to exceed 1350 kg gross) of container (in kg), and
  - (c) **Control Number.** A Control Number to be used to control and identify each container during shipment and storage that shall include:
    - i. **For DND/CF Operations.** MS from military range clearance operations or from DND/CF local MS storage areas the unit monogram, control number of the container and the date (i.e. **GA/C, Pal 2 of 14, May 2007**), and
    - ii. **For Contracted UXO Clearance Activities.** The Site Name {i.e. Suffield, Petawawa, Tracadie, TTN Mortar Pit, Vernon, etc.}, DND Project Number, Contract Number {i.e. FMAS Commitment Number, etc.}, Tri-wall Number {i.e.  $\underline{x}$  of  $\underline{y}$ } and Date (i.e. **Tracadie / 0001538 / IE070752DC / Pallet 2 of 14 / May 2007**) or other markings directed in the SOW/SOR.

2. **Documentation.** A Scrap Chain of Custody Form is required for all scrap removed regardless of its destination. Sample Scrap Accounting/Tracking and Scrap Chain of Custody forms for contracted UXO work are contained in Annex F to Chapter 3, in hard/paper and/or electronic/PDA formats, may be used.

- a. **MS Containers Destined for the CANOSCOM Designated DND/CF MS Storage Facility or Transport on Public Roads.** Documentation for MS destined for the CANOSCOM designated DND/CF MS storage facility or for transport on public roads, shall follow directions provided in Part 7, Section 2 of C-09-005-003/TS-000.
- b. **MS Containers for Local Storage or Other DND/CF MS Ammunition Facility and not being Transported on Public Roads.** For local storage of MS not being transported on public roads, each container will be accompanied by the signed and dated DND 2286 (Orange – Level Three Screened Range Scrap) certificates. If a DND 2286 is not available, a Level Three Screening certification for MS as per the sample in Figure 1D2-1 below may be used. Two (2) signed copies of the DND 2286 or certificates are required as follows:
  - (1) The first DND 2286/certificate is to be sealed within protective coverings to ensure longevity and shall be inserted within each container prior to its being strapped shut.
  - (2) The second DND 2286/certificate, also sealed within protective coverings to ensure longevity, is to be attached to a vertical side of the container exterior.

**CERTIFIED THAT THE MUNITIONS SCRAP CONTAINED OF THIS  
CONTAINER HAVE UNDERGONE LEVEL THREE  
SCREENING/VERIFICATION AND MAY BE TRANSPORTED FOR  
FURTHER DE-MILITARIZATION OR CONDITIONING BUT SHALL  
NOT BE RELEASED FOR PUBLIC SALE OR DISPOSAL**

Inspector/Verifier: \_\_\_\_\_ Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Figure 1D2-1: Sample Certificate for Level Three Screened MS Storage/Transportation**



**APPENDIX 3 TO ANNEX D TO CHAPTER 1  
PLANNING INFORMATION FOR PREPARING MUNITIONS SCRAP FOR DE-  
MILITARIZATION**

**1F01. GENERAL**

1. Munitions scrap (MS) is a potentially dangerous by-product resulting from range clearance/UXO activities. In order to reduce the risk to other range clearance/UXO activities workers and to ensure public safety, proper procedures for handling, screening, storing, transporting, disposal and accounting for MS items is essential.
2. The MS will be subjected to further de-militarization only after having been Level Three screened. Once promulgated by Directorate of Ammunition and Explosives Regulation (DAER), regulations specific to the de-militarization of MS will identify the approved process, procedures, criteria and standards for de-militarization of MS and the specific preparations to be completed prior to de-militarization..

**1F02. AIM**

1. The aim of this annex is to provide information to promote a better understanding of the planning requirements for preparing MS for de-militarization and the importance of those actions prior to MS undergoing de-militarization.

**1F03. SCOPE**

1. The scope of this Annex aim is limited to providing information on the generic de-militarization process of MS solely for the purpose of understanding the importance that those preparations have for MS de-militarization. Once DAER approved processes for MS de-militarization are issued, more detailed procedures for the preparation of MS for the specific de-militarization process will be promulgated.

**1F04. GENERIC DE-MILITARIZATION PROCESS**

1. **General.** The final de-militarization of MS will include the thermal treatment or other approved process to ensure any remaining explosive residue has been removed and that items are physically rendered indistinguishable as a defence EO item. In order to prepare MS for de-militarization processing the following principles apply:
  - a. **Work Initiation/Start-Up.** This is a common element conducted prior to the commencement of any other range clearance/UXO activity and shall be conducted daily to ensure a safe and effective work environment.
  - b. **MS Screening.** Proper screening of MS prior to the de-militarization processing is essential to ensure UXO are not unnecessarily handled and to minimize exposure of personnel to ammunition hazards. If there is any doubt that the integrity of the security/chain of custody of any MS has been compromised, the items must undergo a Level Three screening prior to commencing any treatment process. The screening, storage and transportation of the MS and other scrap shall be done as per the Level Three screening procedures found in Annex D. To facilitate the de-militarization process, sorting of the MS by material, ammunition type or other characteristics may take place as detailed in the Operation Order (for military) or the Statement of Work/Statement of Requirement (for contracted work). A final confirmatory screening and

certification of all de-militarized MS shall be conducted prior to final disposal to commercial entities. During the screening for the preparation for de-militarization, the following criteria must be adhered to:

- (1) **Positive Identification.** All items of MS must be positively identified as safe prior to further handling. Positive identification is achieved by the confirmation of a minimum of two data points in any configuration such as, physical features, characteristics, permanent markings, Color coding and or legible markings denoting the nomenclature. Items shall not be positively identified by colour coding alone.
- (2) **De-confinement.** MS that is fused, plugged or otherwise cannot be physically probed or the cavity and contents cannot be 100% visually inspected must be perforated in two locations (intentionally directed attack both the initiation system and main filling) to be considered free of energetic material;
- (3) **Hard Target considerations:** Hard target material is considered to be treated as MS up until the point at which it is suitable reduced in size and shape in accordance with Appendix 1.

2. **MS De-Militarization Processing.** Once the requirements of the preparation of MS for de-militarization have been completed and the MS is transferred to the de-militarization facility it shall be processed as follows:

- (1) re-inspected and sorted into processing batches
- (2) thermally treated for a specified duration and temperature or other approved process to remove remaining energetic residue;
- (3) inspected to ensure the desired result has been achieved during thermal or other approved treatment (Quality Control/Assurance);
- (4) physically rendered unrecognizable (crushing, cutting, shredding, deforming, etc.) so as not to resemble an item of defence EO to the average person;
- (5) Certificate of Demilitarization is completed; and
- (6) final disposal of the treated MS in accordance with Controlled Goods regulations.

3. **Accountability/Tracking.** In order to maximize the safety and reliability of the range clearance /UXO activities process, an auditable accounting trail must be enforced from the UXO grid/cell location through to the final disposal of the items. Each level and transfer point along the chain of custody shall be identified using the appropriate documentation and sign-off procedures. Sample UXO forms in Annex F to Chapter 3 are examples.

4. **Explosives Related Accident/Incident Reporting/Investigation.** The reporting and investigation of any explosives related accident/incident during any UXO related activity shall be reported in accordance with Annex D to Chapter 3 (contracted work), A&EI 07 and A-GG-040-006/AG-002 *DND Ammunition or Explosives Accident/Incident/Defect/Malfunction Reporting*.

5. **Security.** Strict security precautions are to be taken to ensure the safe handling and custody of all ammunition, explosives, UXO or MS for disposal, both in transit and storage. UXO/MS, being military ammunition, falls under Group 2 of the Controlled Goods provisions of the *Defence Production Act* (R.S. 1985, c.D-1). As such, for military activities, the Commander

must ensure that where necessary, all personnel have the required security clearance and that they are appropriately qualified to handle, control or dispose of items under Controlled Goods regulations. For contracted personnel, The Project Authority must ensure that the appropriate security considerations are annotated in the Security Clearance Checklist (SRCL) prior release of the Request for Proposal. The contractor **shall not** handle or move UXO/suspected UXO unless directed in the SOW/SOR and registered with the PWGSC Controlled Goods Directorate or exempted under ADM(IE) Standard 1606-4000.1-S01-023 *The Identification and Communication of Security Requirements for Realty Projects* paragraph 1.6.

6. **Operation Order, Work Plan and SOPs.** Once promulgated, the DAER approved direction and procedures for the preparation of MS for de-militarization, are to be included in the Operation Orders (for military) or Work Plan and SOPs for contracted work.

#### 1F05. PERSONNEL

1. **General.** As with any UXO related activity, the number of personnel within a danger/exclusion zone should always be the minimum required to conduct the task safely.
2. **Qualifications/Team Composition.** Once promulgated, the approved DAER de-militarization process and procedures will direct what positions are required to fill the positions involved in the preparation of MS for de-militarization procedures. The required qualifications can be found in Annex A to Chapter 2 (for military) and Annex A to Chapter 3 (for contracted work).

#### 1F06. PROCEDURES

1. The approved detailed procedures for the preparation of MS for de-militarization will be promulgated once the DAER approved process, procedures, criteria and standards for MS de-militarization are issued..

#### 1F07. CONCLUSION

The information above is generic in nature and is provided, for planning purposes, an increased understanding of MS further de-militarization processing to be promulgated by DAER.





## ANNEX E TO CHAPTER 1

### SAMPLE GENERIC CLEARANCE DEPTH GUIDELINES TO BE USED FOR PLANNING PURPOSES

#### 1E01. GENERAL

1. **General.** The aim of a range/UXO clearance is to reduce the UXO risk on UXO affected sites when UXO avoidance or another UXO risk mitigation activity is not practicable. However, even after a range/UXO clearance, it is impossible to certify that an area is totally free of UXO.
2. **Range/UXO Clearances.** Range/UXO clearances are classified into two distinct levels, surface or subsurface. Subsurface clearances are conducted to locate and remove/destroy subsurface UXO and remove buried munitions scrap, non-munitions scrap and/or hard target material. For a subsurface clearance, the depth of the clearance required is dependant on and arrived at after the consideration of a combination of various factors as determined through the risk rating process for the particular site.

#### Note

**The guidance and samples provided are to be used for planning purposes only and are NOT to be quoted as DND/CF approved standards**

#### 1E02. AIM

1. The aim is to provide sample generic clearance guidelines to be used for planning purposes only to assist in the planning of range/UXO clearances.

#### 1E03. RESPONSIBILITIES

1. The responsibility for determining the depth of clearance, regardless where the site is or who conducts the range/UXO clearance, rests solely with DND/CF. The responsibilities for military and contract range/UXO clearances are as follows:
  - a. **Military Range Clearance Operations.** The senior Military Commander in charge of the planning and execution of the military range clearance operation is responsible for determining the depth of clearance for the operation and ensuring it is properly completed. Further responsibilities are contained in Chapter 2.
  - b. **Contacted UXO Clearance Activity.** The depth of clearance responsibilities for contracted UXO clearance activities are summarized below. Further responsibilities are contained in Chapter 3.
    - (1) **DND/CF Project Director (PD).** The DND/CF PD, on behalf of the DND/CF Project Authority is responsible for producing the UXO risk assessment and determining the depth of clearance for the site. The PD must ensure these are included in the Statement of Work (SOW)/Statement of Requirement (SOR)
    - (2) **DND/CF Project Manager (PM).** The DND/CF PM assists the DND/CF PD in determining the required depth of clearance by providing technical advice and, on behalf of the PD, is responsible for ensuring the depth of clearance is clearly conveyed in the SOW/SOR and other contractual documentation. The PM is also responsible, through the Contracting Authority, to ensure the work is properly executed by the contractor.

## 1E04. GUIDELINES

1. **General.** The sample generic UXO clearance activities guidelines provide a planning start point from which site-specific criteria can be applied to determine the explosive risk rating for the site. From this, the appropriate DND/CF Project Authority can ascertain the depth the range/UXO clearance required to mitigate the UXO risk commensurate with the intended site usage.

### Note

**The guidance and samples provided are to be used for planning purposes only and are NOT to be quoted as DND/CF approved standards**

2. **Site Specific Criteria.** Site-specific criteria will influence the final determination of the depth of clearance required. This criterion includes, but is not limited to, the following:
- Soil type/depth/condition;
  - Topography and geology/bathymetry;
  - Specific land-use (intended and actual) activity parameters including duration/intensity of human interaction (public access, demographics, amount/size of machinery/equipment of site, intended excavation depth (for foundation/slab, road base, etc.), seasonal usage, etc.);
  - Nature/risk posed by the possible UXO on site (type (e.g. arty, anti-tank, HE, WP, aerial bombs, rockets/missiles, etc.), density, condition/age, sensitivity (e.g. proximity fusing, piezo-electric fusing, etc.), depth of penetration, etc.);
  - Environmental action and climatic conditions (heavy rains/water runoff, ice scouring, frost heave, wind erosion, water currents/tides, etc.); and
  - Others as determined for the site.
3. **Explosive Risk Rating.** Explosive risk rating of a site for UXO shall conform to the Risk Management of Ammunition and Explosives for the DND/CF guidance as approved by DAER. The responsibility for assigning a UXO risk rating to a particular UXO site rests with the ECS/Level 1 (L1) responsible for the site. Risk on a particular UXO site is a factor of the site specific criteria outlined above. For Category C sites, the Directorate of Real Property Management (DRPM) 2 - DND UXO and Legacy Sites Program (UXO Legacy Sites Program) shall complete the Record of Legacy Site Risk Management (RLSRM) in accordance with the UXO Legacy Sites Program Legacy Sites Management Framework process. Appropriate measures to reduce the risk commensurate with the end-use plan for a site shall be undertaken. The UXO Sites SC will remain the DND/CF forum through which ECS/L1s or DRPM 2 - UXO Legacy Sites Program can raise risk concerns or request assistance from the DND/CF UXO community to obtain a broader consensus on the UXO risk level at a particular site.
4. **Sample Generic Clearance Depth Guidelines (For Planning Purposes Only).** The sample generic clearance guidelines provided have been arrived at through anecdotal means and reflect past UXO clearance practices and experiences. They are provided for planning purposes only and shall not be used as the authoritative standard for any site.
- DND/CF Range and Training Area (RTA) Clearances.** Military training and operations within RTAs of Category A and B sites, by the nature of the military activity, follow risk criteria that can be less stringent than that for the general public. As such, the norm for military manoeuvre areas has been to clear to a depth of approximately 45 cm. However, for areas and sites which are routinely

accessed by the general public or are a higher risk criteria is required. The sample generic clearance guidelines provided for non-DND/CF land clearances should be used as the start point for determining the depth of clearance for those areas/sites.

- b. **Non-DND/CF Land Clearances.** Sample generic clearance depth guidelines to assist with and provide a start point for the planning of UXO clearances on Category C and D sites are provided in Appendix 1.

**Note**

**The guidance and samples provided are to be used for planning purposes only and are NOT to be quoted as DND/CF approved standards**



**APPENDIX 1 TO ANNEX E TO CHAPTER 1**  
**SAMPLE GENERIC CLEARANCE DEPTH GUIDELINES – NON-DND LANDS <sup>1</sup>**  
 (FOR PLANNING PURPOSES ONLY)

Activity Type			Proposed Depth (m) <sup>2</sup>	Control Measure <sup>3</sup>		Remarks	Rationale
Generic Activity	Specific Activity			Authority	Controls		
Recreation	Walking/Hiking Trails/Park Land	Foot traffic only	0.15	Y	N	Assumes some soft areas	People on foot. No equipment
		Light Maintenance Equipment	0.30	Y	Y	Assumes Light Maintenance Equipment use	As per ATV
		Heavy Maintenance Equipment	0.45	Y	Y	Assumes Heavy Maintenance Equipment use	As per Hay Production
	Cross Country Ski/Snowshoe Trails <sup>4</sup>		0.30	Y	N	Assumes not all frozen and grooming equipment use	As per ATV
	ATV Trails		0.30	Y	N	Assumes soft areas and grooming equipment use	Grooming equipment ground pressure/rutting
	Snowmobile Trails		0.30	Y	N	Assumes not all frozen	As per ATV
	Camping		0.30	Y	N	Assumes intrusive activity	Depth of tent pegs, etc.
	Campfire/Fire pit		1.0	Y	N	Assumes prepared site	Depth of heat influence
	Swimming/Canoes/Boats/Fishing	Normal Bottom <sup>5</sup>	0.15	Y	N	Shore/shallow water area	As per foot traffic
		Soft Bottom <sup>6</sup>	0.30	Y	N	Shore/shallow water area	Assumes silty conditions
	Boat Launch Area		0.60	Y	N	Shore/launch water area	Same as roads for vehicle

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Activity Type			Proposed Depth (m) <sup>2</sup>	Control Measure <sup>3</sup>		Remarks	Rationale
Generic Activity	Specific Activity			Authority	Controls		
	SUV/4 Wheel Off-Road	Normal Use	1.0	N	Y	Assumes control on access	Equipment ground pressure/rutting
		Heavy Use	2.0	N	N	Assumes no access control	Equipment ground pressure/rutting
	Hunting (no vehicles) <sup>7</sup>		0.15	Y	S	Assumes some soft areas	As per trails
	Trapping (no vehicles)		0.30	Y	S	Assumes intrusive activity	Driving in of stakes, etc.
	Garbage Dump Area	Foot Access	0.15	Y	N	Assumes only foot access	As per trails
		ATV Access	0.30	Y	N	Assumes only ATV access	As per ATV
		Light Vehicle Access	0.6	Y	Y	Assumes control on access	As per road
		Light Vehicle Access	1.0	Y	N	Assumes no access control	As per SUV (Normal Use)
		Heavy Vehicle Access	2.0	Y	Y	Assumes dumping only	As per SUV (Heavy Use)
	Agriculture	Grazing		0.30	Y	N	Assumes some soft areas
Hay Production/Harvesting (surface)		0.45	Y	Y	Assumes some soft areas	Lower tractor ground pressure	
Cultivation/Harvesting (sub-surface)		1.0 +	Y	Y	Assumes intrusive activity	Depends on equipment type, ground pressure, etc.	
Transportation	Grading/Gravel Road Use		0.60	Y	Y	Normal road surface	General vehicle traffic
	Road Construction (Gravel or Paved)		1.0 +	Y	Y	Below excavation level	Depends on equipment type, ground pressure, etc.

Activity Type			Proposed Depth (m) <sup>2</sup>	Control Measure <sup>3</sup>		Remarks	Rationale
Generic Activity	Specific Activity			Authority	Controls		
	Culvert Installation		1.0 +	Y	Y	Below excavation level	Depends on equipment type, ground pressure, etc.
	Ditch Digging/Maintenance		0.45 +	Y	Y	Below excavation level	Depends on equipment type, ground pressure, etc.
	Bridge Abutments/Footings		1.0 +	Y	Y	Below excavation level	Depends on equipment type, ground pressure, etc.
Forestry	Trucks/ Skidders	Normal conditions	0.60 +	Y	Y	Depends on equipment type, ground pressure, etc.	Depends on equipment type, ground pressure, etc.
		Adverse conditions	1.5 +	Y	Y	Depends on equipment type, ground pressure, etc.	Depends on equipment type, ground pressure, etc.
	Felling/ Harvesting	Manual	0.15	Y	Y	Assumes some soft areas	As per trails
		Equipment	0.45	Y	Y	Assumes some soft areas	Low ground pressure equipment
	Silviculture		0.30	Y	Y	Assumes intrusive activity	Depth of planting seedlings
Infrastructure	Pole/Fence or Sign Post/Cable Installation <sup>8</sup>		0.30	Y	Y	Below hole/trench level	Auger/digging pressure
	Well Drilling/Pile Installation <sup>9</sup>		1.0	Y	Y	Below suspect UXO level	Auger/digging pressure
	Slab Foundation		1.0	Y	Y	Below excavation level	Depends on equipment type, ground pressure, etc.
	Residential Foundation		0.45	Y	Y	Below excavation level	Depends on equipment type, ground pressure, etc.

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Activity Type		Proposed Depth (m) <sup>2</sup>	Control Measure <sup>3</sup>		Remarks	Rationale
Generic Activity	Specific Activity		Authority	Controls		
	Industrial/Commercial Foundation	1.0	Y	Y	Below excavation/UXO level	Depends on equipment type, ground pressure, etc.
	Foundation Perimeter Work Area <sup>10</sup>	20m around Slab	Y	Y	Depends on equipment type, ground pressure, etc.	Depends on equipment type, ground pressure, etc.
		25m around Residential	Y	Y	Below ground level	Depends on equipment type, ground pressure, etc.
		50m around Industrial	Y	Y	Below ground level	Depends on equipment type, ground pressure, etc.

(FOR PLANNING PURPOSES ONLY)

<sup>1</sup> Sample generic UXO clearance depth guidelines provide a basis from which site-specific criteria can be applied to ascertain the depth the UXO clearance activity should be done to mitigate the risk for the intended site usage. Site-specific criteria that will influence the final determination includes, but is not limited to: Soil type/depth/condition; Topography and geology/bathymetry; Specific land-use activity parameters including duration/intensity of human interaction; Nature/risk posed by the possible UXO on site; Environmental action and climatic conditions; and Others as determined for the site.

<sup>2</sup> Depths arbitrarily set in 0.15m increments up to 1.0 m. The 0.15 m was selected as the start point as the risk posed by most UXO buried at below the surface at this depth to a normal individual walking on a grass/vegetation-covered surface should be minimal. As stated in Note 1 above, the various other site-specific criterions must be factored into the final determination for a site. The "+" indicates that equipment pressure/intrusive actions may require deeper clearance.

<sup>3</sup> Control Measure indicates whether the activity is Authorized or regulated and if it is subject to any type of access/usage Controls. **Y** = yes, it is authorized or there are controls. **N** = no, it is not authorized or there are no controls. **S** = some controls in place.

<sup>4</sup> Skiing/snowshoeing on non-groomed/maintained trails may use Walking/Hiking Trails criteria

<sup>5</sup> Normal Bottom denotes sandy/soil bottom with limited (>5 cm) foot penetration.

<sup>6</sup> Soft Bottom denotes silt type bottom with <5 cm foot penetration.

<sup>7</sup> If vehicles (i.e. ATV, snowmobile, etc.) are employed, use depth appropriate for the vehicle type.

<sup>8</sup> Should use UXO avoidance unless essential for the pole/post/cable to be on an exact spot.

<sup>9</sup> Should use UXO avoidance unless essential for the well/pile to be on the exact spot. Piles should be augured or dug in to below the maximum suspected depth of UXO before being driven in by a pile driver.

<sup>10</sup> The distances depict a minimum average distance from the edge of the slab/foundation excavation to allow space for machinery/equipment to move/operate. This distance should be increased as required to meet specific site needs/situation.



## CHAPTER 2 MILITARY RANGE CLEARANCE PROCEDURES

### SECTION 1 GENERAL

#### 201. GENERAL

1. Range clearance can be a hazardous task. Potential accidents can be avoided if all personnel are aware of safety requirements, know their job, and remain alert. It is impossible to describe every detailed safety procedure and guideline that would cover all situations due to the fact that the lay of the land, state of vegetation, swamps and other topographical features makes each clearance operation unique.
2. The procedures and guidelines described in this publication are the minimum and their application is mandatory. These procedures and guidelines, in conjunction with those in Chapter 1, must be applied with experience and common sense to deal with the particular circumstances of each site.
3. The range clearance Military Commander shall have available, in addition to this publication, applicable references found in Annex A to Chapter 1. Specifically, Range Standing Orders for the range(s) being cleared and all user manuals for the type of weapon(s) or ammunition suspected to have been used on the range(s) shall be available.

#### 202. MILITARY QUALIFICATIONS

1. A means of enhancing safety is to ensure personnel are qualified to undertake the assigned job. The minimum qualifications and training required by personnel performing range clearance duties are detailed at Annex A.
2. Personnel assigned to command and control, safety, and medical duties shall perform only those roles throughout the operation. Other range clearance personnel may be rotated through different tasks or perform two tasks provided they are qualified and appropriately trained for each task.

#### 203. CONTROL MEASURES

1. **General.** Control measures enhance safety by reducing the possibility of unauthorized or unforeseen events occurring. These measures include the use of the chain of command, and physical controls such as boundaries, markings, rates of advance and hours of operation.
2. **Chain of Command.** The first means of enforcing safety is by respecting an established command structure. This structure must be based upon established unit and sub-unit organizations. The sole responsibility of unit officers and NCMs during a clearance operation shall be the control of the troops under their command.
  - a. **Physical Controls:**
    - (1) **Boundaries.** Where possible, easily distinguishable boundaries should be employed to delineate the extent of the range clearance operation, the limits of various teams, un-cleared areas, and safe areas. If natural boundaries are not readily available, a lane and/or area marking system may be required.

- (2) **Markings.** Aside from physically marking boundaries, the different teams and elements in a range clearance operation (Safety Organization, Command Elements, Sweep Teams, etc.) should wear distinguishing markings (arm bands, helmets, etc.) to enable easy and quick recognition.
- b. **Rate of Advance.** The terrain being cleared, density of UXO, weather and state of the troops will determine the rate of advance. The chain of command will enforce the rate of advance and the Safety Officer shall be responsible for monitoring this rate of advance. Time constraints must not lead to tolerating unsafe techniques or shortcuts to cover a greater area. It may be necessary to adjust the size of the area to be cleared, use additional personnel or increase the time required to ensure a safe yet reasonable rate of advance is followed. If the rate of advance is considered too fast, the operation shall be halted and appropriate direction provided to range clearance teams. In the interest of safety, competitions between sub-units that promote speed of range clearance operation are to be rigorously discouraged.
- c. **Hours of Operation.** Sweep operations shall be conducted only when there is sufficient light to enable the task to be carried out safely. All sweep personnel shall clear the range before UXO destruction operations commence. The Military Commander shall direct timings based upon an 8 hour workday limit for sweepers. Breaks must be scheduled at regular intervals (i.e. at least 10 minutes every two hours). Established hours of operation may be decreased and the duration of breaks may be increased in the interest of safety during inclement weather or during periods of excessive heat or cold. Due to the level of fatigue experienced by troops engaged in this work, these troops shall not engage in any other tasks such as unit training while a range clearance operation is in progress.

## 204. MEDICAL SUPPORT

1. Medical requirements must be a primary consideration in planning and conducting range clearance operations. The Military Commander is responsible to ensure that drills for immediate response specific to the particular operation are known and practiced. All participating personnel must know the emergency procedures to be followed in the event of an accident.
2. The Military Commander will meet with senior Base/ASU/Wing/Establishment medical personnel to ensure that the medical services planned meet the following minimum medical requirements for any operation:
  - a. first aid must be available at each station and at each team level (e.g. sweep, UXO destruction and setting out teams);
  - b. an immediate response capability is required for life sustaining aid by qualified medical personnel;
  - c. rapid evacuation capability to permanent medical facilities must be available, including helicopters if the distance so warrants; and
  - d. where it has been ascertained or suspected that white phosphorus (WP) ammunition has been used on the range, immediate treatment for WP casualties must be available.
3. **Siting of Medical Resources.** The location of the ambulance and any other medical facility will be dictated by access roads and cleared lanes. However, medical resources should

be situated as centrally as possible yet out of any danger area from any accidental detonation. Suitable landing site(s) shall be reconnoitred if a helicopter is being used for evacuation.

## **SECTION 2 SAFETY**

### **205. GENERAL**

1. A well-established safety program will ensure that all participants in the range clearance operation perform their assigned tasks in a safe manner. The safety program should be based on the following:

- a. Safety Procedures
- b. Safety Planning;
- c. Safety Organizations; and
- d. Safety Briefings.

### **206. SAFETY PROCEDURES**

- 1. Safety can best be assured by the following:
  - a. enforcing strict control;
  - b. ensuring personnel possess the proper qualifications for the assigned task;
  - c. ensuring all personnel receive safety briefings immediately prior to the clearance;
  - d. stressing alertness and the dangers related to boredom/fatigue;
  - e. ensuring all personnel, including specialists, receive refresher training immediately prior to the clearance operation;
  - f. teaching and enforcing strict clearance procedures and drills;
  - g. correcting errors immediately as they are identified and ensuring all others are made aware of such errors; and
  - h. ensuring proper medical aid and evacuation resources are readily available.

### **207. SAFETY PLANNING**

1. Safety is the paramount consideration when planning range clearance operations. All range clearance operation orders and directives must include an annex detailing safety requirements and procedures for the operation, including:

- a. size and composition of the Safety Organization;
- b. frequency, timeliness and adequacy of safety briefings;
- c. personnel qualifications required to ensure a safe and effective operation;
- d. chain of command;
- e. procedures and drills, including:
  - (1) rates of advance/clearance method to be used,
  - (2) hours of operation and meteorological effects,

- (3) methods and techniques to be employed for detection, identification, removal, screening and disposal of scrap and UXO, and
- (4) safety distances during UXO intrusive investigations, handling/moving and disposal activities;
- f. training to be conducted before and during the operation;
- g. on site and local medical requirements; and
- h. availability and reliability of communications on site.

## 208. SAFETY ORGANIZATIONS

1. **General.** The role of the Safety Organization is to oversee all aspects of safety during a clearance operation. A Safety Organization will be formed of experienced personnel with the requisite qualifications for any range clearance activity. Members of the Safety Organization are not to be employed in actual clearance activities but must remain free to observe the operation. Involvement by Safety Organization personnel directly with sweepers will result in loss of control, compromise safety, and introduce a greater potential for an accident to occur. When members of the Safety Organization wish to pass information to the sweepers, it shall be done only through unit/sub-unit commanders.

2. **Organization.** Safety Organization qualifications are listed in Annex A. The Safety Organization is superimposed upon the range clearance organization and shall consist of:

- a. Safety Officer;
- b. Assistant Safety Officers (as required);
- c. UXO Recognition Advisors; and
- d. Scrap Screener personnel.

3. **Command.** The Safety Officer commands the Safety Organization. The Safety Officer reports directly to the Military Commander. Members of the Safety Organization are empowered to cease any activity that does not conform to safety rules in effect. If agreement cannot be reached between the appropriate sub-unit commander and the Safety Organization member who halted operations, the matter shall be referred to the Safety Officer and unit commander for resolution. If agreement still cannot be reached, the matter shall be referred to the Military Commander before operations shall be permitted to resume.

4. **Identification.** In order to avoid confusion, all Safety Organization personnel should be suitably identified (e.g. arm bands, helmets, etc.) to permit quick recognition of safety personnel and maintain better control over the range clearance operation.

## 209. SAFETY BRIEFINGS

1. **General.** This paragraph will deal with safety briefings alone. Due to the extent and importance of training, Section 2 is dedicated to training briefings. Range clearance tasks can be lengthy and boring. Initial and subsequent briefings are essential to ensure all personnel are aware of the dangers and the procedures to be followed. Commanders should encourage refresher briefings by specialist personnel at selected times (coffee breaks, lunch, etc.). These briefings should include descriptions of misidentified UXO, and warnings of particularly heavy densities of a particular type of UXO. In short, anything that will keep the range clearance personnel aware and currently advised should be briefed. Errors must be corrected immediately after they are identified.

2. **Purpose of Safety Briefings.** Safety briefings are given to all personnel and take the form described below:
- a. **Military Commander's Introductory Brief.** This all ranks briefing should be done by the Military Commander. It should specify the background or reason for the operation and exactly what the task is, and place the emphasis on safety.
  - b. **General Safety Briefing.** This briefing by the Safety Officer should be conducted in conjunction with the Military Commander's introductory brief. The briefing shall include a slide presentation showing aspects of previous similar clearance operations and review accidents to range users or incidents that may have occurred during previous clearance operations. The need to stay alert, avoid indifference, and guard against fatigue and boredom must be stressed. Safety requirements specific to the operation shall be noted at this time and reinforced in subsequent recognition or range clearance procedures training. A proposed briefing is at Annex B.
  - c. **Ammunition Safety Briefing.** This briefing is given by an Ammunition Technical Officer (ATO) to familiarize all personnel with the natures of ammunition and associated hazards that may be encountered on a specific range, so that MS, NMS and hard target material may be differentiated from possible UXO. It is important that this briefing include examples of typical munitions, clearly displayed by ATO staff so that all personnel can see them at the same time as the ATO describes each nature. Another method of conducting this briefing is for the ATO to give the briefing to specialist personnel, who in turn then give the same briefing to the platoons/sections to which they are attached.

### SECTION 3 TRAINING

#### 210. GENERAL

1. A well-established training program is the most certain method to ensure that all participants in the range clearance operation perform their assigned tasks in a safe and operationally effective manner. This is particularly important on sites where UXO from the 1960s or earlier are likely to be encountered. No person shall be permitted to be actively involved in the range clearance operation unless they have received the minimum levels of training detailed below.

#### 211. SCOPE AND CONDUCT OF TRAINING

1. Training is conducted in three phases as follows:
  - a. **Lectures/Briefings** can be given either in a suitable hall for large numbers of personnel or outdoors. If outdoors, the ideal location is on a high piece of ground overlooking the range to be cleared. Lectures commence immediately after the safety briefing.
  - b. **Rehearsals** of formations and drills taught in lectures are conducted to develop teamwork and knowledge of formations and drills.
  - c. **Range Presentation/Demonstration** is done by having personnel train on an area seeded with inert items and scrap that is representative of what will be encountered. Prior to seeding, the area must be cleared and all items used

verified by specialist staff as inert. This practice develops confidence and permits clarification of points of doubt on certain natures of scrap. For subsurface clearance operations, inert items and scrap must be buried. Care must be taken to record all buried items to facilitate recovering those items not detected.

2. A sample training schedule is at Annex C.

## 212. PURPOSE OF TRAINING

1. **General.** The purpose of training is to:
  - a. update and refresh the technical knowledge of specialist advisors and safety personnel;
  - b. familiarize all personnel with the purpose of the operation, the nature of the terrain, natures of ammunition and associated hazards which may be encountered, and the organization of the range clearance operation; and
  - c. teach and practice personnel, particularly unit(s) conducting the clearance operation, the prescribed range clearance drills, formations and procedures.
2. **Specialist Advisors Refresher Training.** Specialists are considered to be the Safety Organization, UXO Recognition Advisors, prodding team leaders (for subsurface clearance operations), Screeners and UXO Destruction teams. They are selected to fill specialized positions by virtue of technical qualifications. However, these individuals vary in background, experience and leadership training. Consequently, refresher training and tactical exercise without troops (TEWT) type rehearsals are mandatory training for these personnel. This will not only update the individual's technical knowledge of natures of ammunition and associated hazards but will also permit observation of their actual performance. This training will permit an assessment of leadership and experience, and may eliminate certain individuals, who although technically trained, do not satisfy overall requirements.
3. **All Ranks Display of Drills and Formations.** The best display of drills and formations employs a demonstration platoon which has previously been rehearsed. Different formations for different pieces of ground can be demonstrated. It is also possible to demonstrate the duties of individuals, drills used on detection of a UXO or suspected UXO, UXO marking, procedures for screening and disposal of scrap (MS, NMS and hard target material) and mine detector and prodder procedures (for subsurface clearance). Demonstrating all drills permits troop rotation through different jobs, thus helping to reduce boredom. It is important to note that this is a demonstration only. Actual rehearsals are done by the chain of command.
4. **All Ranks Rehearsals.** It is imperative that this be done within the chain of command. Drills and formations are dependent on the level of clearance being undertaken. Some drills are common to all levels of clearance operations while others are unique to surface or subsurface clearances. Sections 3 to 5 and Annex F discuss these drills and formations in detail.
5. **Training Documentation.** A list of all personnel receiving training shall be compiled after initial training and held for record purposes. This can be in the form of sign in sheets or nominal roles. For nominal roles, attendance verification will be required.

## SECTION 4 UXO/SCRAP HANDLING AND DISPOSAL

### 213. UXO HANDLING AND DISPOSAL

1. **General.** This manual deals only with conventional UXO. Any UXO that contains or is suspected to contain CBRN material shall be handled in accordance with DND/CF policies. If CBRN UXO or suspected CBRN UXO is found, procedures outlined in Annex C to Chapter 1 are to be followed. Only qualified personnel (see Appendix 1 to Annex A) will conduct identification, handling and disposal of UXO. Further details on principles for UXO handling and disposal are at Section 2 of Annex F.
2. **UXO Destruction Techniques.** Only approved destruction techniques shall be used. Suspected UXO that prove to be explosive in nature or which cannot be positively identified as safe are left in place and destroyed after all personnel have cleared the area. UXO destruction will only occur during daylight hours. UXO will be destroyed in-situ by explosive means only. Render safe procedures (RSP) will not be employed. Only personnel qualified for missiles and/or similar natures of ammunition shall destroy these types of munitions. Further details on the principles for destruction are at Section 2 of Annex F.

### 214. SCRAP HANDLING AND DISPOSAL

1. **General.** Only qualified personnel as described in Appendix 1 to Annex A will conduct identification, handling and disposal of scrap. Appendix 1 is to be read in conjunction with all relevant regulations and directives concerning transportation, handling and disposal of ammunition, explosives and munitions scrap (MS), non-munitions scrap (NMS) and hard target material.
2. **Scrap Collection Containers.** MS and NMS containers must be kept separate from each other and shall be clearly identified as to their contents. Details of the types of scrap collection containers normally used for personnel and for temporary storage on sites are at Annex D to Chapter 1 and outlined in Section 2 of Annex F.
3. **Scrap Screening.** All scrap that is picked up during the operation must be screened as described above before being consigned to a scrap vehicle or collection area. MS shall always be separated from other scrap and be removed to a secure compound. Details on screening scrap are at Annex D to Chapter 1 and outlined in Section 2 of Annex F.
4. **Scrap Storage.** It is important that different natures of items as well as those at different levels of screening be stored in separate securable approved sites/containers to ensure safety and accountability of the items. Details on scrap storage are at Annex D to Chapter 1.
5. **Scrap Transport Vehicles.** Care must be taken to ensure only inert scrap material is loaded onto clearly identified scrap transport vehicles. Details on scrap vehicles are at Annex D to Chapter 1 and outlined in Section 2 of Annex F.
6. **Scrap Disposal.** MS shall not be buried nor placed in pits on the range or training area. MS that has not undergone a Directorate of Ammunition and Explosive Regulation (DAER) approved de-militarization process must be stored at an approved DND/CF MS storage facility. Access to stored MS must be controlled so that the collected MS remains completely free of explosive hazards and prevents the inadvertent addition of UXO. MS compounds will be clearly signed as to their purpose. NMS, once appropriately screened and certified, may be disposed of in an appropriate manner (as scrap metal, wood waste, garbage, etc.). Hard targets/hard target material, once appropriately screened and certified/documented in accordance with

International Traffic in Arms Regulations (ITAR)/Controlled Technology Access and Transfer (CTAT) regulations may be disposed as per Appendix 1 to Annex D to Chapter 1. Further details on scrap disposal are at Annex D to Chapter 1 and outlined in Section 2 of Annex F.

## **SECTION 5 MILITARY UXO AVOIDANCE TASKS**

### **215. GENERAL**

1. A UXO avoidance task is normally associated with another non-UXO related task/operation within an area of suspected UXO. Military personnel may be called upon to perform UXO avoidance tasks in support of range maintenance or other activities (escorting vehicles or personnel, emplacement of posts, etc.) where UXO are suspected or known.

### **216. CONCEPT**

1. The main aim of a UXO avoidance task is to detect and avoid UXO so that another non-UXO related activity can proceed in a safe manner. During UXO avoidance tasks, the surface is visually swept and detection equipment is used to detect suspected UXO below the surface. **No intrusive work is done and any UXO and/or suspected UXO that is found or detected is not disturbed nor handled.**

### **217. PROCESS**

1. **General.** A UXO avoidance task follows normal military battle/task procedures and incorporates many of the elements detailed in the range survey and clearance Sections below.
2. **Structure.** UXO avoidance organizations are based on teams tailored to the particular task. A unit will be designated as the main provider, with specialist elements added as required. Qualifications and training requirements for UXO Avoidance team members are at Appendix 1 to Annex A.

### **218. METHODOLOGY**

1. UXO avoidance tasks are usually conducted using non-intrusive visual and electronic sensing methods to detect suspected UXO. These detection drills are similar to those detailed in the range survey and clearance Sections below. A sample SOP for conducting a UXO avoidance task is at Annex D.

## **SECTION 6 MILITARY RANGE SURVEYS**

### **219. GENERAL**

1. A range survey is normally the precursor to a major range clearance operation.

### **220. CONCEPT**

1. A range survey is used to identify and determine outer limits and extent of UXO on a range. This includes the probable extent of ordnance density and representative types of UXO in the area to be cleared. It is normally employed prior to a major range clearance in order to



facilitate estimating resources required to undertake a range clearance operation and writing the range clearance plan.

## 221. PROCESS

1. **General.** A range survey follows normal military battle/task procedures and incorporates many of the elements detailed in the range clearance Section below. Some elements specific to range surveys include:

- a. **Planning Phase.** The planning phase is used to provide the background for range usage and to assist in determining the number and location of sample strips. Procedures include:
  - (1) **Information Gathering.** Information on past usage/activity can be obtained from:
    - (a) **Historical Records Search.** A search of range records and other historical data of range usage are required to assess types of weaponry likely used, types of munitions, duration of use, and any other pertinent data. Maximum use of limited records must be made where they exist.
    - (b) **Imagery.** Imagery, in particular old photographs and aerial images, is very useful. Impact areas contain many craters/entry holes, most of which are not easily identifiable from the ground because of the growth of grass and brush. These craters/entry holes have tended to accumulate more water than surrounding areas and as a result have supported more lush growth of grass and underbrush. Film analysis can reveal these areas and can confirm results of other reconnaissance methods, and may reveal areas that have been overlooked. Other imagery from satellites or other sources can be used if available.
    - (c) **Interviews.** Interviews with range users (units, FOOs, FCs, FACs, etc.), Ammo Compound personnel, Range Control personnel and caretakers are of extreme value. This anecdotal information serves to confirm data accumulated through other means.
  - (2) **Site Visit/Reconnaissance.** A site visit to the range may reveal past usage through vegetation growth, ground disturbances and other indicators.
- b. **Survey Plan Preparation.** From the information obtained, a survey plan is made to confirm the information and satisfy any gaps. It will include the determination of the survey methodology and areas to be surveyed.
- c. **Survey Phase.** Random sampling, through manual/intrusive or electronic/remote sensing methods, is vital in identifying possible UXO affected areas. Finds are plotted on a map/GIS platform and, by analysis, high UXO concentration/risk areas become apparent. The amount of Quality Assurance (QA) or validation of the survey's effectiveness will be specified in the range clearance order. QA procedures are discussed briefly in final Section below.
- d. **Report Submission.** The range survey report provides the following:

- (1) detailed description of methods used for information gathering and sampling;
- (2) sampling methodology and locations;
- (3) information gathering and sampling results in graphic and written terms; and
- (4) suggested levels and methods of clearance.

2. **Structure.** Range survey organizations are based on teams tailored to the particular task, with a unit designated as the main provider and specialist elements added as required.

## 222. METHODOLOGY

1. **General.** Range surveys may be conducted using manual/intrusive or electronic/remote sensing methods. The current primary method uses manual/intrusive methods to sample a portion of the area. Improved technology using electronic/remote-sensing equipment allows large parts or the entire area to be surveyed and provides improved results. However, current technology is not sufficiently advanced to provide absolute discrimination of items found and must be used in conjunction with manual/intrusive sampling.

2. **Manual/Intrusive Method.** A range survey using military personnel and in-service equipment will normally employ the following methodology:

- a. **Survey Area.** The survey area normally samples a minimum of 2.5% throughout the entire range area followed by 12.5% minimum sample survey of areas of UXO concern (i.e. impact areas). Individual sample test strips should be a minimum of 6 m x 50 m. The location of individual sample test strips should be based on information gathered in the planning phase to ensure a good statistical base is provided to allow proper determination of the boundaries, type and amount of UXO. The UXO affected area may not be determined by the number of UXO found but rather on the degree and type of fragments discovered. This is a very accurate method for defining impact areas. The number of sample strips to be investigated will depend upon the nature of land to be cleared, proposed usage of the area under investigation, and resources available. The greater the area initially investigated, the more reliable the information which has been gathered.
- b. **Procedures.** Using the manual/intrusive method of sampling, each test strip is treated as a clearance operation using procedures and equipment described in the range clearance Section below. The extent of screening for each sample test strip is as follows:
  - (1) all objects in the top 30 cm of soil will be excavated, recovered, identified and recorded;
  - (2) all objects in the top 1 m of soil which by size and configuration are suspected of being a UXO item will be excavated, identified and recorded;
  - (3) objects below 1 m in the soil will be investigated if they are a size and configuration suspected of being larger type air-to-ground ordnance or a possible ordnance dumpsite; and

- (4) objects below 2 m in the soil will be recorded and reported, with a decision to excavate being made on a case-by-case basis, particularly on a bombing range impact area.
- c. **Interpretation of Results.** If it is determined that the 2.5% survey already identifies an EO impact area, then the 12.5% minimum survey can be deleted. If the results are inconclusive, the 12.5% survey will continue. Once the outer limits of UXO are determined within an impact area, analysis will focus on quantifying and/or confirming the concentration and types of UXO present. All functioned EO including fragments are significant when conducting subsurface surveys because they are vital evidence. From this information and the intended use of the site, a determination as to the level of clearance can be made.
- 3. **Electronic/Remote Sensing Methods.** Electronic/Remote sensing equipment and expertise is currently not organic to CF military organizations and would normally be contracted to a company specializing in this field. Details on this survey methodology are contained in Chapter 3.

## SECTION 7 MILITARY RANGE CLEARANCE

### 223. GENERAL

- 1. Range clearance is normally conducted as part of scheduled range maintenance/development or when there is an intended change in use of the site.

### 224. CONCEPT

- 1. **General.** The Military Commander plans and executes the operation using normal battle procedure. The operation follows the normal five stages (Warning/Planning, Preparation, Deployment, Execution and Redeployment) as follows:
  - a. **Warning/Planning.** During this phase, the Military Commander and staff, in consultation with specialists, conduct the reconnaissance, prepare an estimate of the situation, and undertake planning activities to produce the plan.
  - b. **Preparation.** Orders are prepared and passed on to all personnel and the required resources are gathered. Reorganization, training and rehearsals are undertaken.
  - c. **Deployment.** When the unit is ready, the command element, specialists, clearance personnel and support organization deploy to the site.
  - d. **Execution.** During the operation the Military Commander and staff monitors progress, re-evaluates the situation, and reorganizes forces if required to meet changing circumstances. The morale, safety and well being of the unit must be constantly monitored.
  - e. **Redeployment.** Upon completion of the operation, the normal post operation activities to return resources and clean up take place. As well, an assessment as to the effectiveness of the range clearance and a Range Clearance Post-Operation Report must be completed.
- 2. **Structure.** Range clearance organizations are based on teams tailored to the particular task as outline in Appendix 1 to Annex A. A unit is normally tasked to conduct the operation,

augmented with safety, UXO recognition, UXO destruction and screening specialists to assist in planning and executing the task. Support personnel such as medical, vehicle maintenance, cooks and traffic control normally come from within the unit's support element. On larger operations, or if the required elements are not organic to the unit, this support can be provided from external sources. The safety, UXO recognition, and UXO disposal specialists perform a "staff" function and provide advice on their specialty. Training troops and conducting the operation remain a "line" function.

## 225. WARNING/PLANNING PHASE

1. **General Planning Procedures.** Upon receiving the warning to conduct a range clearance operation, the Military Commander initiates the planning process, including:
  - a. reconnaissance (preliminary and detailed) and/or range clearance survey;
  - b. estimate of the situation;
  - c. preparing the plan; and
  - d. preparing the orders.
2. **Reconnaissance.** The reconnaissance for range clearance operations is in two parts, preliminary and detailed:
  - a. **Preliminary Reconnaissance.** This is undertaken to determine the probable UXO density and representative types in the area to be cleared. This provides data to estimate the resources required to undertake a clearance operation. Preliminary reconnaissance for routine annual range clearance operations should be undertaken by range staff, appropriately qualified individuals, or personnel experienced in range clearance operations. A search of range records followed by a site reconnaissance of the area should be conducted. The Military Commander should conduct the preliminary reconnaissance personally. The preliminary reconnaissance should be conducted well in advance in order to fully analyze the results of the different sources of information. This information may be part of a survey and/or from the sources/process listed in the Survey Planning Phase (see range survey Section above).
  - b. **Detailed Reconnaissance.** This is undertaken after it has been decided to conduct the operation and builds on the information gathered during the preliminary reconnaissance. The detailed reconnaissance examines area characteristics such as terrain, vegetation, routes and natural control features so that a detailed plan can be written. It is normally conducted by the Military Commander and should include those officers commanding the troops who will actually clear the area.
3. **Estimate of the Situation.** No two-clearance operations will be identical since no two pieces of land will be the same. Based on the findings of the reconnaissance, the Military Commander conducts an estimate. The principal factors to be considered and some of the deductions that will ensue are:
  - a. **Level of Clearance.** The level of clearance and depth of clearance will depend on the end use intended for the land. This will affect the rate of work, overall time required to complete the clearance, formations to be employed, number of personnel and specialists required, and equipment needed. Sample generic clearance depth guidelines are available for planning purposes in Annex E to Chapter 1.

- b. **Number of UXO/Size of Area.** This will affect the rate of work, formations to be employed, number of specialists and scrap vehicles, and extent of training.
- c. **Risk Assessment Factors.** On completion of the reconnaissance and/or subsurface survey, the area can be categorized into the appropriate danger area risk classification (see Chapter 1 Section 1). These factors help identify to planning and executing personnel the level of UXO risk. In order to properly classify a UXO affected area and determine the level of risk, a history of the subject range or training area will have to be compiled. This is especially true for disused, closed, and many active facilities. In Canada, the retention and maintenance of range records was scant if existent at all. To make a proper assessment the following material will have to be assessed (this assessment can also be made during the reconnaissance phase of the planning process):
  - (1) probable types of ammunition fired;
  - (2) maps (historical and current);
  - (3) range records;
  - (4) base or unit historical records; and
  - (5) residents, and past and present employees.
- d. **Terrain Analysis.** This is probably the main factor to be considered. Is the land open or tree covered? How much undergrowth is there? Are there any swamps, streams or rivers? Is the land dry, wet or marshy? Is the land easily accessible with many trails or roads? This will affect:
  - (1) the formation(s) to be used, number of personnel required, rate of work, duration of the operation, and support required;
  - (2) the need to pre-burn or not; and
  - (3) the use of specialized tools and equipment.
- e. **Resources Available.** This will affect the time required to do the work and may indicate outside resources required to meet the deadline. For prolonged clearance operations it may become necessary to replace entire units. Using relief-in-place procedures for this has proven to be very successful in previous operations. It must be stressed however that new personnel introduced into the operation must undertake all necessary training. Any requirements for additional specialist personnel must be identified early.
- f. **Environmental, Archaeological, Historical, Cultural and Aboriginal Concerns.** Environmental, archaeological, historical, cultural and aboriginal issues pertaining to range clearance activities shall be incorporated into all phases of the activity. (See Chapter 1 Section 2 for further details.)

4. **The Plan.** From the estimate, the Military Commander prepares the plan, to include the following:

- a. **Organization and Responsibilities.** The plan must specifically detail authorities, responsibilities, task organization, control measures, quality control methodology and safety for the operation.
- b. **Risk Rating and Clearance Depth.** The plan must detail the acceptable risk levels required and the depth of clearance to attain these levels.

- c. **Clearance Rates.** Since ground and the number of UXO vary locally within the area to be cleared, clearance rates cannot be established initially with any degree of assurance. The plan must cater for major variations in individual section and platoon rates of clearing. Care must be taken to ensure that imposing an artificially high clearance rate does not reduce personnel safety and quality of clearance. As a preliminary estimate, 1.5 person days/acre for surface clearances and 8 person days/acre for sub-surface clearances (based on 45 cm depth) has been achieved on previous operations using well drilled teams.
- d. **Specialist Requirements.** Most units do not possess the number of specialists required for clearance operations. Specialist requirements must be assessed at an early stage in the planning in order to have them provided from outside sources.
- e. **Preliminary Training and Rehearsals.** Preparation for training must begin prior to the actual clearance to ensure that the required technical data, training aids and areas for rehearsals are available. Instructors and a demonstration platoon, if used, must be detailed, prepared and rehearsed to conduct the necessary training. Liaison with range control and supporting ammunition sections is needed to determine ammunition natures on the range involved, prepare training packages, and arrange availability of ammunition training aids.
- f. **Medical.** During the planning stage the advice of a Medical Officer should be sought in order to determine medical requirements for resources and evacuation procedures.
- g. **Support and Logistics.** Requirements are similar to most operations conducted in a training area. Special consideration should be given to:
  - (1) stores and equipment (GPS, stakes, marker tape, etc.) to mark boundaries, reference points, and routes;
  - (2) UXO markers (pickets and mine or surveyor's tape or marker flags);
  - (3) lane control markers (mine/surveyor's tape or marker boards);
  - (4) scrap collection devices for personnel (plastic pails, etc.) and for collection points (metal/plastic drums/bins, etc);
  - (5) explosives and demolition accessories for UXO destruction;
  - (6) packaging, pallets and consumables;
  - (7) protective equipment (leather gloves, safety eyewear, dust/breathing masks, etc.); and
  - (8) UXO detection and removal equipment for subsurface clearance operations.
- h. **Environmental Considerations.** Environmental assessment (a screening or comprehensive study as required for due diligence or by regulation), identification of environmentally sensitive areas, and environmental reporting, reaction and remediation measures must be detailed.
- i. **Command, Control, Communications and Information (C3I).** C3I procedures and methods must be detailed in the plan.

5. **Orders.** The Military Commander's plan will result in orders in operation order format. Annex E contains an example outline of orders for a range clearance operation at battalion level. For smaller or larger operations, the format can be adjusted accordingly.

## 226. PREPARATION/TRAINING PHASE

1. During the preparation/training phase, all required resources are brought together for training and rehearsals. A well-established and effective training program ensures maximum safety and efficiency of all personnel. No personnel shall be permitted to be actively involved in the range clearance operation without receiving the minimum levels of training described at Section 2. Annex F outlines detailed drills and procedures to be followed. During rehearsals, all aspects of the operational plan are to be exercised to ensure all personnel are thoroughly practised in them.

## 227. DEPLOYMENT PHASE

1. The deployment phase commences when the Military Commander confirms that the command and control, safety and range clearance organizations are operationally ready. During this phase, personnel and required resources move to the task site and administrative site preparations are completed. No preparations of the contaminated area shall be undertaken at this time.

2. Normal operational and administrative procedures are followed. Once command, control and communications, safety, medical, and administrative area are set up and functioning the execution phase can begin.

## 228. EXECUTION PHASE

1. **General.** This phase includes the actual conduct of the range clearance operation. The Military Commander and staff monitor progress, re-evaluate the situation, and reorganize forces as required. The morale, safety and well being of the unit must be constantly monitored.

2. **Conduct.** The range clearance operation will be conducted in accordance with the procedures detailed in Annex F. The sequence of events is as follows:

- a. **Range Preparations.** The UXO affected range area surface, if practicable and allowed within the environmental assessment (screening or comprehensive study) or other regulations, will be prepared by burning, mulching or other means of defoliation.
- b. **Setting Out.** Setting Out Teams will establish easily recognizable boundary and control measures to guide the follow on teams.
- c. **Sweeping.** Visual (surface clearance) and electronic (subsurface) Sweep Teams will locate and mark all UXO found. These teams will have UXO Recognition Advisors to identify and screen any surface material found. If declared as scrap, the material will be collected in the designated scrap vehicles. Items identified as UXO will be left for UXO Destruction Teams and buried material will be left for the Prodding Teams.
- d. **Prodding (Subsurface Clearance only).** Prodding Teams will uncover any buried material for identification and screening by the UXO Recognition Advisors. For details see Appendix 2 of Annex F. UXO will be left for UXO Destruction Teams to destroy.

- e. **UXO Destruction.** Items identified and declared as UXO by the UXO Recognition Team will be destroyed in accordance with the destruction plan by UXO Destruction Teams.
- f. **Scrap Handling/Screening.** All NMS items will be screened to Level Three before being handled through the normal scrap metal system. Hard target/hard target material will be screened to Level Three before being handled as per Appendix 1 to Annex D to Chapter 1. MS will be screened to Level Three before proceeding to a DND/CF MS storage facility or further de-militarization. The first screening is done on site when found by a sweeper. If the sweeper cannot positively identify the object as scrap, the UXO Recognition Advisor will be called to identify it and make the decision. Prior to loading onto a scrap vehicle, a second screening shall be conducted by an appropriately qualified Level Two Screener. An appropriately qualified Level Three screener shall conduct the third screening in the designated MS collection area. Details on scrap handling are contained in Annex D to Chapter 1 and outlined in Annex F.
- g. **Quality Assurance (QA).** The amount of QA or validation of the effectiveness of the clearance will be specified in the operation order. QA procedures are briefly discussed in the final Section below.

## 229. REDEPLOYMENT PHASE

1. **General.** Redeployment entails completing all aspects dealing with the close out of the operation. These include:
  - a. close down and clean up of the task site(s);
  - b. return of unit(s) to garrison postures and clean up/return of all equipment;
  - c. completion of Post-Operation Reports and documentation; and
  - d. assessment of residual risk for end use of the area and the area surrounding clearance sites.
2. **Post-Operation Report.** A report on range clearance operations must be completed and forwarded within three weeks of completion of the task. Orders for the operation will normally stipulate where the report is to be sent. However, for Base/ASU/Wing/Establishment initiated range clearance operations the post-operation report will be sent through the operations chain of command. Annex H details the minimum contents of the report. Anything in addition that will be of value to future operations should also be included. As a minimum, the Annual Range and Training Area UXO Report (sample in Annex B to Chapter 1) or equivalent information from the CF Range Information System (CFRIS) must be included as part of the ECS/L 1 Sustainable RTA Management Plan (SRTAMP) in accordance with ADM(IE) Standard 1606-4000.1-S01-024 being submitted to ADM(IE). As well, an information copy of Annex B to 1 Chapter or CFRIS equivalent is to be sent to DAER.
3. **Residual Risk Assessment.** It is not possible to guarantee that all potential dangers have been removed from a range area. Areas surrounding the clearance site may still contain UXO. Therefore, an assessment of residual risk after completion of the clearance operation is required to ensure the end use is appropriate for the level of clearance undertaken and dangers in the surrounding area are documented. The residual risk assessment must be completed before resuming training on the range or before returning the property over to a non-DND agency/party. The risk is classified as Types 1 through 4, depending on residual dangers (see Chapter 1 Section 1).



## **SECTION 8 QUALITY ASSURANCE (QA)**

### **230. GENERAL**

1. QA is a command responsibility and forms an integral part of all military activities. Range clearance activities are no exception, with CF personnel normally being used for QA on military range clearance activities.

### **231. QA CONCEPTS AND TECHNIQUES**

1. Further details on QA concepts and techniques can be found in Chapter 4.

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**ANNEX A TO CHAPTER 2  
MILITARY RANGE CLEARANCE ACTIVITIES ORGANIZATIONS, ROLES,  
AND PERSONNEL QUALIFICATIONS**

**2A01. GENERAL**

1. All personnel involved in the range clearance operation shall possess the necessary qualifications and training to perform assigned tasks. The following military occupations/qualifications are referred to in this publication:

- a. 00181-01 — Engineer;
- b. 00005-01 — Crewman;
- c. 00008-01 — Artilleryman;
- d. 00010-01 — Infantryman;
- e. 00339-01 — Combat Engineer;
- f. 00169-01 — Ammunition Technician;
- g. 00135-01 — Aviation Technician (Air Weapons);
- h. 00342-01 — Clearance Diver;
- i. AJEJ (formerly UH/HA) — Conventional Munitions Disposal—Basic;
- j. AJFB (formerly HB) — Conventional Munitions Disposal—Advanced;
- k. AEXN — Ammunition Technical Officer (ATO);
- l. AGRS — Officer/NCM Unit Basic Demolition Instructor; and
- m. AGIB — Missile Monitoring and Analysis; and
- n. AGIC — Guided Missile Instructor.

**2A02. ORGANIZATIONS, ROLES AND QUALIFICATIONS**

1. Organizations, roles and minimum qualifications required for military personnel involved in range clearance/UXO activities, along with training required and suggested team compositions, are summarized in Appendix 1 by activity. Personnel assigned to command and control, safety, medical or logistic duties will perform only those specific roles throughout and must not be used to augment or in substitution of personnel involved in the range clearance operation proper. Range clearance/UXO activities personnel may be rotated through different tasks or perform multiple tasks provided safety is not compromised and they are suitably qualified and trained.



**APPENDIX 1 TO ANNEX A TO CHAPTER 2**  
**QUALIFICATIONS MATRIX—MILITARY PERSONNEL EMPLOYED**  
**ON RANGE CLEARANCE OPERATIONS**

ORG	POSN	QUALIFICATIONS	ROLE	TRG	REMARKS
<b>Command and Control</b>	Military Comd	The Military Comd, ops staff and ops sp staff perform their normal military duties and roles. No distinct qualifications are required.	Command the op	All pers shall receive the op safety briefing.	Experience and/or qualifications in EOD/UXO and range clearance/UXO activities for the Military Comd and key ops staff members would be an asset.
	Ops Staff		Provide staff sp to the op		
	Ops Sp Staff		Provide ops sp to the op		
<b>Safety Organization</b>	Safety Officer	<b>Officer</b> —OSQ AEXN  <b>NCM</b> —MOSID 00169 Ammo Tech (WO or above)	Responsible to Military Comd for: a. safe conduct of the op; b. Safety Org comd and control; c. conduct recce of ops area with the Military Comd prior to writing the Op O; d. write Op O safety annex; e. conduct trg of Safety Org; f. conduct safety briefings and UXO recognition trg for all range clearance pers; and g. conduct post op Safety Org debrief and provide input to Post-Operation Report.	The Safety Officer shall undertake refresher trg in UXO recognition with emphasis on the types of munitions used on the range being cleared.	a. The Safety Org is superimposed over the Clearance Org. b. Only the Military Comd can overrule decisions by the Safety Offr. c. Safety Org personnel are NOT to be used in the actual range clearance task and are to be free to observe at all times.
	Assistant Safety Officer (ASO)	<b>Officer</b> —MOSID 00181 ENGRS or OSQ AEXN/AJEJ/AGRS  <b>NCM</b> —OSQ AJEJ (MCpl/QL5B or above)	ASO(s) are responsible to the Safety Officer for the safe conduct of the range clearance operation.	They shall receive trg in UXO recognition and safety practices from an officer qualified AEXN or MOSID 00169 Ammo Tech (WO or above) not more than one week prior to the op.	ASO(s) shall closely monitor the op to ensure all range clearance procedures are strictly adhered to, and are empowered to halt ops at the platoon level. ASO(s) shall refer conflicts with Command and Control staff to the Safety Officer for resolution.

ORG	POSN	QUALIFICATIONS	ROLE	TRG	REMARKS
<b>Safety Organization</b>	UXO Recognition Advisor(s)/ Level One Scrap Screener(s) for items not positively identified by Sweep Team members	<b>Officer</b> —OSQ AJEJ/AGRS  <b>NCM</b> —MOSID 00339 Cbt Engr (QL5B or above), MOSID 00342 Clr Diver (QL5B or above), OSQ AJEJ/AGRS (QL6B or above) or MOSID 00169 Ammo Tech (Journeyman or above)	Identify suspect items as being safe to move, or requiring marking and reporting as a suspect UXO. Perform the initial Level One screening for scrap not <b>POSITIVELY IDENTIFIED</b> by Sweep Team members prior to moving the item to the scrap collection point for Level Two screening.	They shall receive the same trg as Sweep Teams and shall have added UXO recognition refresher trg from officer qualified OSQ AEXN or MOSID 00169 Ammo Tech Supervisor no more than one week prior to the op.	1. They shall be employed at the platoon level at a ratio of one advisor per Sweep Team. 2. Positive identification is achieved by the confirmation of a minimum of two data points in any configuration such as, physical features, characteristics, permanent markings, colour coding and or legible markings denoting the nomenclature. Items shall not be positively identified by colour coding alone.
<b>Safety Organization</b>	Level Two Scrap Screener(s)	<b>Ground Ranges</b> —Any CF member QL 5B or above with OSQ AJEJ or MOSID 00169 (Journeyman or above)  <b>Air Ranges</b> —MOSID 00135 Avn Tech (Air Wpns) (QL5A or above) or MOSID 00169 (Journeyman or above)  <b>Combined Air/Ground Ranges</b> —Consider using a combined team of suitably qualified CF member QL 5B or above with OSQ AJEJ and MOSID 00169 Ammo Tech (Journeyman or above) and/or MOSID 00135 (MOC 514 Avn Tech (Air Wpns) (QL5A or above)  <b>Test/Experimental Range</b> —Qualified civilian engr	Level Two Screeners shall be responsible to the Safety Officer for Level Two scrap screening of all items collected by Sweep Teams. They will personally inspect each piece of scrap prior to loading onto the scrap vehicle.	They shall receive refresher training from an officer qualified AEXN or MOSID 00169 Ammo Tech (WO or above) not more than one week prior to the start of the op.	Level Two Screeners are empowered to halt clearance op at the platoon level if they believe safety is being compromised. If the reason for the halt cannot be resolved between Sweep Team Comd and Screeners, the matter shall be referred to the Safety Officer. Level Two Screeners shall point out errors in identification so as to correct and educate personnel.

ORG	POSN	QUALIFICATIONS	ROLE	TRG	REMARKS
<b>Safety Organization</b>	Level Three Scrap Screener(s)/ Certification	Any CF member QL 6B or above with OSQ AJEJ or MOSID 00169 Ammo Tech (Supervisor).	Level Three Screeners shall be responsible to the Safety Officer for Level Three scrap inspection and subsequent certification at the temporary munitions scrap collection facility of all items prior to loading into transport containers.	They shall undergo refresher trg in UXO recognition with emphasis on the types of munitions used on the range.	As a minimum there shall be two Level Three Screeners per screening site.
<b>UXO Avoidance Task Organization</b>	UXO Avoidance Team	<b>Team Comd</b> —MCpl (QL5B) or above, and should be familiar with ordnance likely to be encountered.	Comd of UXO Avoidance Team	All team members shall receive refresher trg in UXO recognition and safety practices from an officer OSQ AEXN or MOSID 00169 (WO or above).	a. The need for separate comd/control elements and safety org will depend on task size. b. Team may include a UXO Recognition Advisor.
		<b>Electronic/Subsurface Sweeper(s)</b> —QL3 or above members of MOSIDs 00005, 00008, 00010, 00339, 00342 or 00169 occupations.	Search electronically to locate then report finding of surface and sub-surface UXO, suspected UXO and scrap.	As per above plus specific trg on the use/care of electronic eqpt used to search for/locate buried items.	c. Team composition is similar to a Range Sub-Surface Clearance Operation electronic Sweep Team with only the Comd and Electronic Sweeper elements.
<b>Range Survey Operation Organization</b>	Manual/ Intrusive UXO Survey Team(s)	A Range Survey Operation/Task using manual/intrusive methodology will use the same team composition, qualifications and trg as those required for a Range Subsurface Clearance Operation. This will also include comd and control elements, safety org and support org as required for the size/scope of the survey.			
<b>Range Clearance Operation Organization</b>	Comd and Control Team	The size of the Range Clearance Operation will dictate the level of comd and control required for the clearance portion of the operation. As a norm, overall comd will be at the unit level, with sub-unit comd of assigned clearance areas. Normal coy/sqn/bty and pl/tp chain of comd and supporting elements will be used.			
	Setting Out Team	<b>Team Comd</b> —MCpl (QL5B) or above, and should be familiar with ordnance likely to be encountered.	Comd of Setting Out Team	All team members shall receive refresher trg in UXO recognition and safety practices from an officer OSQ AEXN or MOSID 00169 (WO or above).	1. Each team may include a UXO Recognition Advisor as required for safety. 2. Normal team composition: a. Team Comd (i.e. Sect Comd); and b. 4 x members.
		<b>Team Members</b> —Any CF members, including reserve force, qualified QL3 or above.	Establish easily recognizable boundary and control measures, in accordance with the op plan, to guide follow-on survey/clearance teams.		

ORG	POSN	QUALIFICATIONS	ROLE	TRG	REMARKS
<b>Range Clearance Operation Organization</b>	Sweep Team (Surface and Subsurface Clearances)	<b>Team Comd</b> —MCpl (QL5B) or above, and should be familiar with ordnance likely to be encountered.	Comd of Sweep Team	All team members shall receive refresher trg in: a. UXO recognition and safety practices from an officer OSQ AEXN or MOSID 00169 (WO or above); and b. formation and drills trg on applicable tasks from normal chain of command.	1. Each team will have a UXO Recognition Advisor. 2. Normal team composition: a. Team Comd (i.e. Sect Comd); b. 4 x Sweepers (visual or electronic); c. at least 1 x Marker; d. at least 1 x Scrap Collector (preferably 2 pers - one for munitions and one for non-munitions scrap); and e. 1 x Tape Man. 3. Any item not <b>POSITIVELY IDENTIFIED</b> is to be left untouched for identification by the UXO Recognition Advisor. 4. Positive identification is achieved by the confirmation of a minimum of two data points in any configuration such as, physical features, characteristics, permanent markings, colour coding and or legible markings denoting the nomenclature. Items shall not be positively identified by colour coding alone.
		<b>Visual/Surface Sweeper</b> —Any CF members, including reserve force, qualified QL3 or above	Search visually to locate then report the finding of surface UXO, suspected UXO and scrap. For items that are <b>POSITIVELY IDENTIFIED</b> , perform the initial Level One screening for scrap prior to moving the item to the scrap collection point for Level Two screening.		
		<b>Marker(s)/Scrap Collector(s)/ Tape Man</b> —Any CF members, including reserve force, qualified QL3 or above.	<b>Marker(s)</b> —marks items designated as suspected UXO. <b>Scrap Collector(s)</b> —separately collect items designated munitions and non-munitions scrap. <b>Tape Man</b> —checks sweep lane width and lays out edge of area swept by the team.		
		<b>Electronic/Subsurface Sweeper(s)</b> —MOSIDs 00005, 00008, 00010, 00339, 00342 or 00169 qualified QL3 or above.	Search electronically to locate then report the finding of subsurface UXO, suspected UXO and scrap.	As per above plus specific trg on the use/care of electronic eqpt used to search for/locate buried items.	
<b>Range Clearance Operation Organization</b>	Prodding Teams (Sub-Surface Clearance)	<b>Comd</b> —MCpl (QL5B or above) OSQ AJEJ/AGMF or MOSIDs 00339 or 00342.	Comd of Prodding Team	All team members shall receive refresher trg in: a. UXO recognition and safety practices from an officer OSQ AEXN or MOSID 00169 (WO or above); and b. formation and drills trg on applicable tasks from normal chain of command.	Normal team composition: a. Team Comd; b. 4 x Prodders; and c. UXO Recognition Advisor.



ORG	POSN	QUALIFICATIONS	ROLE	TRG	REMARKS
		<b>Members</b> — MOSIDs 00005, 00008, 00010, 00339 or 00342 qualified QL3 or above.	Uncover any buried items marked as suspected UXO for identification and screening as per the Op O.	As per above plus prodger drill/UXO uncovering trg from the Team Comd	
<b>Range Clearance Operation Organization</b>	UXO Destruction Team	<b>Comd</b> — a. <b>Officer</b> —MOSID 00181 or OSQ AJEJ/AJFB/AGRT/ AEXN, b. <b>NCM</b> —MCpl (QL5B) or above) OSQ AJEJ/ AJFB/AGRS or MOSID 00169, 00339 or 00342 (Supervisor/QL6A or above)	Comd UXO Destruction Team	Entire team shall receive refresher trg in UXO recognition and destruction techniques from an officer OSQ AEXN or MOSID 00169 (WO or above) IAW C-09- 008-002/FP-000.	
		<b>Members</b> —MOSID 00169, 00339 or 00342 (Journeyman/QL5A or above MOC 921) or MCpl (QL5B or above) OSQ AJEJ/AJFB	Destruction of suspected UXO		
<b>Support Organization</b>	Medical Team(s)	Medical qualifications as determined by the senior medical advisor to the Military Comd.	Provide medical coverage for the operation/task.	All pers shall receive the op safety briefing.	Pers assigned to medical and logistics duties will perform only those roles throughout the operation. Clearance pers may be rotated through different tasks or perform multiple tasks provided safety is not compromised and they are suitably qualified and trained.
	Logistics Team(s)	As per occupational requirements	Provide logistics support to the operation/task.		



## ANNEX B TO CHAPTER 2

### SAMPLE RANGE CLEARANCE GENERAL SAFETY BRIEF

#### 2B01. GENERAL

1. **General.** You are members of a team that will be conducting a range clearance for Unexploded Explosive Ordnance, or UXO. UXO is Explosive Ordnance (EO) which has been primed, fused, armed or otherwise prepared for action and which has been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel or material, and remains unexploded either by malfunction or design or for any other causes. UXO is sometimes referred to as hazardous EO, a blind or a dud.
2. It is imperative that this briefing leaves no doubt in the minds of all personnel precisely what they can and cannot pick up from the range.
3. **Aim.** To familiarize sweep teams with the natures of ammunition and associated hazards that are likely to be found on the range so that:
  - a. UXO and suspected UXO may be recognized and marked; and
  - b. munitions scrap (MS), non-munitions scrap (NMS) and hard target material may be removed safely.
4. **Definition {select appropriate statement in italics}.** You are going to be conducting a {surface or subsurface} clearance operation. {"A surface clearance is only interested in identifying items that are readily visible on the surface. Anything partially buried is to be marked and not disturbed." Or "A subsurface clearance is to locate, identify and remove or destroy all suspected UXO or man-made items of xx size to a depth of zz."}

#### 2B02. TASKS

1. **Sweepers.** Your job is to locate and {select appropriate statement in italics according to type of clearance}.
  - a. {for a Surface Clearance} recognize all readily visible surface objects whether live ammunition, suspected live ammunition, MS or NMS, and to remove the positively identified scrap. UXO Recognition Advisors form part of the clearing organization and are there to assist in recognition of objects and to enforce safety. MS will be given to the MS Collector. NMS will be placed in the NMS containers provided.
  - b. {for a Subsurface Clearance} report any suspect findings to the UXO Recognition Advisors.
2. **Markers.** Your job is to mark all suspected and known UXO found by the Sweepers and identified by the UXO Recognition Advisor.
3. **Tape Men.** Your job is to ensure the proper lane width is maintained and mark the left outer edge of the lane as the clearance progresses.
4. **MS Collector.** Your job is to collect MS found by the Sweepers and identified as MS by the UXO Recognition Advisor in the MS container. Once your container is full, you will take it to the appropriate MS Collection Point and turn it over to the Level Two Screeners.
5. **NMS Collector.** Your job is to collect NMS found by the Sweepers and identified as NMS by the UXO Recognition Advisor in separate containers. Once your container is full, you will take it to the appropriate NMS Vehicle and turn it over to the Screeners.

## 2B03. PRESENTATION

1. **Briefing Format.** This briefing will consist of a lecture, visual display of scrap, and a slide presentation. The slide presentation is available through applicable HQs
2. **UXO Recognition.** Most ammunition found on the range will be in a deteriorated state. It will be discoloured, distorted, rusty, broken or otherwise very unlike what you have seen coming out of its shipping container. It will blend in with the ground so that extreme caution must be taken to spot everything. On the range, you may encounter both land and air ammunition. This doesn't imply that they are treated differently—it merely alerts you to expect unusual things. The objects you encounter may be less than perfect in appearance. It will also be helpful to know some of the types of ammunition fuses you may encounter so you may further appreciate the hazards involved. Fuses are used to arm ammunition at the appropriate moment before delivery to the target. Therefore any fused ammunition that is found on the range must be considered armed and set to function. Fuses operate by combinations of springs, ball bearings, setback forces, spin and impact. They are very sensitive to any sort of disturbance after they have been armed during delivery. Two types of fuses are in general use in projectiles: the nose fuse and the base fuse. Beware of objects that appear to have no fuse, because the fuse may be buried in the ground or recessed in the base of the projectile. You may find some nose fuses lying on the ground all by themselves. These contain high explosives and are dangerous. Treat them as UXO.
3. **Scrap Identification.** Scrap may be MS, NMS or hard target material..

### Note

**MS, NMS or hard target material not positively identified as such must be treated as a UXO until the UXO Recognition Advisor has confirmed that it is truly NMS**

- a. **MS.** MS results from the complete functioning of a munition, or pieces of targets identified as being exposed to energetic (i.e. explosive) rounds and/or material but where no further hazard exists.
  - b. **NMS.** NMS is any other foreign material that may be found on the range such as barbed wire, steel pickets, sandbags, soft drink cans, pieces of target vehicles not exposed to energetic rounds and/or material, wooden planks, etc.
  - c. **Hard Target Material.** Hard target material consists of entire or the pieces of hard target/vehicles identified as being exposed to energetic (i.e. explosive) rounds. Though non-munitions in origin, hard target material will be treated as MS until properly screened since hidden or residual munitions/energetic material on or imbedded within the items may be of an explosive nature.
4. **Final Points**
    - a. **Smoke in the Pail.** This point must be clarified based on previous experience. If you pick up “scrap” that still has white phosphorous or smoke composition stuck to it, and during the operation your scrap pail begins to generate smoke, don't panic. Just place the pail on the ground, notify your commander and carry on using another pail.
    - b. **Handout (if used).** On the sheet handed out there are a few key reminders. Refer to it frequently so that you may be continually reminded of your responsibilities. Not only you but your team members may be seriously injured or killed through carelessness so remain informed and alert throughout the clearance.

c. **Important Points to Remember.**

- (1) UXO and suspected UXO will never be removed or disturbed.
- (2) Prior to picking up any item on the range, positive identification of the item as scrap must be made. If any doubt exists mark the item as a suspected dud or request the advice of the UXO Recognition Advisor.
- (3) Ensure you are wearing proper PPE.
- (4) Be careful of large items of scrap. They may cover, contain or otherwise conceal UXO. Again, leave the large scrap alone, mark and move on.
- (5) Handle all scrap carefully—it can injure.
- (6) All intact projectiles must not be touched—mark them and move on.
- (7) This task can be boring and tiresome. Carelessness may set in within two hours of the start of the operation. Beware of this attitude and at all costs, stay alert. It is carelessness that kills.
- (8) Keep thinking.



### ANNEX C TO CHAPTER 2 SAMPLE TRAINING SCHEDULE

DAY	TIMINGS	TASK	INSTRUCTOR	LOCATION	REMARKS
1	0730-1600	Ammo Tech Briefing/Trg	ATO	Ammo Facility	All Ammo pers
2	0700-0730	Military Comd Brief	Military Comd	Theatre or trg area	All pers
	0730-0900	All ranks briefing	ATO	Theatre	All pers
	0915-1200	UXO Recognition Advisor Brief	ATO/Ammo Techs	Theatre or trg area	All pers
	1300-1600	Coy/pl/sect, practice formation movement	Chain of Command (A/R)	TBD	All pers
3	0730-1200	UXO Recognition Advisor Trg	ATO Staff	Ammo Facility	All UXO Recognition Advisors
	1300-1600	UXO Recognition Advisor Trg—Section Command & Control	ATO Staff	Trg area	All UXO Recognition Advisors
4	0730-1600	UXO Recognition Advisor Testing	ATO staff	Ammo Compound	All UXO Recognition Advisors
	0730-1600	Section Command & Control Testing	UXO Recognition Advisor	TBD	All
5	0730-1600	Section Testing w/UXO Recognition Advisor	Sect Comd	TBD	All

**Notes:**

1. Rest breaks and lunch timings not included.
2. Routine on Day 5 is repeated until all personnel involved in the Range Clearance have been tested on all mandatory training and their names recorded on the Range Clearance Control List.
3. Depending on the number of personnel involved, this schedule may be shortened or lengthened.





## ANNEX D TO CHAPTER 2

### SAMPLE SOP—UXO AVOIDANCE PROCEDURES

#### 2D01. GENERAL

1. UXO avoidance is employed to detect and avoid UXO so that another non-UXO related activity can proceed in a safe manner. Activities that do not require the complete area to be cleared of UXO and have the flexibility to shift short distances normally employ UXO avoidance.
2. UXO avoidance activities could include escorting vehicles/equipment or non-UXO qualified personnel, installation of fences/utility poles, routing of utility lines or vehicle/equipment lanes, etc., across an area of suspected UXO. During UXO avoidance tasks, the surface is visually swept and detection equipment is used to detect suspected subsurface UXO. **No intrusive work is done and any UXO/suspected UXO found or detected is not disturbed or handled.**

#### 2D02. AIM

1. The aim of this SOP is to provide guidelines and procedures to conduct UXO avoidance activities using military or contracted resources.

#### 2D03. PERSONNEL

1. **General.** As with any UXO activity, the number of personnel within a danger/exclusion zone should always be the minimum required to conduct the task safely.
2. **Composition.** A UXO Avoidance Team consists of a Team Commander and Electronic/Subsurface Sweeper(s). For small tasks the team is a minimum of two personnel. One conducts a visual sweep to locate any surface items and the second operates the detection device to locate subsurface items. For larger tasks, up to five sweepers can conduct both visual surface and electronic subsurface searches, the team being formed as follows:

Qualifications	Role	Training	Remarks
<b>Comd</b> —MCpl (QL5B) or above, and should be familiar with ordnance likely to be encountered.	Comd of UXO Avoidance Team	All team members shall receive refresher trg in UXO recognition and safety practices from an officer OSQ AEXN or MOSID 00169 (WO or above) no more than one week prior to the op	<p>a. Team may include a UXO Recognition Advisor if the Team Comd is not qualified to that level.</p> <p>b. Team may include Marker(s) if the size of the safe lane and/or number of UXO expected exceeds the capability of the Sweeper(s) to mark.</p> <p>c. Team composition is similar to a Subsurface Clearance Op electronic Sweep Team with only the Comd and Sweeper elements.</p>

Qualifications	Role	Training	Remarks
<b>Electronic/Subsurface Sweeper(s)</b> —MOSIDs 00005, 00008, 00010, 00339, 00342 or 00169 qualified QL3 or above	Search visually and electronically to locate then report the finding of surface and subsurface UXO, suspected UXO and scrap	As per above plus specific trg on the use/care of electronic eqpt used to search for/locate buried items.	As per above
<b>Marker(s)</b> —Any CF members, including reserve force, qualified QL3 or above	Marks items designated as suspected UXO, lanes, safe routes, etc.	Refresher trg in: a. UXO recognition and safety practices from an officer OSQ AEXN or MOSID 00169 (WO or above), and b. formation and drills trg on applicable tasks from normal chain of command.	As required
UXO Recognition Advisor(s) - <b>Officer</b> —OSQ AJEJ/AGRS <b>NCM</b> —MOSID 00339 or 00342 (QL5B or above), OSQ AJEJ/AGRS (QL6B or above) or MOSID 00169 Ammo Tech (Journeyman or above)	Identify suspect items as being safe.	They shall receive the same trg as Sweep Teams and shall have added UXO recognition refresher trg from officer qualified OSQ AEXN or MOSID 00169 Ammo Tech Supervisor no more than one week prior to the op.	As required

## 2D04. PROCEDURES

1. Procedures for UXO avoidance follow the same phases as any other UXO activity described in B-GL-381-003/TS-000 *Operational Training Part 3 – Range Clearance and UXO Activities Manual*. For this SOP, only those steps related to the actual conduct of UXO

avoidance are detailed. It is assumed that all planning, preparations, training, and deployment/site activation activities have been completed.

<b>Step 1</b>	The authority to commence work is coordinated and scheduled through site-specific SOPs, Range Standing Orders/Daily Range Orders, and SOW/SOR/Work Plan as applicable prior to commencement of work
<b>Frequency</b>	Daily
<b>Instructions</b>	None
<b>Step 2</b>	The Team Comd/Ldr will conduct a general work and safety briefing and address specific topics prior to commencement of work
<b>Frequency</b>	Daily
<b>Instructions</b>	<ol style="list-style-type: none"> <li>1. Specific topics to be covered as a minimum: <ol style="list-style-type: none"> <li>a. general health and safety rules;</li> <li>b. safety procedures;</li> <li>c. confirmation that adequate PPE is available and worn;</li> <li>d. review task allocations (visual sweeper, electronic sweeper, etc) and methods;</li> <li>e. review boundaries, marking and rate/width of work, etc;</li> <li>f. coordination with non-UXO task personnel and their activities (equipment operations, drivers, etc);</li> <li>g. review hazards and actions/drills/SOPs ("Do's and Don'ts", what to do if UXO is found, etc);</li> <li>h. review any environmental, archaeological, cultural, or other concerns that may affect task; and</li> <li>i. any other significant information required for the day's task.</li> </ol> </li> </ol>
<b>Step 3</b>	Conduct equipment checks/calibration.
<b>Frequency</b>	Daily and as specified.
<b>Instructions</b>	Manufacturers operation instructions shall be followed, defects/discrepancies documented, and non-serviceable equipment isolated.
<b>Step 4</b>	The Team Comd/Ldr will notify the superior chain of command that the team is ready to commence UXO avoidance work required ahead of the non-UXO task.
<b>Frequency</b>	Daily
<b>Instructions</b>	None
<b>Step 5</b>	Upon receiving clearance to commence work, the Team Comd/Ldr directs the UXO avoidance task.
<b>Frequency</b>	Daily
<b>Instructions</b>	<ol style="list-style-type: none"> <li>1. UXO avoidance for a linear task (path, lane, trench, etc): <ol style="list-style-type: none"> <li>a. At the start point, a visual search is conducted to locate any possible surface or partially buried UXO/suspected UXO out to the width required to ensure it is safe to move forward. Any UXO/suspected UXO found is marked.</li> <li>b. An electronic search with the detector is then conducted over the area where no surface UXO/suspected UXO was found. Any UXO/suspected UXO found is marked.</li> <li>c. The "safe lane" to the width required is marked out such that no UXO/suspected UXO found and marked is located in the lane. GPS coordinates and the "track" of the safe lane must be recorded if required.</li> <li>d. Repeat a. through c. until the distance required from the start point is reached.</li> </ol> </li> <li>2. UXO avoidance for a point task (fence post, pole, etc): <ol style="list-style-type: none"> <li>a. At the start point, a visual search is conducted to locate any possible surface or partially buried UXO/suspected UXO out to the point in question to ensure it is safe to move forward. Any UXO/suspected UXO found is marked and the Team Comd/Ldr will determine an alternate location close by for the subsurface search.</li> <li>b. An electronic search with the detector is then conducted over the point in question if no</li> </ol> </li> </ol>

	<p>surface UXO/suspected UXO was found there, or as directed by the Team Comd/Ldr if surface UXO/suspected UXO was found. If the subsurface search locates a UXO/suspected UXO, the Team Comd/Ldr will determine an alternate location(s) close by for subsequent subsurface searches until a clear spot is found.</p> <p>c. The clear spot is then marked appropriately. GPS coordinates must be recorded if required.</p> <p>d. Repeat a. through c. until the distance required from the start point is reached.</p>
<b>Step 6</b>	The Team Comd/Ldr will notify the superior chain of command that the team has completed the distance required and marked the safe spot(s) and/or safe path/lane as required, and the non-UXO task can proceed.
<b>Frequency</b>	As required
<b>Instructions</b>	None
<b>Step 7</b>	Upon receiving direction to proceed, the Team Comd/Ldr, assisted as required by the remainder of the UXO Avoidance Team, will assist non-UXO qualified personnel as per the plan.
<b>Frequency</b>	As required
<b>Instructions</b>	<p>1. For a linear task (path, lane, trench, etc.) that does not exceed the depth of detection of the detector:</p> <ol style="list-style-type: none"> <li>the UXO Avoidance Team will guide the vehicle/equipment to its working location, and</li> <li>as allowed under the plan and safety requirements, the UXO Avoidance Team may remain with the vehicle/equipment or retire to a safe location while the vehicle/equipment performs its task.</li> </ol> <p>2. For a point task (fence post, pole, etc.) or a linear task where the depth exceeds the depth of detection of the detector:</p> <ol style="list-style-type: none"> <li>The UXO Avoidance Team will guide the vehicle/equipment to its working location.</li> <li>As allowed under the plan and safety requirements, the UXO Avoidance Team may remain with the vehicle/equipment or retire to a safe location while the vehicle/equipment performs its task to a depth less than the detection depth of the detector.</li> <li>The vehicle/equipment withdraws from the excavation and the UXO Avoidance Team will check the hole. If declared free from UXO/suspected UXO, the vehicle/equipment returns to its task and repeats b. If UXO/suspected UXO is found, the task is restarted in a new spot free from UXO/suspected UXO.</li> <li>Repeat a. through c. as required until the desired depth is obtained.</li> </ol>
<b>Step 8</b>	Repeat Steps 5 through 7 as required until the task is completed for the day.
<b>Frequency</b>	As required
<b>Instructions</b>	None
<b>Step 9</b>	The Team Comd/Ldr will notify the superior chain of command that the team has completed its task and request authorization to leave the site.
<b>Frequency</b>	As required at the end of the day or task
<b>Instructions</b>	The Team Comd/Ldr will provide the chain of command with a debrief of the day's work including any documentation recording the lanes/spots, lessons learned and any other significant information pertaining to the task.

## 2D05. CONCLUSION

1. The procedures above are generic in nature and are provided as guidelines to conduct UXO Avoidance. Specific site and task/project conditions and requirements, as well as the most current regulations, must be applied when planning or conducting a UXO avoidance activity.

## ANNEX E TO CHAPTER 2 SAMPLE ORDERS—MILITARY RANGE CLEARANCE

(Note: this sample Operation Order is based on a battalion-level range clearance operation, and can be modified as required.)

TF Name

TF Location

DTG

OP \_\_\_\_\_ Op O \_\_\_\_\_

References: Applicable previous clearance operations, publications, reports, etc.

### 1. **Situation**

- a. General. History of range use, purpose of the operation, previous clearance operation results and lessons learned, anticipated nature and frequency of UXO, etc.
- b. Atts and Dets. Engrs, ATOs and Ammo Techs, Base/Wing Range Staff pers, med, avn, etc.

2. **Mission**. To clear range \_\_\_\_\_ of UXO and scrap *{if required as part of the op}* to a depth of \_\_\_\_\_ *{if a subsurface clearance}* by *{date}*.

### 3. **Execution**

- a. Commander's Concept and Intent
- b. Gen Outline. Task org down to sweep pl and specialist teams level, including general tasks of each:
  - (1) **Phase I**—Trg for UXO Recognition Advisors, Screen and UXO Destruction Teams, Safety Org and other specialists.
  - (2) **Phase II**—Setting out, trg for remainder of clearance pers.
  - (3) **Phase III**—Clearance op.
  - (4) **Phase IV**—Destruction of UXO.
- c. Trg Cadre. In accordance with timetable and briefings already issued. To include rehearsals for demonstration platoon if one is used.
- d. Tasks:
  - (1) A Coy (followed by separate sub-paras for other coys)
    - (a) Grouping:
      - i. Under Comd—truck(s) for scrap.
      - ii. In Sp—UXO Recognition Advisor, Screeners.
    - (b) Tasks. Clear area assigned (see trace at Anx L) within bdrys, mark all suspected UXO, and remove all scrap.

- (2) Setting Out Team:
    - (a) Grouping.
    - (b) Tasks. Set out all area and sector bdrys (see trace at Anx L), mark safe routes.
  - (3) Screening Team:
    - (a) Grouping.
    - (b) Tasks. Check all scrap as it is loaded on vehicles to ensure no UXO are incl, and again at munitions scrap dump.
  - (4) UXO Destruction Team:
    - (a) Grouping.
    - (b) Tasks. Destroy all UXO or suspected UXO.
  - (5) Safety Org:
    - (a) Grouping.
    - (b) Tasks. Observe all safety aspects throughout op, order activities ceased as necessary.
  - (6) Base Range Staff:
    - (a) Grouping.
    - (b) Tasks.
  - (7) Etc.
- e. Coord Instrs:
- (1) Timings:
    - (a) Phase I, II, III, IV.
    - (b) Approx rate of adv \_\_\_\_\_ sq m/hr.
  - (2) UXO Disposal Team timings.
  - (3) Work hrs—meals, rest, halts, etc.
  - (4) Markings:
    - (a) Area, sector bdrys.
    - (b) Ref pts.
    - (c) Sweep lanes.
    - (d) Safe routes.
    - (e) Secure compound for munitions scrap.
    - (f) Scrap vehicles (e.g. marked with coy/pl/sect ident and as munitions or non-munitions).
    - (g) Extent of progress (for halts).
    - (h) UXO.
  - (5) Allocation of UXO Con Numbers, e.g. A Coy—A1 to A1000.

- (6) Coord—Final coord conference.
- (7) Debriefings—daily at \_\_\_\_\_ for this O Gp.
- (8) Briefings—Daily prior to work commencement, based on previous debriefs.
- (9) UXO report procedure—form, control #s, radio reports.
- (10) Allocation of stores—UXO markers, scrap pails, mine tape, surveyor tape, detectors, etc.
- (11) Environmental, Archaeological, Historical and Cultural Considerations—areas of interest, action on finding, etc.
- (12) Etc.

#### 4. **Service Support**

- a. Tpt. Safe routes, veh markings.
- b. Pers Dress and Eqpt. PPE, headwear, water bottle, gloves, rainwear.
- c. Meals and refreshments.
- d. Med. Org, loc, evac procedure.
- e. Fire Fighting. Eqpt, loc, drills.
- f. Explosives and Accessories. UXO Disposal team allotments.
- g. Etc.

#### 5. **Command and Control**

- a. Comd. Op, Areas/Sectors, spec teams.
- b. CP locs.
- c. Comms:
  - (1) Net diagram.
  - (2) Freq.
  - (3) Comd nets.
  - (4) Range safety net.
  - (5) Other nets (e.g. air, avn).
  - (6) Net checks.
- d. Hours of op.
- e. Tels—loc and no.
- f. CP ops.
- g. Ops log.
- h. Control map and UXO control system.
- i. UXO record form and disposition.
- j. Etc.

6. **Safety**

- a. Safety org and task.
- b. Med evac drills.
- c. Rate of adv.
- d. Procedures. Setting out, object loc, destroying UXO, screening scrap, WP "smoke in pails".
- e. Requirement for rest breaks. Use of rest and meal breaks for refresher briefings.
- f. Etc.

Signature

**ANNEXES TO OPORD**

- A. OUTLINE OF EVENTS
- B. SWEEP/ORG DRILLS
- C. WNG TO ALL TPS
- D. SAFETY BRIEFING (ATO)
- E. UXO SITREP SHEET
- F. OP\_\_\_\_\_—TFHQ—ORG
- G. SOP FOR SCREENING OPS
- H. OP\_\_\_\_\_—SAFETY COURSE
- I. OP\_\_\_\_\_—SURFACE/SUBSURFACE CLR—ORG
- J. INITIAL UNIT TASKS AND AREA TRACE
- K. Etc.

**DISTR LIST**



## **ANNEX F TO CHAPTER 2 MILITARY RANGE CLEARANCE PROCEDURES**

### **SECTION 1 GENERAL**

#### **2F01. GENERAL**

1. Range clearance procedures described in this Annex are to be used when CF military personnel are conducting the range clearance. They may be used as guidelines for others if deemed appropriate. Range clearance procedures are divided in three parts as follows:
  - a. procedures common to all range clearance operations, described in the main body of this annex;
  - b. procedures unique to surface clearances, described in Appendix 1; and
  - c. procedures unique to subsurface clearances, described in Appendix 2.
2. To minimize hazards to personnel, range clearance procedures and drills detailed in this Annex and associated Appendices shall be followed during all range clearance operations.

### **SECTION 2 PROCEDURES COMMON TO BOTH SURFACE AND SUBSURFACE CLEARANCE OPERATIONS**

#### **2F02. GENERAL**

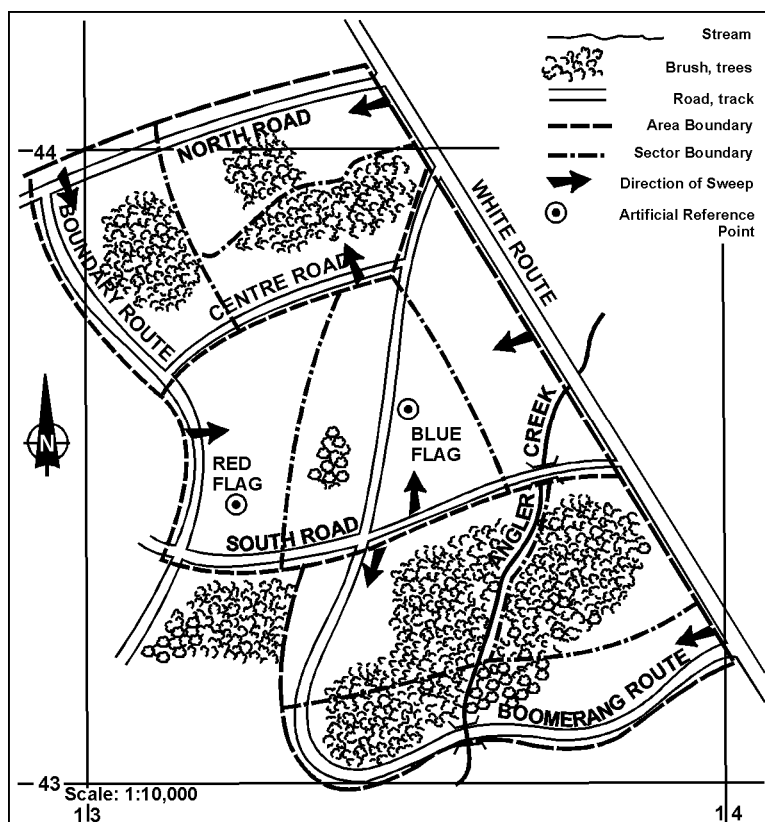
1. Procedures common to any clearance operation are described below. These form the basis for the unique procedures described in Appendices 1 and 2. These common elements include:
  - a. command and control;
  - b. range preparation;
  - c. setting out;
  - d. sweep operations;
  - e. UXO marking, reporting and control;
  - f. scrap handling;
  - g. UXO destruction; and
  - h. post operation reporting.

#### **2F03. COMMAND AND CONTROL**

1. Command and Control measures are of great importance if a high standard of safety is to be maintained. In this Annex procedures and responsibilities of each element of a clearance operation are given for a battalion task. They can be modified for a company or lesser size operation. The following augments control measures described in Chapter 2 Section 1:
  - a. **Command Structure.** Each clearance operation is based on an organization of the appropriate level (i.e. battalion, company, platoon, section, or equivalents). The normal command structure is the first control measure. The command

element consists of the Military Commander and the staffs required to plan, direct, control and record the operation. The Military Commander is responsible for overall conduct of the operation, including training, and safety. Command is executed through the normal chain of command, except that safety personnel remain under the command of the Safety Officer.

- b. **Area Layout and Control.** The range to be cleared must be divided into readily recognizable areas and sectors. Responsibility for clearance of these areas and sectors is assigned to sub-units. An Operation Command Post (CP) is established to control the entire operation, and a number of Area Control and Sector Headquarters may be established and, if necessary, co-located. The Operation CP must be set up in a safe area and must provide for visitors. The Area Control and Sector HQs are based on company and platoon headquarters respectively. It is imperative that all levels of headquarters retain accurate up-to-date records of activity and UXO control.
- c. **Control Map.** An enlarged map of the area showing topographical detail, sector and area boundaries, and troop and UXO locations is used as the control map (see Figure 2F-1). A map as large scale as possible (preferably 1:10,000) should be used. An electronic map is preferred, or an enlargement produced by a base photo section or formation intelligence section. UXO locations must be recorded accurately (for paper maps, flat-headed pins marked with the UXO control number, or if the number of UXO recorded is too large, use pins related to a UXO Control Record). As sector searches are completed, areas are shaded in. Control maps will be kept at the Operation CP for the entire task area, and at each level's CP for individual areas.



**Figure 2F-1: Example of a Control Map**

- d. **Communications.** Radio communications must be available to section level. The ground and the scope of the operation dictate whether radios are on platoon, company or battalion net. Rapid radio contact with medical, UXO destruction, setting out and safety organizations must be available to the sweep sections. An example of a battalion level communications system is shown at Figure 2F-2.

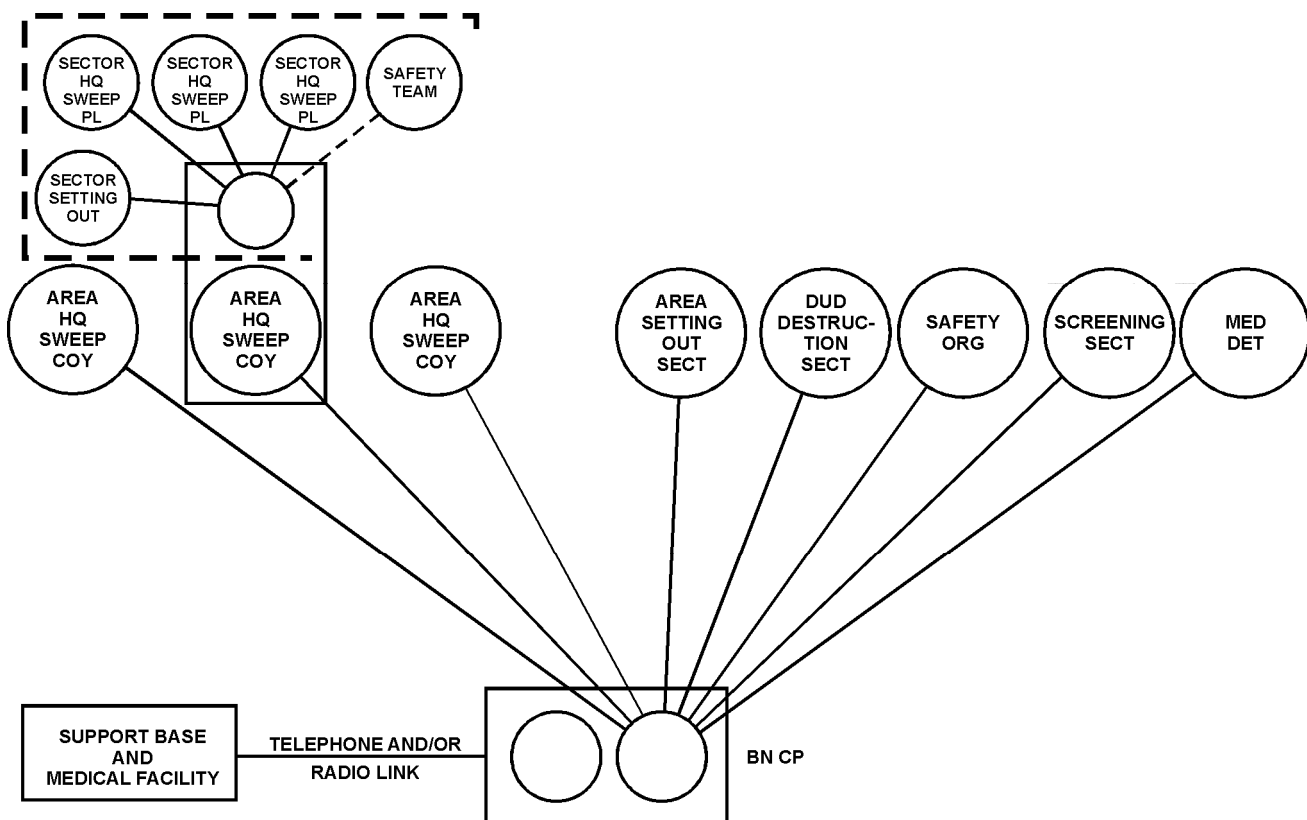


Figure 2F-2: Example of Battalion Level Clearance Communications

## 2F04. RANGE PREPARATION

1. The effectiveness of the clearance operation, especially for a surface clearance operation, will be improved by preparing the ground, as permitted under the environmental assessment (a screening or comprehensive study as per due diligence or regulatory requirements), prior to setting out. This normally involves removing vegetation (i.e. cutting or burning off the grass/scrubs and/or mulching trees/brush). Without removing vegetation, both the quality and the speed of the operation will be seriously downgraded. The best time to conduct range clearance is in the early spring as soon as the ground is sufficiently dry. Undergrowth has not yet begun to grow, and burning of dead grass, leaves and underbrush is practicable. Ideally, burning should take place approximately two weeks prior to the operation. Any burning or other vegetation removal measure undertaken must be in accordance with established Range Standing Orders and DND/CF environmental guidelines and regulations. Similarly, the use of a mechanical means (if available) will make a subsurface clearance easier.

## 2F05. SETTING OUT

1. **General.** Area and sector boundaries, artificial reference points, in and out routes, and any other control points are sited by setting out teams prior to the sweep operation. Setting out may be done concurrently with sweeping operations but must move well ahead of sweep teams. As setting out is done over un-swept ground, team movement must be controlled.
2. **Setting Out Teams.** Teams are used to set out and maintain area and sector boundary markings, establish artificial reference points, and determine in and out routes. These markings

should as much as possible use existing features such as roads or tracks, or follow natural features. They must be visible, and durable enough to remain for the duration of the operation. Since setting out is done in un-swept areas, teams must have received adequate training (see Chapter 2 Section 2) and be supervised by personnel familiar with ordnance likely to be encountered. They should have and be able to use electronic detectors to check areas before stakes are driven if the degree of hazard warrants this precaution. However, the Military Commander may authorize driving of stakes without electronic clearance. The setting out teams should also be capable of identifying, reporting and marking any UXO they locate.

3. **Setting Out Marking Stores.** Marking stores are cumbersome and thus each team requires a vehicle, which should be armoured if the area is highly affected by UXO. Teams are also required to check visually the path along which foot or vehicular traffic will follow in order to establish the boundary line. Area and sector boundary markings must be well defined. The use of highly visible markers denoting boundaries is necessary. Additionally, boundaries through underbrush and wooded areas may have to be cleared.

## 2F06. SWEEP OPERATIONS

1. **Composition and Formations.** The composition of sweep teams and formations employed to conduct sweeps will vary according to the level of sweep being undertaken. Terrain, vegetation cover and obstacles such as swamps and streams will also have an affect. Further details for sweep operations and examples of company level formations in close/broken and open terrain are contained in Appendices 1 and 2 for surface and subsurface clearances respectively.

## 2F07. UXO MARKING, REPORTING AND CONTROL

1. **General.** UXO or other items found by sweep teams not positively identified as non-munitions scrap (NMS) or safe munitions scrap (MS), are reported and marked by an easily recognizable marker (see Figures 2F-3 and 2F-4). Fluorescent pin flags on wire or plastic stakes will normally be used or, where vegetation growth necessitates, longer wooden stakes with tape should be used. The marker stake should be made visible by fluorescent paint, a flag or survey tape streamers. UXO numbers are marked on the stake or flag with a permanent marker pen. UXO control numbers are assigned in blocks to each area and sector, with prefixes and suffixes to identify units and sub-units. UXO records (see Annex G) are maintained by the Operations CP and Area/Sector CPs, and may also be held by the Sweep Platoon. In addition to filling in the form, the information is passed by radio (see Figure 2F-5). UXO Destruction Teams verify the information as they complete their tasks.

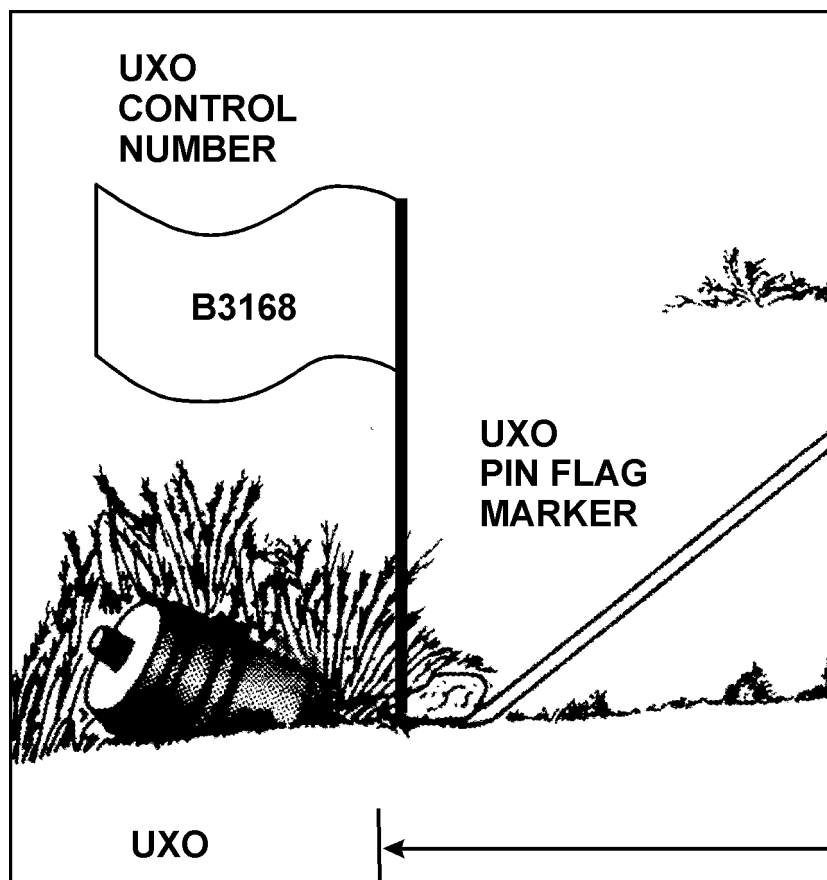


Figure 2F-3: Example of UXO Pin Flag Marking

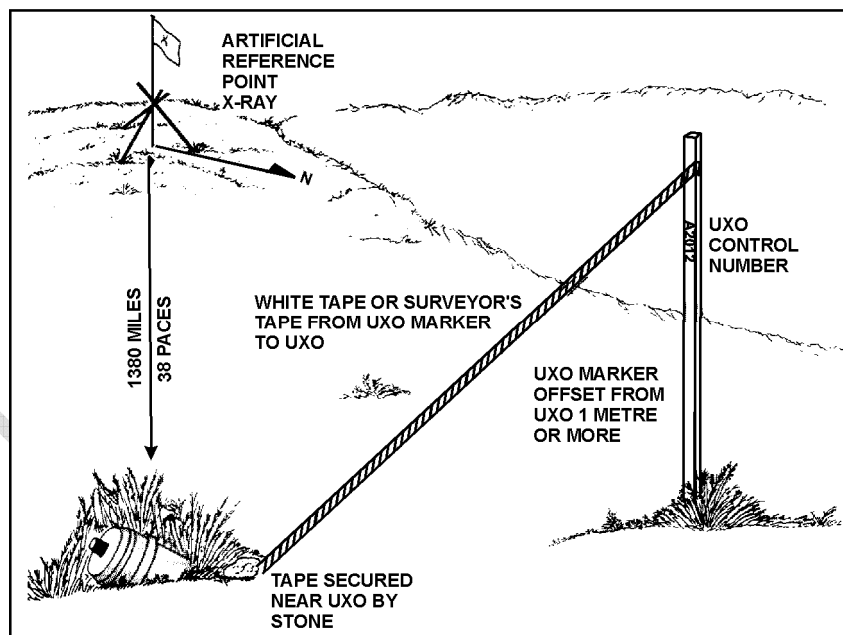


Figure 2F-4: Alternate UXO Location and Reporting Method Example

UXO Radio Report

**Alpha:** Number A 2012

**Bravo:** Grid 43829775 (GPS to sub-metre accuracy preferred)

**Charlie:** Four Point Two Inch Mortar, Suspected HE. Bearing from Reference Point X-Ray—1380 mils Magnetic/Distance 38 paces (if GPS not available)

Read Back, Over

**Figure 2F-5: Example of UXO Radio Report**

2. **Dealing with UXO and Scrap.** Identification, handling and disposal of UXO will only be done by qualified personnel (see Annex A Appendix 1). The following principles shall be applied when dealing with UXO, suspected UXO and scrap:

- a. UXO and other suspect items shall never be moved, disturbed or touched in any way. Any UXO item that contains or is suspected to contain CBRN material shall be handled in accordance with DND/CF policies and regulations. If CBRN UXO or suspected CBRN UXO is found, the guidance and procedures outlined in Annex C to Chapter 1 are to be followed.
- b. Prior to picking up any item on a range, **POSITIVE** identification of the item is mandatory. If any doubt exists, the item shall be marked, reported as suspected UXO and the UXO Recognition Advisor shall be consulted. Procedures described in Appendix 1 for Sweep Operations shall be applied.

**Note**

**Positive identification is achieved by the confirmation of a minimum of two data points (permanent in nature) in any configuration such as, documented and confirmed physical features, known and measured physical characteristics/dimensions, permanent markings (stamped, engraved, embossed, cast etc). Colour coding and or legible markings denoting the nomenclature may be indicators of proper identification, however they shall not be solely or in conjunction with each other relied upon to make a positively identification of a UXO. Colour coding and less permanent type markings may fade over time and/or have been re-marked incorrectly**

- c. Large items of scrap or partially buried scrap shall be treated as suspect and the UXO Recognition Advisor shall be consulted. These items shall only be moved if the UXO Recognition Advisor can positively identify that no UXO are either under, by or concealed within the item. Excavating/intrusive work required to verify that no UXO are under or concealed within the item shall apply procedures described in Appendix 2.
- d. Potentially hazardous UXO items shall be destroyed in place and shall not be moved for any reason. For safety reasons, any item that cannot be 100% visually inspected or safely physically probed shall undergo destruction procedures before transporting it to a designated disposal site. Render safe procedures (RSP) will not be employed.

3. **UXO Destruction Techniques.** Operations shall be conducted so that all personnel are clear of the range and accounted for prior to commencement of UXO destruction, while still allowing sufficient time to clear those UXO marked during that day's sweeping operation. A reconnaissance may be conducted while personnel are still in the area. Suspect UXO that can

be positively proven to be non-explosive can be removed immediately, cancelled from the UXO record form, and reported as such. Suspected UXO that prove to be explosive in nature or which cannot be positively identified as safe are left in place for perforation to determine the fill and/or destruction. Items shall only be destroyed after all personnel have cleared the area and UXO Destruction Teams will only operate during daylight hours. UXO will be destroyed in-situ by explosive means only, using non-electric initiation in accordance with C-09-008-002/FP-000 *Ammunition and Explosives Procedural Manual – Destruction of Duds and Misfired Ammunition on CF Ranges and Training Areas* and current Range Standing Orders. Perforations to expose/determine the fill must be in two locations attacking the initiation system and main filling to be considered safe to move. RSP will not be employed. Missiles and/or similar natures of ammunition shall only be disposed of by or under the supervision of personnel with the following qualifications:

- a. Ground Launched Anti-Aircraft/Anti-Tank Guided Missiles (e.g. TOW, Eryx, ADATS, Javelin, Starburst, Blowpipe, etc.):
  - (1) AGIB – Land Guided Missiles,
  - (2) AGIC – Guided Missile Instructor,
  - (3) AJFB - CMD Advanced, and
  - (4) if none of the above are available - an officer qualified AEXN (ATO) or MOSID 00169 Ammo Tech (Journeyman qualified after Dec 1998 or above);
- b. Air Launched Guided Missiles (e.g. AIM-7, AIM-9, etc.):
  - (1) AJFB - CMD Advanced (with missile phase),
  - (2) AJFB - CMD Advanced (without missile phase but with specific Air Force missile training), and
  - (3) if none of the above are available – an officer qualified AEXN (ATO) or MOSID 00169 Ammo Tech Supervisor

## 2F08. SCRAP SCREENING AND HANDLING

1. **General.** Proper screening of scrap, whether MS, NMS and hard target material in nature, is essential to ensure UXO are not unnecessarily handled and to minimize exposure of personnel to ammunition hazards. Training and qualifications for Screeners are at Appendix 1 to Annex A.
2. **Screening Procedures.** In all clearance operations there are three levels of screening, with final screening to include certifying whether or not an item is safe for transportation on public roads. Range scrap screening and certification shall be conducted in accordance with Annex D to Chapter 1. Sample documentation for certifying, tracking, handling and disposal of scrap as well as certifying scrap safe for transportation on public roads are in Annex F to Chapter 3 and are available from DEEM 2 or the DRPM 2 - UXO Legacy Sites Program. Range scrap screening consists of the following levels:
  - a. **Level One Scrap Screening** is done at the moment an item is found. Sweepers may pick up items of MS, NMS or hard target material which they **POSITIVELY KNOW TO BE HARMLESS**. If any doubt exists as to whether it is UXO, MS, NMS or hard target material, the UXO Recognition Advisor shall be consulted. All MS that is fuzed or cannot be physically probed to confirm the contents as



empty or safe, shall be treated as suspected UXO and be perforated in two locations (normally at the nose and base) prior to proceeding to Level Two screening.

- b. **Level Two Scrap Screening** is done at the scrap collection point by a Level Two qualified Screener (as per Appendix 1 to Annex A). Scrap is brought back to the Screeners and placed on the ground at the rear of the scrap vehicles. Each piece is individually inspected by the Screeners and loaded by the Screeners on the appropriate scrap vehicle. **ONLY SCREENERS SHALL LOAD SCRAP ON THE SCRAP VEHICLE.** If live or suspect items are being brought back by the Sweepers, the Screener will have the Sweep Team Commander halt the operation and detail the corrective action to be taken. For safety purposes, a second person must accompany the Screener.

**Note**

**Positive identification is achieved by the confirmation of a minimum of two data points (permanent in nature) in any configuration such as, documented and confirmed physical features, known and measured physical characteristics/dimensions, permanent markings (stamped, engraved, embossed, cast etc). Colour coding and or legible markings denoting the nomenclature may be indicators of proper identification, however they shall not be solely or in conjunction with each other relied upon to make a positive identification of a UXO. Colour coding and less permanent type markings may fade over time and/or have been re-marked incorrectly**

- c. **Level Three Scrap Screening** and certification safe for transportation on public roads is done by at least one Level Three qualified Screener (as per Appendix 1 to Annex A) at designated secure MS storage area(s). Each item must be individually inspected as it is unloaded from the vehicle and placed in the secure storage area. For safety purposes, a second person must accompany the Screener.

**Note**

**These three levels normally equate to at least three different persons visually inspecting each item**

**3. Handling Procedures.**

- a. **Scrap Collection Containers.** Scrap collection containers are used to collect scrap and to temporarily store it. MS, NMS and hard target material (if collected separately from MS) containers must be kept separate from each other and shall be clearly identified as to their contents. These containers should be secured to prevent dumping of unscreened scrap. Those storing MS must comply with MS storage criteria given in Annex D to Chapter 1 and appropriate regulations. Further details and guidance on scrap containers are provided in Annex D to Chapter 1.
- b. **Scrap Transport Vehicles.** Care must be taken to ensure only inert scrap material is loaded onto scrap transport vehicles. MS and NMS vehicles should therefore be separated. Further details and guidance on scrap transport vehicles are provided in Annex D to Chapter 1.
- c. **Scrap Disposal.** Scrap that is picked up during the sweep operation must be screened as described above before being consigned to a scrap vehicle or area.

- (1) MS shall always be separated from other scrap and be removed to a secure compound. MS shall not be buried nor placed in pits on the range or training area. Access to such MS piles must be controlled so that the munitions scrap pile remains completely free of explosive hazards. MS compounds will be clearly signed as to their purpose. MS, after appropriate Level Three screening can be sent to a designated DND/CF MS storage facility in accordance with Appendix 2 to Annex D to Chapter 1 or undergo an approved de-militarization process.
- (2) NMS may be disposed of in an appropriate manner (as scrap metal, wood salvage, garbage dump, etc.) after appropriate levels of screening are completed.
- (3) Hard target material, after appropriate screening in accordance with Appendix 1 to Annex D to Chapter 1 is deemed to be de-militarized and may, with the appropriate ITAR/CTAT certification, be disposed of through normal supply channels.

## **2F09. POST OPERATION REPORTS**

1. A report on range clearance operations must be completed and forwarded within three weeks of completion of the task. Orders for the operation will normally stipulate where the report is to be sent. However, for base initiated range clearance operations the post operation report will be sent through the operations chain of command where, as a minimum, the Annual Range and Training Area UXO Report (sample in Annex B to Chapter 1) or equivalent information from the CF Range Information System (CFRIS) shall be included as part of the ECS/L1 Sustainable RTA Management Plan (SRTAMP) in accordance with ADM(IE) Standard 1606-4000.1-S01-024 being submitted to ADM(IE). As well, an information copy of Annex B to Chapter 1 or CFRIS equivalent is to be sent to DAER.
2. Annex H details the minimum contents of the report. Anything additional, which will be of value to future operations, should also be included.

### **SECTION 3 PROCEDURES UNIQUE TO SURFACE CLEARANCE OPERATIONS**

#### **2F10. GENERAL**

1. Surface clearance operations are undertaken to dispose of all UXO and remove scrap that is visible on the surface. Unique procedures for surface clearance operations are described in Appendix 1, and must be read in conjunction with the common procedures detailed in this Annex.

### **SECTION 4 PROCEDURES UNIQUE TO SUBSURFACE CLEARANCE OPERATIONS**

#### **2F11. GENERAL**

1. Subsurface clearance operations are undertaken to dispose of all UXO and scrap (if required) below the surface to a given depth (normally to a depth of 45 cm for military active ranges). Subsurface clearance operations are normally carried out after a surface clearance or a surface sweep has removed all UXO and scrap on the surface. It is not mandatory to conduct a surface clearance prior to a subsurface clearance unless there is a high level of surface debris

that will affect detector readings. Special procedures for subsurface clearance where vegetation/undergrowth prevents an effective visual search may be required. Unique procedures for subsurface clearance operations are described in Appendix 2, and must be read in conjunction with the common procedures detailed in this Annex.

INTERIM 12 Apr 2011



## APPENDIX 1 TO ANNEX F TO CHAPTER 2 PROCEDURES UNIQUE TO SURFACE CLEARANCE OPERATIONS

### 2F101. GENERAL

1. Surface clearance operations are undertaken to locate and destroy all surface UXO and remove scrap that is visible on the surface. These unique procedures for surface clearance operations **SHALL** be read in conjunction with the common procedures laid out in Annex F.

### 2F102. RESPONSIBILITIES

1. **Command and Control.** Care must be taken to maintain the regular chain of command. The Sweep Team Commander must be able to exercise adequate control of the formation, and specialist personnel (UXO Recognition Advisor, Screeners and Safety personnel) must be able to perform their tasks and keep pace with the Sweep Team. Distances between Sweepers are based on vegetation cover and types of UXO, but should not exceed 3 m. The Sweep Team frontage depends on topography, level of UXO and volume of scrap.
2. **Task Responsibilities.** Sweep platoons/sections, augmented by a UXO Recognition Adviser and Screeners, are responsible for clearing all scrap from the sector as well as marking, recording and reporting the location of all UXO. They are not responsible for the UXO Destruction team. Areas that cannot be searched due to terrain constraints (excessive vegetation, swamps, etc.) must be clearly marked and recorded.

### 2F103. ORGANIZATION

1. The number of UXO Destruction, Setting Out and Screening teams depends upon the area to be cleared and the anticipated number of UXO. The exact number of teams will be determined by judgment and experience. The area to be swept and the land (e.g. trees, underbrush, swamps, etc.) will dictate Sweep Team size.

### 2F104. FORMATIONS

1. **General.** Formations to be adopted will be dictated by ground conditions. Only a detailed reconnaissance and experience can determine what is to be used and even then it will be necessary to modify these as the ground changes. Formations that have proven effective in the past are:

- a. **Company Sweep Formations (Open Terrain).** Figure 2F1-1 illustrates a company using the arrowhead formation for open terrain. It is the most flexible, provides good command and control, and is conducive to safety. It allows by-pass by other platoons should a platoon encounter obstacles or a heavily UXO affected area. The formation can be easily switched to an echelon, reversed echelon, and back to arrowhead without one platoon delaying the progress of others, while the company commander retains excellent control.

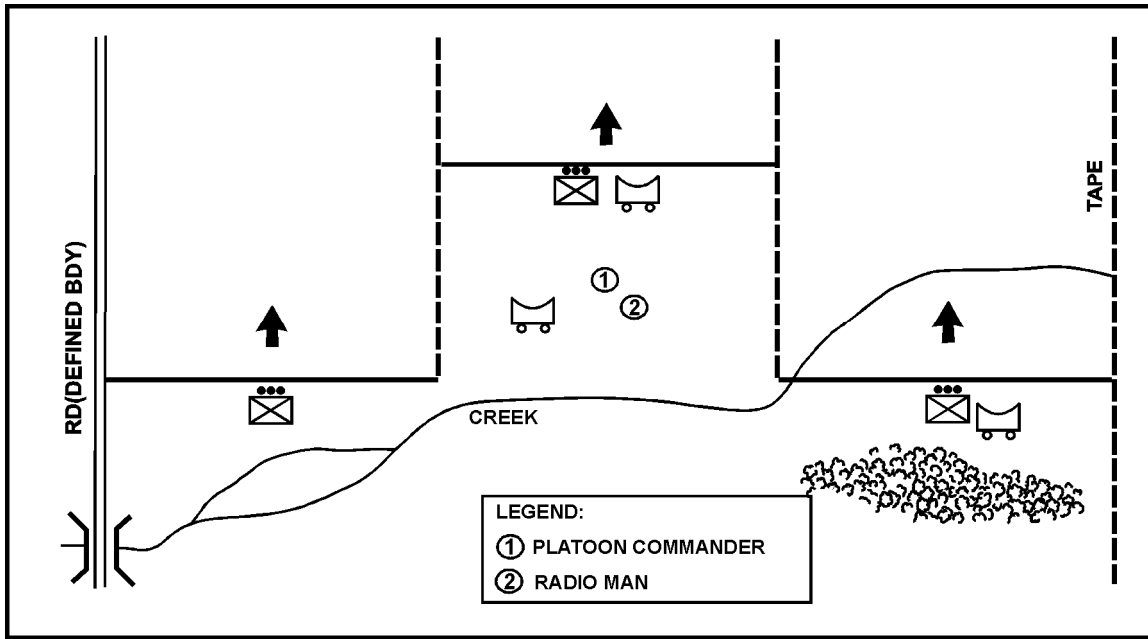


Figure 2F1-1: Company in Arrowhead Formation in Open Terrain

- b. **Platoon Sector (Close/Broken Terrain).** In close or broken terrain the company should employ platoon sectors (see Figures 2F1-2 and 2F1-3). Each platoon should be assigned a well-defined sector and control its own operation. The company commander roves to monitor overall control. To attempt to sweep close/broken terrain as a company operation is too slow, poses extreme control problems, and results in boredom for soldiers due to the frequent delays, which can itself lead to inattention and unsafe behaviour.

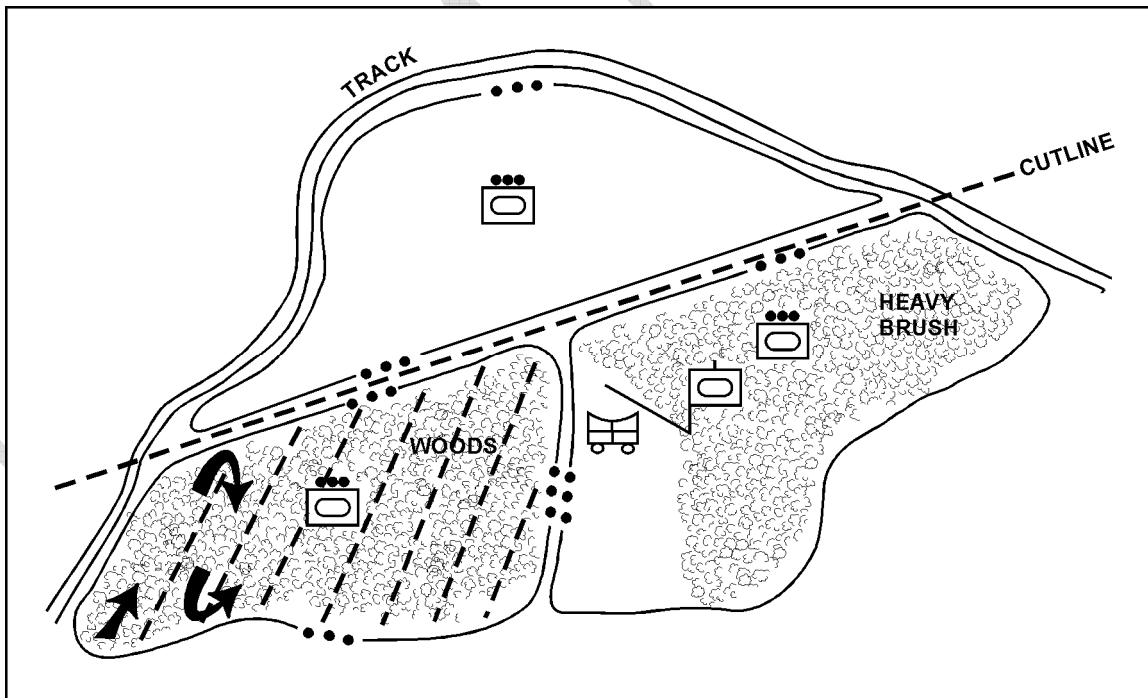


Figure 2F1-2: Company in Platoon Sector Formation in Close or Broken Terrain

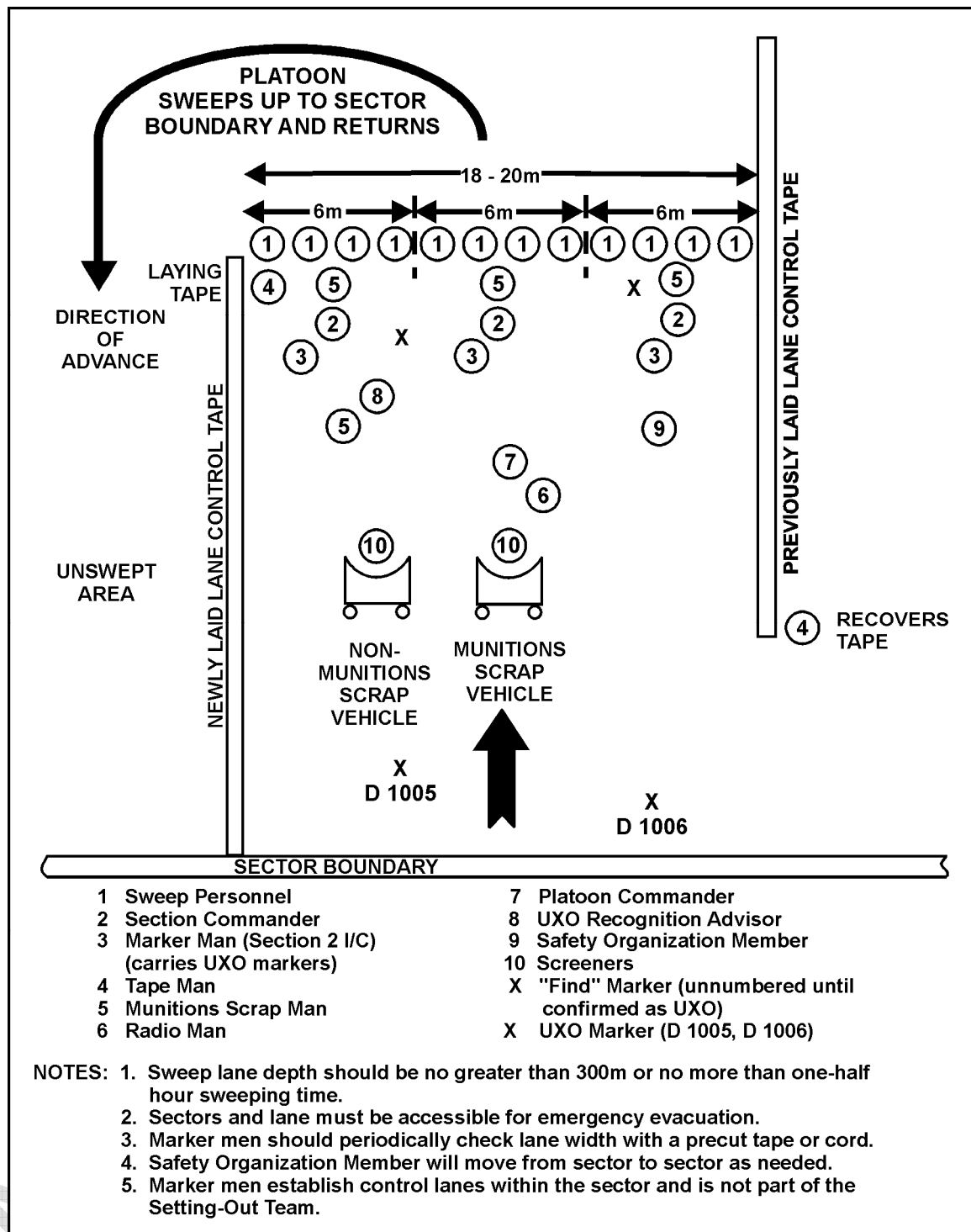


Figure 2F1-3: Platoon Sweep Team

- c. **Sweep Section.** In extremely close country, it may not be possible to sweep safely or effectively in line at the platoon level. Operations in these conditions will be carried out as a section sweep (see Figure 2F1-4).

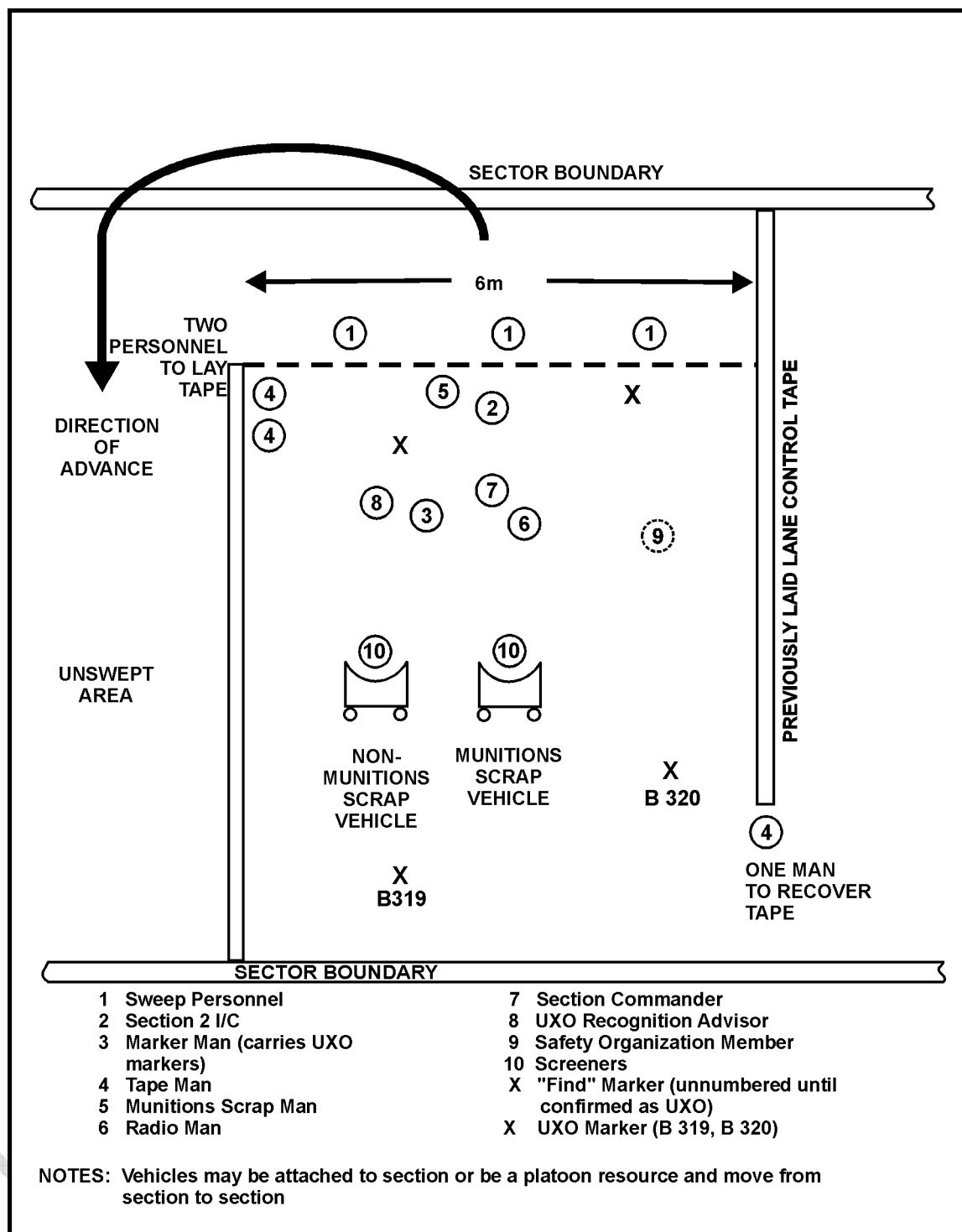


Figure 2F1-4: Section Sweep Team

## 2F105. PROCEDURES SPECIFIC TO SURFACE CLEARANCES

1. **Sweep Operation Procedures.** These procedures shall be read in conjunction with procedures set out in Chapters 1 and 2 for safety, training and overall conduct of the operation. Common procedures found in Annex F also apply. The purpose of the sweep is to clear the area of all surface scrap that is deemed safe to move while marking all UXO for disposal.



**SWEEPERS MAY ONLY PICK UP AN OBJECT THAT THEY POSITIVELY IDENTIFY AS MUNITION SCRAP (MS), NON-MUNITION SCRAP (NMS) OR HARD TARGET MATERIAL.** A UXO Recognition Advisor shall examine any doubtful objects and to determine its identity and condition. **UXO WILL NOT BE DESTROYED DURING A SWEEP OPERATION.** The procedure for dealing with MS, NMS and hard target material is described below:

- a. **Possible UXO.** The following procedure will be adhered to on detecting a possible UXO:
  - (1) Sweeper stops, holds up hand, and points to possible UXO.
  - (2) Sweep Section Marker (usually Section 2 I/C), inserts surveyor pin flag near the "find" and moves on.
  - (3) Sweep Team Section Commander does not get involved with the placement of the pin flag, but is concerned only with the uniform movement and control of the whole section.
  - (4) Sweep Team Platoon Sergeant and UXO Recognition Advisor move to the unmarked "find" marker and confirm the object. If the object is scrap, UXO Recognition Advisor shall pick up the MS and hand the scrap to the accompanying MS Collector. If the object is a UXO, the marker is numbered, recorded and the UXO reported.
  - (5) Sweep Team Platoon Commander is concerned with the movement and control of the whole platoon.
- b. **Scrap.** The procedure on detecting possible scrap is as follows:
  - (1) Sweeper pauses, positively identifies the object as MS, NMS or hard target material:
    - (a) If the Sweeper cannot positively identify the item as scrap it is treated as a suspected UXO.
    - (b) Large items of scrap or partially buried scrap shall be treated as suspect and the UXO Recognition Advisor shall be consulted. These items shall only be moved if the UXO Recognition Advisor can positively identify that no UXO are either under, by or concealed within the item. Excavating/intrusive work required to verify that no UXO are under or concealed within the item shall apply procedures described in Appendix 2.
    - (c) If **POSITIVELY** identified as NMS, the Sweeper places it in the NMS container carried by the Sweeper.
    - (d) If **POSITIVELY** identified as MS or hard target material by a UXO Recognition Advisor, it is passed to the MS Collector. Large hard target items may be marked and collected separately as required. For whole projectiles or items not **POSITIVELY** recognized by the Sweeper as safe to move or, if the item is fuzed or the contents of the fill confirmed, the UXO Recognition Advisor must confirm the object as safe to move.

#### Note

**Positive identification is achieved by the confirmation of a minimum of two data points (permanent in nature) in any configuration such as, documented and confirmed physical**

**features, known and measured physical characteristics/dimensions, permanent markings (stamped, engraved, embossed, cast etc). Colour coding and or legible markings denoting the nomenclature may be indicators of proper identification, however they shall not be solely or in conjunction with each other relied upon to make a positively identification of a UXO. Colour coding and less permanent type markings may fade over time and/or have been re-marked incorrectly**

- (2) Full NMS containers will be placed on the ground for Level Two screening and pick up by the NMS vehicle, thus maintaining the integrity of the sweep line. The location of these pails must be apparent and quite visible to ensure none are missed by the NMS vehicle.
- (3) Full MS containers shall not be placed on the ground for later pick-up. They shall be returned to the scrap sorting area by the MS Collector for screening by the Level Two Screener prior to being loaded on a MS vehicle. Therefore, the rate of advance may be greatly influenced by the rate at which the Screener can safely screen and load the screened MS on the MS vehicle. Unit command and control staff shall ensure that the sweep line does not outpace the MS vehicle, thereby increasing the likelihood of an accident.

- c. **Scrap handling.** Procedures set out in Annex F and Annex D to Chapter 1 shall be followed for collection, handling and screening of all scrap found. Specific instructions for handling hard target material are provided in Appendix 1 to Annex D to Chapter 1.

2. **UXO Destruction Teams.** All UXO will be perforated or destroyed by UXO Destruction Teams at a time deemed safe by the Military Commander. UXO fragments or items, once perforated and/or destroyed and positively identified as MS that can be safely moved, will be deposited for screening prior to loading on a munitions scrap vehicle. Once a UXO is destroyed, the hole is checked with a detector to ensure that it is free of any metallic objects. UXO destruction procedures are detailed in Annex F.

3. **Other Team Procedures.** Procedures for other teams are provided in Chapters 1 and 2, or relevant DND/CF documents.

## APPENDIX 2 TO ANNEX F TO CHAPTER 2

### PROCEDURES UNIQUE TO SUBSURFACE CLEARANCE OPERATIONS

#### 2F201. GENERAL

1. Subsurface clearance operations are normally carried out after a surface clearance or sweep in order to remove scrap and locate and destroy all UXO located below the surface to the specified depth. It is not mandatory to conduct a surface clearance prior to a subsurface clearance unless there is a high level of surface debris that will affect detector readings. If a surface clearance has not been conducted, the procedures contained in Appendix 1 shall be used in conjunction with the subsurface procedures listed here. Regardless, the procedures for subsurface clearance operations **SHALL** be read in conjunction with the common procedures laid out in Annex F and Appendix 1.

#### 2F202. RESPONSIBILITIES

1. **Command and Control.** Care must be taken to maintain the regular chain of command. The Sweep Team Commander must be able to exercise adequate control of the sweep formation, and specialist personnel (Prodder/UXO Destruction Teams, Screeners and Safety personnel) must be able to perform their tasks and keep pace with the Sweep Team. Distances between Sweepers are based on vegetation cover and types of UXO. Sweep Team frontage depends on topography, level of UXO and volume of scrap.
2. **Task Responsibilities.** Sweep platoons/sections, augmented by a UXO Recognition Adviser and Screeners, are responsible for locating, marking, recording and reporting the location of all UXO and scrap (if required) found at the depth specified. They are not responsible for Prodding and UXO Destruction teams. Areas that cannot be searched due to terrain constraints (excessive vegetation, swamps, etc.) must be clearly marked and recorded.

#### 2F203. ORGANIZATION

1. The number of Prodder, UXO Destruction, Setting Out and Screening teams depends upon the area to be cleared and the anticipated number of UXO. The exact number of teams will be determined by judgment and experience. The area to be swept and the land (e.g. trees, underbrush, swamps, etc.) will dictate Sweep Team size. Suggested organizations are shown at Figure 2F2-1.

#### 2F204. FORMATIONS

1. **Platoon Formations.** Subsurface clearance operations are best conducted based on a platoon organization deployed by sections, with the section commander assuming sector responsibility. Since it is unlikely that there will be surface UXO or scrap remaining after a surface clearance operation, subsurface clearance operations will not normally require a UXO Recognition Advisor. Suggested platoon formations that have proven successful in the past are shown at Figures 2F2-1 and 2F2-2.

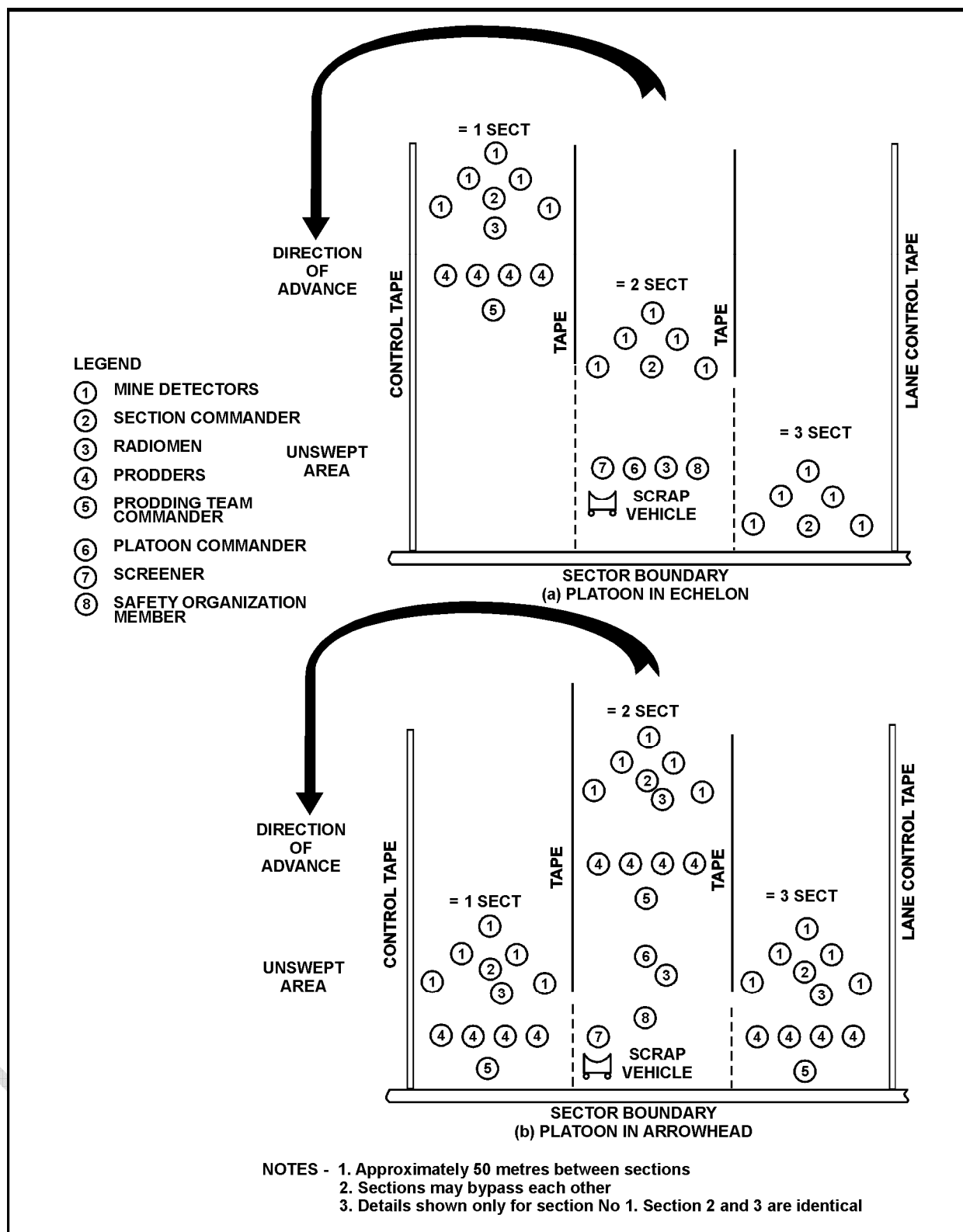


Figure 2F2-1: Subsurface Clearance Basic Platoon Organization and Formation

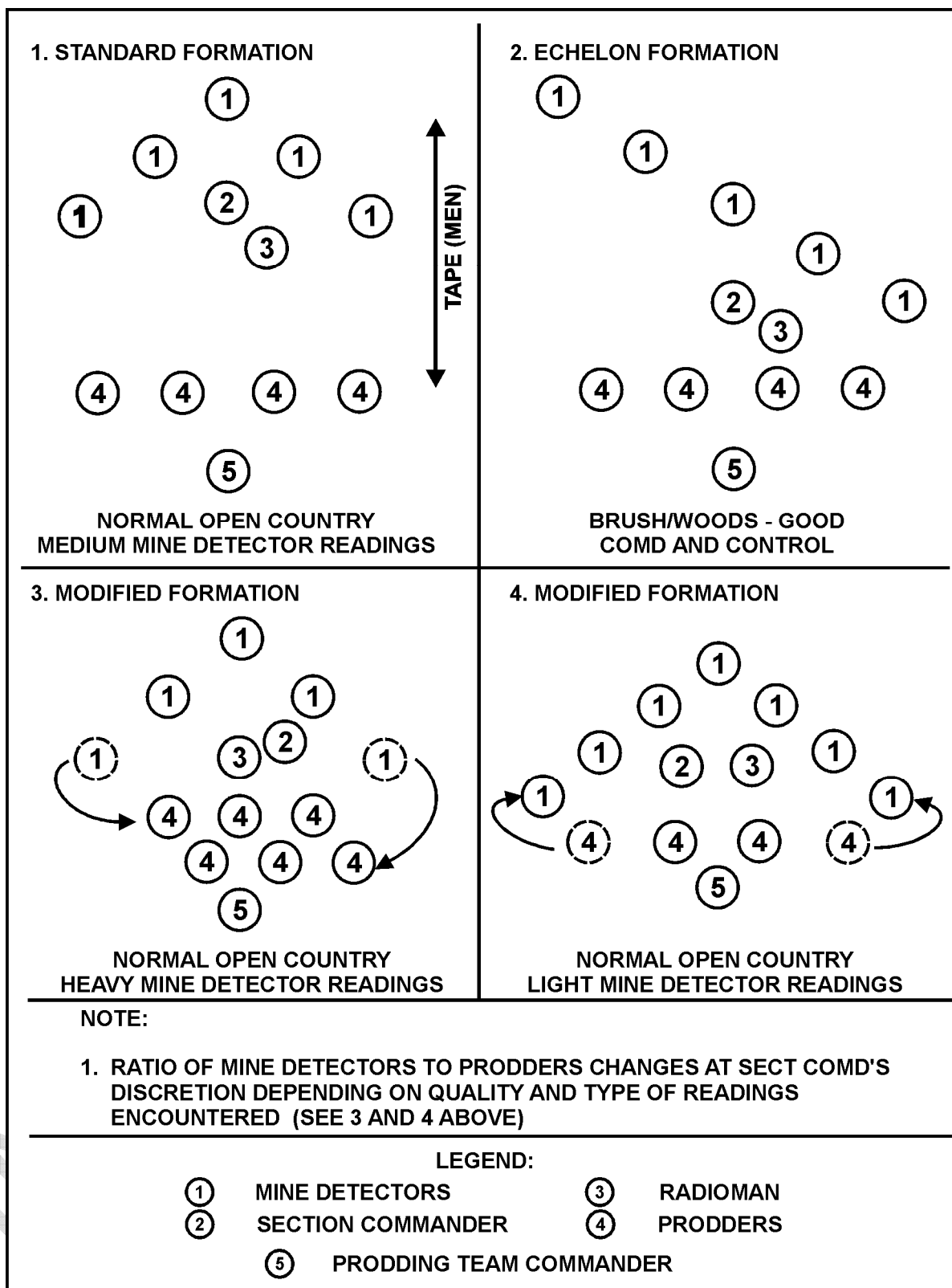
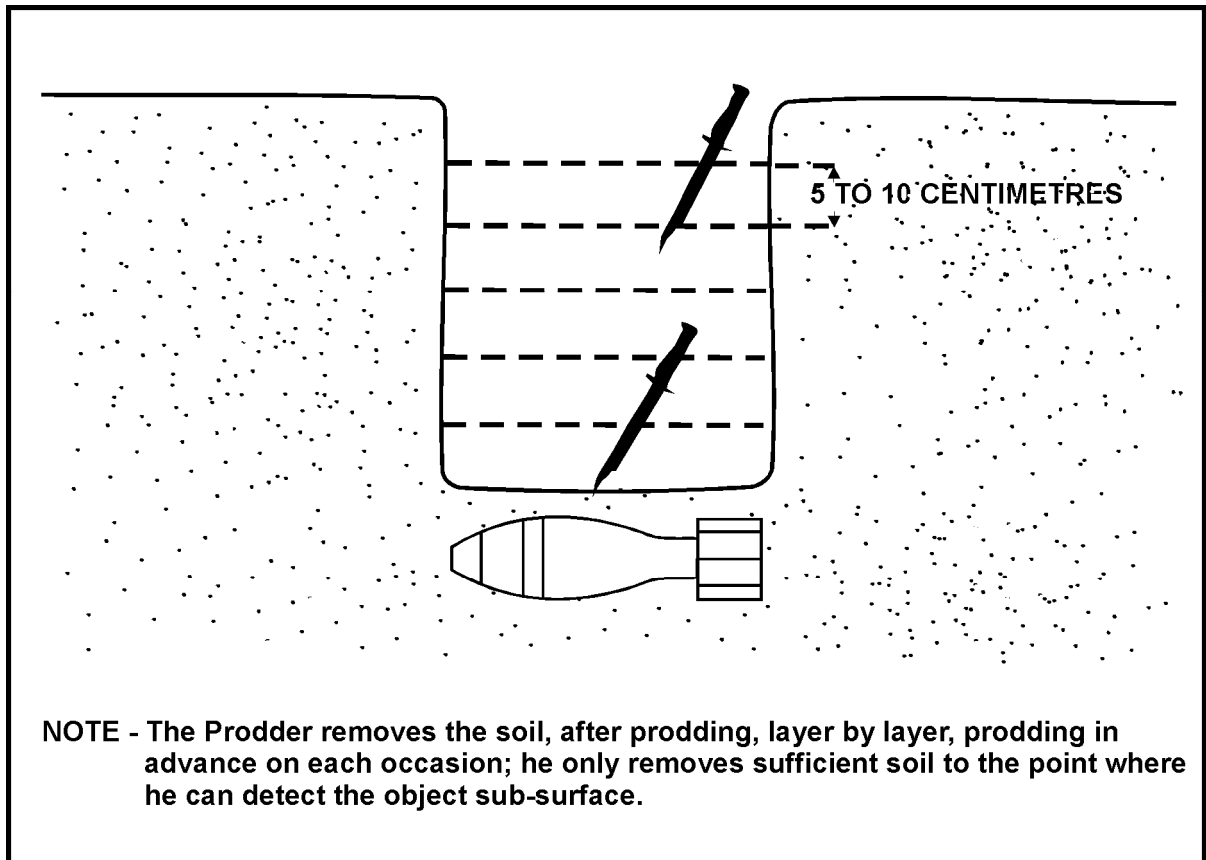


Figure 2F2-2: Subsurface Clearance Section Formations Applied to Ground

## 2F205. PROCEDURES SPECIFIC TO SUBSURFACE CLEARANCES

1. **General.** These procedures shall be read in conjunction with procedures set out in Chapters 1 and 2 for safety, training and overall conduct of the operation. Specific common procedures found in Annex F will also apply.
2. **Sweep Team.** The Sweep Team sweeps the lane to locate buried objects using an in-service mine or other type of detector. It is not this section's function to excavate and identify the buried find. Once the detector locates an object it is marked with a "find" marker and the sweep team moves on. A find marker can be a pin flag, a nail with a piece of tape, or a picket laid on the ground with the head pointing to the area of the mine detector's reading. Since there may be UXO left over from the visual sweep, the section commander must be familiar with UXO that may be encountered. Adjacent detectors must be spaced far enough apart to minimize electronic interference. Approximately one meter is recommended. The sweeping motion used by the detector however must overlap with the sweep of the adjacent detector and/or lane control tape to ensure no UXO are missed. Detector personnel should be rotated frequently to avoid fatigue-induced carelessness.
3. **Prodders.** Once the Sweep Team moves on and are a safe distance away, prodders come forward to investigate the buried find. The Prodding Team should make use of more sophisticated detector equipment, such as a bomb locator, which will pin-point the reading originally detected by the detector. This will normally reduce the amount of time prodding. Prodders do **NOT** excavate to expose the find. They merely define the size of the object and thus determine whether it is UXO or scrap. By using a prodder and carefully prodding the find, the prodder can establish the shape and size of the find, as follows:
  - a. **Small Objects.** If the object turns out to be small (under 5 cm), it is more than likely fragments or other non-offensive scrap such as 0.50 cal projectiles or casings. The prodder then carefully removes the soil until the object is exposed (see Figure 2F-3).
  - b. **Large Objects.** If the object proves to be large (greater than 5 cm), then the prodder will **NOT** attempt to excavate the find. He will leave this task to the Prodding Team Commander who is more qualified to excavate and identify. If the Prodding Team Commander determines that the find is a UXO or possible UXO, it will be marked, recorded and reported. Before the team commander starts to excavate, prodders **must** have moved a safe distance away.
  - c. **Deep Objects.** If the object is deeper than the length of the blade of the prodder, the prodder is permitted to carefully remove soil, 5 to 10 centimetres at a time (see Figure 2F2-3), so that the blade can make contact with the find. Once contact is made, the procedures mentioned above will be followed. If prodders or Prodding Team Commander are in doubt, they will treat a find as a possible UXO and leave it for the UXO Destruction Team.



**Figure 2F2-3: Example of Prodding and Soil Removal**

4. **UXO Destruction Teams.** Every find that has not been excavated by the Prodding Team Commander is excavated by UXO Destruction Teams. They will then proceed to destroy all UXO at a time deemed safe by the Military Commander. UXO fragments or items, once positively identified as munitions scrap (MS) that can be safely moved, will be Level Two screened prior to loading on a MS vehicle. After a UXO is destroyed, the hole and immediate surrounding area is to be checked with a detector to ensure that it is free of any metallic objects. UXO destruction procedures are detailed in Annex F.
5. **Scrap handling.** Procedures set out in Annex F Appendix 1 and Annex D to Chapter 1 shall be followed for collection, handling and screening of all scrap found. Specific instructions for handling hard target material are provided in Appendix 1 to Annex D to Chapter 1.
6. **Other Team Procedures.** Procedures for other teams are provided in Chapters 1 and 2 or relevant DND/CF documents

## **2F206. PROCEDURES SPECIFIC TO SUBSURFACE CLEARANCES (MODIFIED FOR DENSE VEGETATION)**

1. Modified subsurface clearance procedures are undertaken when vegetation undergrowth prevents effective visual surface search of an area. In such cases a UXO Recognition Adviser, located immediately behind the Section Commander, must be added to each sweeping section. In addition, MS Collectors, Non-Munitions Scrap (NMS) Collectors, and MS and NMS vehicles must be provided for each Sweep Team. Scrap collectors will follow the detector operators. Procedures for surface MS/NMS scrap pick up are detailed in Appendix 1. Prodding, UXO destruction and scrap handling procedures remain the same as detailed above.





**ANNEX G TO CHAPTER 2**  
**UXO REPORT AND RECORD SHEET**

UNIT/SUB UNIT		FOR USE OF UXO DISPOSAL TEAMS ONLY			
NAME					
C/S					
UXO CONTROL #	GRID REF/LOCATION	DEPTH	TYPE OF UXO AND LOCATION (Note 4)	ACTION TAKEN	DISPOSAL TEAM I/C SIGNATURE

**Notes:**

1. Complete this sheet at sector level and report to Area Control CP by radio (C/S of sub-unit grid UXO type location).
2. Deliver completed sheet(s) to Area Control CP by xxxx hrs daily.
3. UXO Disposal Teams pick up completed sheet(s) at Area Control CP at xxxx hrs and return by the end of the day, indicating that all UXOs have been identified, destroyed/disposed of and UXO marker stakes recovered.
4. Give detailed description of UXO location (e.g. "North end, centre of copse marked by red surveyors tape to edge of track 50 m NE of copse").
5. These forms will be produced locally.



## **ANNEX H TO CHAPTER 2 POST OPERATION REPORTS**

1. On completion of a clearance operation, a Post Operation Report must be completed as directed in the Op O. The report covers the operation in detail and includes maps, photographs, UXO Record Sheets, and other records as necessary. As a minimum the following information is to be included in the report (in both paper and electronic formats):
  - a. Unit(s) and groups carrying out the operation.
  - b. Duration of the operation.
  - c. Area cleared (m<sup>2</sup>/acres/hectares), level of clearance (e.g. surface/subsurface), depth (if subsurface) and residual risk factor (e.g. Type 3).
  - d. Number of personnel employed, identified by units and groups.
  - e. Man-hours expended in the operation.
  - f. Types and numbers of UXO found, destroyed and/or left in place.
  - g. Types and numbers of intact functioned EO classified as munitions scrap (MS) (shell casings, inert rounds, etc.).
  - h. Map indicating the locations of UXO found.
  - i. An estimate of scrap removed (kilograms) by type (MS and non-munitions scrap).
  - j. Location of secure MS compound.
  - k. Lessons learned.
  - l. Comments and suggestions to improve procedures or techniques.
  - m. Information or data of historical interest (location of abandoned ranges, high-density areas, unusual or unidentified ordnance encountered, etc).
  - n. An annex, written by the Safety Officer, detailing comments and suggestions to improve safety organization operations.
  - o. A photographic record (digital photos, video, etc.) recording the operation including briefings, training sessions, practices, sweep and screening operations, UXO destruction, and scrap disposal, as well as photographs of UXO and other material (with linear reference included) found during the operation. This package will be used to train future range clearance personnel and as background for future clearances at that site.
2. The introduction of sustainable range programs for active sites will require establishing and maintaining a Conceptual Site Model (CSM) for all sites. Until a fully developed CSM is promulgated, the use of an electronic means such as the CF Range Information System (CFRIS) is encouraged to facilitate annual reporting requirements detailed in Chapters 1 and 2. Range clearance operation input into a Base/Wing range and training area CSM is through the Site UXO Model (SUM). The SUM captures a geo-referenced record of all UXO and other items found, identified and removed or left on the range. It also includes any other data (in text and graphics) found, discovered or learned during the operation. The information contained in the SUM will facilitate future clearance operations and assist in range maintenance determinations. An electronic format in an approved DND GIS tools, standards and architecture is the preferred method.



## CHAPTER 3 CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES

### SECTION 1 GENERAL

#### 301. GENERAL

1. Commercial contracting for UXO services (i.e. UXO avoidance and range/UXO surveys and clearances) is the preferred method for UXO activities on legacy sites, and has become the norm for range clearance/UXO activities on DND/CF sites.
2. Authority for DND range clearance/UXO activities policy and expertise for contracted UXO activities resides in ADM(IE) through the Directorate of Real Property Plans (DRPP) 5 - ADM(IE) Range and Training Area Coordinator (RTA Coord)/ for policy and, for technical issues, the Directorate of Environmental Engineering Management (DEEM) 2 (DND centre of excellence for DND sites and contracted range clearance/UXO activities), with input from Subject Matter Experts (SMEs).
3. ADM(IE), through the UXO Sites Sub Committee (UXOS SC), collects and monitors information on planned contracted range clearance/UXO activities work for both legacy and DND sites. ECS/Level 1 (L1) organizations that have been designated custodianship and control of sites can report contracted range/UXO activity information on their UXO activities annually as part of their Sustainable RTA Management Plan (SRTAMP) in accordance with ADM(IE) Standard 1606-4000.1-S01-024 *Sustainable Range and Training Area Management* and provide intermediate updates for Category A and B sites contracted UXO clearance activities to the UXOS SC. These reports can be taken directly from the CF Range Information System (CFRIS) or for those not using CFRIS, through individual submission of copies of Annex B to Chapter 1.
4. This manual deals only with conventional UXO. Any UXO that contains or is suspected to contain CBRN material shall be handled in accordance with DND/CF policies. If CBRN UXO or suspected CBRN UXO is found, procedures outlined in Annex C to Chapter 1 are to be followed.

#### 302. RESPONSIBILITIES

1. **DND**
  - a. **General DND Responsibilities**
    - (1) DND is delegated authority by Natural Resources Canada (NRCan) over compliance with and enforcement of the *Explosives Act* (R.S. 1985, c.E-17) in regards to UXO activities and services in Canada. DND is responsible for providing the standards, regulations, procedures and/or guidelines for contracted UXO activities and services in Canada for the following:
      - (a) Civilian UXO worker training and qualifications.
      - (b) UXO (Ammunition) and explosive accident and incident reporting,
      - (c) Transportation, screening and disposal of munitions scrap (MS),
      - (d) UXO (Ammunition) and explosive safety program; and

- (e) Destruction of UXO.
  - (2) DND is the owner and technical authority for the project. As such, DND assumes project management responsibilities including management and direction, through the Contracting Authority (CA), of the contractor's work.
  - (3) For the Request for Proposal (RFP) stage of the contracting process, DND is responsible for developing the Statement of Work (SOW)/Statement of Requirement (SOR) document, establishing technical evaluation criteria, and conducting the technical evaluation of submitted proposals.
  - (4) DND is responsible for obtaining departmental and government approvals required to implement the project and approve funding.
  - (5) DND will provide the contractor with access to any existing DND information, such as drawings, reports, notes and correspondence, that will aid in the contractor's work. Such documents shall be returned to DND on termination of the contract.
  - (6) DND will review the contractor's work from a general perspective, to ensure that governmental and departmental policies, and overall project objectives and requirements, have been met. DND will not, except for explosive safety issues as per the delegated NRCan responsibility, conduct detailed checks of the contractor's work for accuracy, coordination or technical adequacy, as these issues are the contractor's responsibility and done by the CA on behalf of DND.
  - (7) DND will designate where and how to transport Level Three screened and certified munitions scrap (MS) containers to the designated DND holding area on completion of the UXO activities work.
  - (8) DND will, through DND/CF or contracted resources, provide an Environmental Assessment (a screening or comprehensive study as required by regulation or as due diligence) for the task/project.
  - (9) DND shall be responsible for handling and disposal of any item containing CBRN material as defined in DND/CF policies and regulations.
- b. **Specific DND Responsibilities.** The following responsibilities can only be exercised by a DND employee or a CF member:
- (1) **Project Sponsor.** The task/project sponsor initiates the requirement for the UXO clearance activity and provides the funding.
  - (2) **Project Leader (PL).** The PL is accountable to the Deputy Minister for the overall management of the project. The PL is normally the L1 sponsor of specifically delegated in accordance with the PAG criteria. The PL responsibilities may transfer from the Project Sponsor to the Project Implementor.
  - (3) **Project Director (PD).** The PD is responsible to the task/project sponsor. The PD defines the scope of the work to be performed and provides or obtains overall approval for the task/project execution and funding. The PD, on behalf of the DND/CF Project Authority, defines the security implications and requirements for the task/project and staffs the Security Requirements Checklist in accordance with National Defence

Security Instructions and Controlled Goods provisions under the *Defence Production Act* (R.S. 1985, c.D-1).

- (4) **Project Manager (PM).** The PM is the formal point of contact between the contractor team, the CA and DND. The PM is responsible to the PD for day-to-day management of the project and is the liaison between the contractor, the CA and other DND elements related to the contract. The PM is also responsible to ensure the various approvals are in place and coordinates DND's review of the contractor's work.
- (5) **Project Officers (POs).** Although control for the project will remain with the PM, the PM may designate DND POs to assist in project management activities. POs are responsible to the PM. They provide guidance, direction, information and departmental policy within their disciplines. They will monitor the contractor's progress from their discipline perspective and advise the PM of the technical merits of the contractor's recommendations and work.

2. **Contracting Authority (CA) Responsibilities.** The CA (Defence Construction Canada (DCC), Public Works & Government Services Canada (PWGSC) or other appropriate contracting agency) is responsible for:

- a. providing contractor and contracting services on behalf of DND;
- b. the overall contractor selection process (including soliciting and evaluating RFPs, evaluating the cost element of proposals, and appointment of contractors);
- c. the award and administration processes for the contracts;
- d. the management of the contract to ensure all aspect of the RFP, including Quality Assurance, are adhered to; and
- e. ensuring that the DND PM is informed of any deviations from the contractor's accepted Work Plan and any changes to the contract.

3. **Quality Assurance Representative (QA Rep).** A QA Rep may be engaged by DND through DND resources or contracted sources to oversee the UXO activity contractor's QC and Work Plans. The QA Rep reports directly to the CA and is the first point of contact for contractual procedures, safety and quality issues. All aspects of the contractor's work will be scrutinized and any deviation from an acceptable standard will be reported to the contractor by the QA Rep. QA checks will be conducted in accordance with the QA Plan.

4. **DND On-Site Representative (DND On-Site Rep).** A DND On-Site Rep will normally be engaged by DND through DND resources or contracted sources as the DND technical representative to ensure the contractor's work meets the DND project objective and provide the Point of Contact for DND oversight issues. The DND On-Site Rep reports directly to the DND PM and is the first point of contact for UXO/explosive procedural/safety and other DND oversight issues. Unless otherwise directed in the SOW/SOR, the DND On-Site Rep will review and approve all UXO intrusive investigations, UXO handling/moving actions or UXO destruction activities prior to implementation to ensure adherence to the regulatory and safety requirements. The DND On-Site Rep will seek approval/confirmation from the DND PM for any issue/procedure outside of the approved Work Plan or where they feel it is outside their expertise. The DND On-Site Rep must ensure the CA or their representative on the site is kept informed and that no changes are initiated without the approval of and appropriate documentation by the CA. The DND On-Site Rep and QA Rep may be the same individual unless safety and/or liability issues preclude this.

### Note

**In accordance with the security requirements contained in Chapter 1 Section 2, if the contractor is tasked to handle, control or destroy UXO, the DND On-Site Rep must be a DND employee, CF member or a DCC employee acting as DND's technical representative unless the contractor is registered with PWGSC Controlled Goods Directorate**

5. **Range/UXO Survey/Clearance Contractor's Responsibilities.** The contractor is legally and professionally responsible and accountable for the proper execution of all work identified in the SOW/SOR as being the contractor's responsibility. DND review and acceptance of the contractor's work does not relieve the contractor of responsibility for the completeness and accuracy of their Work Plan and Standard Operating Procedures (SOPs). The DND review also does not relieve the contractor from ensuring all licenses, permits or qualifications are in accordance with federal, provincial or municipal laws/regulations for the site are obtained prior to commencing work, or that the equipment and workers required to complete the contracted work are obtained and properly cared for during the duration of the work. Specific responsibilities, deliverables, constraints and other details will be included as part of the task/project SOW/SOR.

## 303. SAFETY

1. **General.** Safety during contracted range clearance/UXO activities is paramount and is governed by established practices for UXO work and federal/provincial work place safety regulations. Contractors are required to prepare and submit a Health, Safety and Emergency Response Plan (HSERP) as part of their proposed Work Plans. The HSERP must be evaluated and accepted as part of the contract assessment. The guidelines provided in Chapters 1 and 2 may be used as the basis of these evaluations in conjunction with federal/provincial regulations.

2. **Escort Requirements.** Appropriately qualified UXO person shall escort any non-UXO qualified personnel in areas that are or are suspected of being affected by UXO unless:

- a. the area has been surface cleared;
- b. the activities being undertaken by the non-UXO qualified personnel are non-intrusive or do not entail the physically handling of UXO; and
- c. the assessed residual UXO risk permits un-escorted movement in the area.

3. **Supervision.** Proper supervision within any UXO activity is an important element in the safe conduct of UXO work. Contractors are required to prepare and submit a Work Plan and SOPs that specifies the level of supervision proposed for each task and the qualifications of the supervisors. These must be evaluated and accepted as part of the contract terms in order to have the confidence that the proposed level of supervision and qualifications of the supervisors promotes a safe working environment.

4. **Safety Distances.** The minimum safety distances commensurate with the assessed potential blast and fragmentation risk and measures proscribed in DND/CF explosive safety manuals and Annex E shall be adhered to during any UXO intrusive investigation, handling/moving action or destruction procedures.

## 304. TRAINING

1. Site specific and refresher training are mandatory and deemed essential to ensure safety on the site. This is particularly important on legacy sites or any other site where UXO from vintage ammunition and explosives are likely to be encountered. Contractors are required



to prepare and submit a Training Plan as part of their proposed Work Plans. The Training Plans must be evaluated and accepted by DND as part of the contract assessment. The guidelines provided in Chapters 1 and 2 should be used as the basis of these evaluations in conjunction with the direction provided in Annex A.

### **305. QUALIFICATIONS**

2. Qualifications of contracted personnel deemed acceptable to DND for work on DND/CF contracted clearance activities are approved by Directorate of Ammunition and Explosive Regulation (DAER) and available from the Directorate of Real Property Management (DRPM) 2 – DND UXO and Legacy Sites Program (UXO Legacy Sites Program) or DEEM 2. A listing of these qualifications and the expected duties normally associated with DND contracted UXO work can be found at Annex A.

### **306. RECORDING AND REPORTING OF CONTRACTED RANGE CLEARANCE /UXO ACTIVITIES**

1. **General.** Recording and reporting issues for range clearance/UXO activities are covered in Chapter 1 Section 2 and detailed in Annex C. Specific details for any contracted range clearance/UXO activities shall be included in the SOW/SOR.
2. **Conceptual Site Models (CSM).** The introduction of sustainable range programs for DND sites and the UXO Legacy Sites Program Legacy Sites Database requires establishing and maintaining a Conceptual Site Model (CSM) for all sites. The input into a CSM from a range clearance/UXO activity will be through the Site UXO Model (SUM). An electronic format in an approved DND GIS tools, standards and architecture is the preferred method.
3. **GIS.** Any GIS shall use ADM(Information Management) accepted and supported tools in a standardized GIS warehouse that meets Chief of Force Development approved DND/CF GIS standards and guidelines (see CF Interoperability Standards list)

### **307. ENVIRONMENTAL, ARCHAEOLOGICAL, HISTORICAL, CULTURAL AND ABORIGINAL CONSIDERATIONS**

1. Environmental, archaeological, historical, cultural and aboriginal issues pertaining to range clearance/UXO activities shall be incorporated in all phases of the activity. Further details are provided in Chapter 1 Section 2.

## **SECTION 2 CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES PROCESS**

### **308. GENERAL**

1. The process for contracting UXO services is similar to any other DND contracted service and is governed by DND rules and regulations for contracting, task/project management and financial accountability. Contracted range clearance/UXO activities have three distinct elements. The first, Technical Authority management, involves DND personnel who identify the requirement, prepare project and contract-related documentation, and manage the task/project. The second element, Contract Authority (CA) management, involves the CA (PWGSC, DCC or other as applicable) personnel who prepare the contract documents required to engage and manage the final element, the civilian contractor who executes the contract. A similar five phases to that described in Chapter 2 (Warning/Planning, Preparation, Deployment, Execution

and Redeployment) are followed, but use DND task/project management terms as outlined below.

2. The main project process reference is the Project Approval Guide (PAG). Specific application of the PAG for contracted range clearance/UXO activities are in the DEEM Procedures Manual and the UXO Legacy Sites Program Legacy Sites Management Framework process which are available from DEEM 2 and DRPM 2 - UXO Legacy Sites Program respectively to provide further details and guidance on these processes.
3. As with any other project, due regard for environmental, archaeological, historical, cultural and aboriginal concerns must be undertaken at all levels and stages.

### **309. RANGE CLEARANCE/UXO ACTIVITIES SOW/SOR**

1. The SOW/SOR should designate the results required within the safety and other constraints that may apply. It should not specify how the results are to be achieved. In this way, the responsibility for results rests with the contractor. Sample SOW/SORs and technical assistance for preparation of contracted UXO avoidance, range/UXO surveys and range/UXO clearances are available from DRPM 2 - UXO Legacy Sites Program for legacy sites or DEEM 2 for DND/CF sites.

### **310. RANGE CLEARANCE/UXO ACTIVITIES PROCESS PHASES**

1. **General.** The phases listed here (Initiation/Identification, Development/Options Analysis, Definition, Implementation and Close-Out/Termination) represent those reflected in the generic DND/CF project management process as presented in the departmental Project Approval Guide (PAG) and the PAG(IE). A copy of the PAG(IE) UXO Process Map is enclosed at Annex B. The size, complexity along with the unique situations posed by each site may require the process to be amended to cater to the unique requirements for a particular site. As well, the selection of the project type (stand-alone, omni-bus, phased, etc.) will require the process to be tailored. While the phases may require tailoring, the basic tenets of the process of identifying the requirement, implementing a solution and recording the results, all backed by the appropriate approval/authorization documentation, remains unchanged. The following examples highlight the need for the PD and PM to determine, in conjunction with DND/CF project approval SMEs and the CA, on the type and nature of the project process:

- a. If there is sufficient information from the outset to allow proceeding directly to implementing the solution, the project may proceed from initiation to implementation with only a development/options analysis phase or without either of the development/options analysis or definition phases;
- b. If there is not sufficient information from the outset to allow proceeding directly to implementing the solution but there is no requirement for trials/tests, etc., the project may proceed from development/options analysis phases without requiring the definition phase; or
- c. If, due to the complexity or size of the project, an Omni-bus or phased project is selected, there may be multiple definition and/or implementations phases for each phase, sub-site or "child" project within the overall site/project.

2. **Project Initiation/Identification Phase.** During this phase the DND Project Leader/PD, in consultation with specialists, initiates the task/project and will undertake an estimate to determine the possible scope of work required. The estimate will determine such things as: the types and extent of suspected UXO; the intended end use of the area; the degree of risk

involved; whether a range/UXO survey is required; etc. Once the project is defined, a plan of action and estimated costing is prepared. The details found in Chapter 2 Sections 2 and 3 for the Planning Phases of a military survey/clearance may be of assistance. For legacy sites, particular attention must be paid to interviewing retired range users, caretakers and local residents for information.

3. **Project Development Phase/Options Analysis Phase.** This phase commences on approval of the appropriate DND task/project approval documentation (Synopsis Sheet (Identification) (SS(ID) for larger projects or the corresponding ECS/L1 document for smaller tasks/projects). Upon task/project approval by the appropriate authority, project documentation (Charter, Plan, etc.) and contract documentation (SOW/SOR, RFP, etc.) is prepared in conjunction with the CA (PWGSC, DCC or other as applicable) to gather the information required to conduct an options analysis and recommend a preferred option (historical research, surveys, investigations, etc.).

4. **Project Definition Phase.** This phase commences on approval of the appropriate DND task/project approval documentation (Synopsis Sheet (Preliminary Project Approval) (SS(PPA)) for larger projects or the corresponding ECS/L1 document for smaller tasks/projects). Upon approval by the appropriate authority, project documentation is updated and contract documentation (SOW/SOR, RFP, etc.) is prepared in conjunction with the CA to refine methods to mitigate the risk, try/test new technologies or conduct trials to better define costs and/or the scope of work required.

5. **Project Implementation/Execution Phase.** This phase commences on approval of the appropriate DND task/project approval documentation Synopsis Sheet (Effective Project Approval) (SS(EPA)) for larger projects or the corresponding ECS/L 1 document for smaller tasks/projects). Upon task/project approval by the appropriate authority, project documentation is again updated and contract documentation (SOW/SOR, RFP, etc.) is prepared in conjunction with the CA to implement the preferred risk mitigation/remediation option(s).

6. **Project Close-Out/Termination.** Upon completion of the project, normal project close out activities takes place. For DND sites, an updated SUM may be required for the Base/Wing CSM. For legacy sites a complete CSM may be required or, if a CSM for the site exists, an updated SUM. A suggested report format is provided at Annex C. As well, an assessment of the contractor's final report and deliverables are used to determine the effectiveness of the range clearance/UXO activity and ascertain the residual risk classification. If the land is to be returned to a non-DND party, a copy of the final report (electronic and paper copy) should be forwarded to DRPM 2 - UXO Legacy Sites Program in NDHQ as part of their Corporate UXO Liabilities Reporting responsibilities and the appropriate property record documentation must identify residual dangers. As a minimum, for Category A and B sites, the Annual Range and Training Area UXO Report (sample in Annex B to Chapter 1) or equivalent information from the CF Range Information System (CFRIS) must be included as part of the ECS/L 1 Sustainable RTA Management Plan (SRTAMP) in accordance with ADM(IE) Standard 1606-4000.1-S01-024 being submitted to ADM(IE). As well, an information copy of Annex B to Chapter 1 or CFRIS equivalent is to be sent to DAER.

### 311. CONTRACTING PROCESS

1. The typical flow during the contracting process is as follows:

- a. **Contractor Selection.** The contract demand/RFP is posted through the normal contract bidding system (MERX™, etc.) or from another contracting mechanism (Source List, Supply Arrangement, Standing Offer, etc.). The contract

demand/RFP will include normal elements such as the SOW/SOR, list of deliverables, assessment criteria and other pertinent contract documentation. There may be a requirement for a Bidders Conference on the site as part of the Bidding Process to clarify any aspects of the contract demand. Upon closing of bids, the bids are assessed by the DND/CF PM and the CA on technical and financial merit and a successful bidder is chosen.

- b. **Contractor Work Plan Review and Acceptance.** Following award of the contract, the contractor submits a detailed Work Plan with supporting annexes and SOPs for review and acceptance by the DND/CF PM. DND review and acceptance of the contractor's Work Plan does not relieve the contractor of responsibility for the completeness and accuracy of their work. A "kick-off" meeting on site will normally also occur to confirm all aspects of the Work Plan prior to commencing work. Once accepted by DND, any changes to the Work Plan that affect scheduling, cost or any other contractual obligation must be authorized through the contract change order process. The Work Plan will provide details on project activities and should include, but is not limited to, the items listed in Annex C.
1. **Contract Monitoring.** The DND/CF PM and CA monitor progress, re-evaluate the situation, and meet with the contractor at regular intervals to address changing circumstances to ensure compliance with the SOW/SOR, contract terms and QA.

### **SECTION 3**

#### **UXO, AMMUNITION AND EXPLOSIVES ACCIDENT/INCIDENT REPORTING AND INVESTIGATION PROCEDURES FOR CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES**

#### **312. AUTHORITIES**

1. The DND/CF is responsible to regulate and provide guidelines for UXO, Ammunition and explosive accident/incident reporting and investigation for DND/CF contracted UXO activities. In accordance with A-GG-040-006/AG-002 *DND Ammunition or Explosives Accidents/Incidents/Defects/Malfunctions Reporting* and Ammunition and Explosive Instruction (A&EI) 07, *Ammunition and Explosives Accident/Incident Investigation and Reporting*, only a DND/CF member can conduct the investigation and final reporting of an accident/incident related to ammunition or defence EO. This includes UXO encountered during contracted UXO activities. The ammunition and explosives accident/incident reports and investigation does not obviate the need for additional reports and action if the circumstances of an UXO, explosives and explosives accident or incident so warrants. These may include but are not limited to, Labour Canada, NRCAN, Coroners Inquest, civilian police, insurance and or other provincial/municipal reporting requirements. Further details are contained in Annex D.

#### **313. RESPONSIBILITIES**

1. The reporting responsibilities and procedures for UXO, ammunition and explosives related accidents/incidents are provided in Annex D. Contractors must ensure their planned procedures for this reporting are part of their accepted Work Plan and SOPs.

## SECTION 4

### UXO HANDLING AND DESTRUCTION PROCEDURES FOR CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES

#### 314. AUTHORITIES

1. The SOW/SOR will state whether the contractor or DND resources are authorized to handle/destroy UXO or suspected UXO during the task/project. The contractor will normally be tasked to detect, expose and identify UXO/suspected UXO and, upon determining the items as MS, non-munitions scrap (NMS) or hard target material, collect and screen items. If the contractor is tasked to destroy UXO or suspected UXO, due regard to the security provisions laid out in Chapter 1 Section 2 shall be followed. Identification, handling and destruction of UXO/suspected UXO will only be done by qualified personnel (see Chapter 2, Appendix 1 to Annex A, for military personnel, and Annex A for contracted personnel) and in accordance with DND/CF guidelines.

#### 315. PROCEDURES

1. **General.** The contractor will submit their planned procedures as part of their Work Plan for evaluation and acceptance in accordance with the SOW/SOR, the guidance provided in Annex E and the references below. The decision whether suspected UXO deemed safe to move are disposed of at a central destruction area or are destroyed in situ will depend on the situation specific to the range/site. However, for safety concerns, destruction in the location UXO are found will be the norm. Unless otherwise directed in the SOW/SOR, the DND On-Site Rep will review and approve all UXO intrusive investigations, UXO handling/movement actions or UXO destruction activities prior to implementation to ensure adherence to the regulatory and safety requirements. Principles and procedures for military personnel dealing with handling and destruction of UXO (see Chapter 2 Section 1) and all other pertinent CF regulations should be used as a guideline for this evaluation, including:

- a. **On DND Property.** Procedures in C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas* and current Range Standing Orders will be followed in conjunction with Annex E.
- b. **Off DND Property.** Procedures in C-09-008-003/FP-000, *Ammunition and Explosives Procedural Manual – Explosive ordnance Disposal - Disposal of Stray Ammunition*) and C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas* can be used as guidelines in conjunction with Annex E. Whichever regulations, CF or civilian, for handling, storage, transporting and disposal of explosives are more stringent will be followed. Proper environmental considerations must be followed and an Environmental Assessment (a screening or comprehensive study as required by regulation or as due diligence) is to be conducted for all lands outside of DND control.

2. **Tracking and Accounting for UXO.** Tracking and accounting for UXO during contracted range clearance/UXO activities is important to maintaining safety and accurately building and recording the extent of UXO on a site. Sample forms for recording, tracking and accounting for UXO and MS through the chain-of-custody are provided in Annex F. The use of electronic data gathering utilizing Personal Data Assistant (PDA) or similar devices vice hard/paper copies is encouraged to expedite and maintain integrity of data. Specific details on the level, type and frequency of these reports for the project must be provided in the SOW/SOR.

### 316. EXPLOSIVES LICENSING/PERMITS AND STORAGE

1. **Explosives/Explosives Accessories Personnel Licensing.** All contracted personnel storing, handling and/or transporting explosives and explosives accessories (detonators, etc.) to be used for UXO destruction shall meet all applicable federal regulations and possess all valid provincial licenses required.
2. **Explosives/Explosives Accessories Storage.** Temporary storage may be required for explosives and explosives accessories to be used for UXO disposal/destruction or for suspected UXO deemed safe to move but awaiting disposal. Licensing requirements for storage of explosives, explosives accessories and UXO/suspected UXO will be stipulated in the SOW/SOR. For DND sites, the DND PM may require either DND/CF (A&EI 03/07, *Ammunition and Explosives Storage Licenses* and C-09-153-001/TS-000 *Ammunition and Explosives Safety Manual, Volume 1, Storage and Transportation*) or NRCAN regulations/licensing criteria be followed. For legacy sites, NRCAN regulations and licensing requirements shall be followed. Further information on NRCAN licensing can be obtained through DAER or the NRCAN website (<http://www.nrcan-rncan.gc.ca>). The safety distances required for ammunition and explosive storage sites are provided for DND licensed sites in A&EI 16, *Small Quantities Distance Tables*, A&EI 21, *Containment Vessel Siting and Storage Instructions* or C-09-153-001/TS-000 *Ammunition and Explosives Safety Manual, Volume 1, Storage and Transportation* (as appropriate) and for NRCAN licensed sites through NRCAN regulations.

## SECTION 5 SCRAP HANDLING AND DISPOSAL PROCEDURES FOR CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES

### 317. AUTHORITIES

1. The SOW/SOR will state whether the contractor or DND resources are authorized and responsible to handle scrap during the task/project. The SOW/SOR will also include current DAER approved procedures for certification, tracking, handling and disposal of MS and other scrap. Only qualified personnel (see Chapter 2 Appendix 1 to Annex A for military personnel and Annex A for contracted personnel) will conduct scrap screening and certification.

### 318. PROCEDURES

1. **General.** The contractor will submit their planned procedures for dealing with handling and disposal of MS, NMS or, if applicable, hard target material as part of their Work Plan for evaluation and acceptance in accordance with the SOW/SOR. Principles and procedures for MS, NMS and hard target material contained in Annex D to Chapter 1 shall be used as a guideline in conjunction with the most current DAER approved procedures for the evaluation.
2. **Scrap Screening.** All scrap will be screened in accordance with Annex D to Chapter 1, the process and procedures proscribed in the SOW/SOR and the contractor's accepted Work Plan/SOPs. NMS shall undergo Level Three screening before proceeding to disposal. All MS that is fuzed or cannot be physically probed to confirm the contents as empty or safe, shall be treated as suspected UXO and be perforated in two locations (intentionally directed attack on the initiation system and main filling) prior to proceeding to Level Two screening. All MS and hard target material will normally undergo a minimum of three inspections and be screened to Level Three unless precluded in Annex D to Chapter 1 or in the SOW/SOR (previous Level Three or equivalent screened material in known scrap piles may require only two levels of screening (i.e. Level Two and Three) if safety is not compromised). After Level Three

screening, the MS can be certified safe for transportation on public roads prior to leaving the range/site for the designated DND Ammunition storage site or further de-militarization treatment.

### Note

**The three scrap screening levels normally equate to at least three different persons visually inspecting each item**

3. **De-militarization of MS and Hard Target Material.** MS de-militarization will consist of a DAER approved de-militarization process incorporating of a treatment to remove any explosive residue (i.e. heat/thermal) and a physical rendering treatment to make the MS unrecognizable as a defence EO item. Subject to DAER approval of the process and individual treatments and criteria, Appendix 3 to Annex D to Chapter 1 contains planning information that can assist in developing the preparation for de-militarization planning and SOW/SOR for a DAER approved process. Hard target material, once Level Three screened in accordance with and meeting the provisions of Appendix 1 to Annex D to Chapter 1 is deemed de-militarized.
4. **Disposal of Scrap.**
  - a. **MS**
    - (1) **Without De-Militarization.** MS that has been Level Three screened and certified safe for transport on public roads but that has not undergone any further DAER approved de-militarization shall be transported in accordance with Appendix 2 to Annex D to Chapter 1 for storage at a designated DND/CF Ammunition storage facility.
    - (2) **With De-Militarization.** MS that has undergone a DAER approved de-militarization process may be disposed of to a commercial scrap/salvage company provided International Traffic in Arms Regulations (ITAR)/Controlled Technology Access and Transfer (CTAT) requirements have been fulfilled.
  - b. **NMS.** After Level Three screening in accordance with Annex D to Chapter 1, NMS may be disposed of as through normal scrap or waste adhering to federal, provincial and/or municipal guidelines for waste disposal methods for the items.
  - c. **Hard Target Material.** Hard target material, screened in accordance with and meeting the provisions of Appendix 1 to Annex D to Chapter 1, is deemed de-militarized and shall be disposed of in accordance with Appendix 1 to Annex D to Chapter 1 and ITAR/CTAT regulations and documentation.
5. **Tracking and Accounting for Scrap.** Tracking and accounting for scrap during contracted range clearance/UXO activities is important to maintaining safety and accurately building and recording the extent of UXO on a site. Sample forms for recording, tracking and accounting for UXO and scrap (MS, NMS and hard target material) through the chain-of-custody are provided in Annex F. The use of electronic data gathering utilizing Personal Data Assistant (PDA) or similar devices vice hard/paper copies is encouraged to expedite and maintain integrity of data. Specific details on the level, type and frequency of these reports for the project must be provided in the SOW/SOR.

## 319. EXPLOSIVE LICENSING FOR MS STORAGE

1. Temporary or field type storage may be required for MS awaiting certification as safe for transport on public roads and onward transport to the designated DND/CF holding/disposal site or de-militarization. Licensing requirements for the storage of this material will be stipulated in

the SOW/SOR. As with the storage and licensing of explosives and explosive accessories, the following general principles apply:

- a. **For DND Sites.** The DND PM may require either DND/CF or NRCan regulations/licensing criteria be followed.
- b. **For Legacy Sites.** NRCan regulations and licensing requirements shall be followed. Further information on NRCan licensing can be obtained through DAER or the NRCan website (<http://www.nrcan-rncan.gc.ca>).

## SECTION 6 CONTRACTED UXO AVOIDANCE TASKS/PROJECT

### 320. GENERAL

1. UXO avoidance activities do not remove the UXO threat but reduce the UXO risk by employing measures to avoid encounters with UXO. Intrusive work and/or handling of suspected UXO is not part of UXO avoidance activities.

### 321. CONCEPT

1. UXO avoidance tasks are normally an adjunct to another activity to ensure that that activity can be completed safely and at minimum risk from UXO. Activities that do not require the complete area to be cleared of potential UXO and have the flexibility to shift short distances would normally employ UXO avoidance procedures. These activities could include such things as installation of a fence, routing of utility lines, etc., across an area of suspected UXO. During UXO avoidance tasks, the surface is visually swept and detection equipment is used to detect suspected UXO below the surface. **No intrusive work is done, and any UXO and/or suspected UXO that is found or detected is not disturbed nor handled.** Any UXO and/or suspected UXO that is found or detected are to be marked and reported as per directions provided in the SOW/SOR.

### 322. METHODOLOGY

1. Techniques employed to locate suspected UXO, less any intrusive work or handling of UXO/suspected UXO, are similar to those used during range/UXO surveys/clearances. The DND PM can ascertain whether the organizations, technologies and work proposed by the contractor will provide the results requested in the SOW/SOR in a safe and effective manner by reviewing the contractor's Work Plan. A listing of qualifications required, expected roles and training associated with DND contracted range/UXO avoidance work can be found at Annex A. Procedures at Chapter 2 Annex E can be used as a guideline for planning and evaluation of contracted UXO avoidance. DEEM 2 is available to assist CF Formations, Bases and Wings in the preparation and execution of contracted UXO avoidance tasks/projects on DND sites.

## SECTION 7 CONTRACTED RANGE/UXO SURVEYS

### 323. GENERAL

1. A range/UXO survey is used to identify and determine outer limits and extent of UXO on a range or site. This includes such things as the probable UXO density and representative types of UXO on the site. It is normally employed to ascertain the extent of the UXO problem to



assist in risk determination and in turn, determine what, if any, further UXO risk reduction action may be required. When done prior to a major clearance, this will assist in estimating the resources required to undertake a clearance operation and in writing range/UXO clearance contract terms and specifications.

### 324. CONCEPT

1. A range/UXO survey is normally a precursor to a range/UXO clearance task/project. Surveys can be undertaken during the following process phases:
  - a. Identification phase in order to ascertain the risk posed by potential UXO on a site;
  - b. Development phase to gather data/information to assist in Options Analysis; or
  - c. Definition phase to assist in determining the best clearance methodology and to estimate the amount of work/cost to conduct the clearance.

### 325. METHODOLOGY

1. **General.** Range/UXO surveys may be conducted using manual/intrusive or electronic/remote sensing methods. Improved technology using electronic/remote-sensing equipment allows large parts or the entire area of a site to be surveyed and provides improved results. However, the current technology is not sufficiently advanced at this time and must be used in conjunction with manual/intrusive sampling to validate and provide positive proof of the electronic information. A listing of expected duties normally associated with DND contracted range/UXO survey work can be found at Annex A. For contracted UXO surveys, the methodology proposed by the contractor will be submitted as part of the Work Plan for evaluation and acceptance. DEEM 2 is available to assist CF Formations, Bases and Wings in the preparation and execution of contracted survey tasks/projects on DND sites.
2. **Manual/Intrusive Method.** Military personnel using military equipment normally use the manual/intrusive survey methodology. However, the nature of the terrain and requirement for a particular site may dictate that this method be used on contracted surveys. Details on this methodology (see Chapter 2 Section 4) can be used to assist in preparing the SOW/SOR and evaluating the contractor's Work Plan.
3. **Electronic/Remote Sensing Methods.** Electronic/Remote sensing equipment, computer software, and expertise in use, interpretation and analysis of data continues to improve. Wide Area Assessments as well as detection and discrimination of anomalies using such tools greatly add to available knowledge to make informed decisions on risk and clearance requirements:
  - a. **Survey Area.** Electronic/remote sensing methods offer the advantage of being able to sample the entire range area more quickly and at less expense than manual/intrusive methods. When coupled with statistical analysis and prediction software, the amount of manual/intrusive investigation and sampling required to confirm electronic results is greatly reduced.
  - b. **Procedures.** The variety and highly technical nature of electronic/remote sensing technology precludes providing detailed information in this manual. Current and emerging technologies capable of electronic/remote sensing (magnetometers, ground penetrating radar, thermal imaging, electro-magnetic devices, etc.) are deployable on man-portable, vehicle, water/underwater borne, or airborne (fixed or rotary winged) platforms. All these are tied into geophysical

systems and Geographic Information Systems (GIS) coupled with Global Positioning System (GPS) or other position locating systems. Most systems also provide real/near-real time data acquisition and recording. Companies providing such technology will also supply the procedures for its use. Annex G provides additional guidelines for geophysical related activities.

- c. **Interpretation of Results.** GIS and other associated software allow real and near-real time analysis of the data but require specialized personnel to optimize interpretation of the results into an appropriate CSM of the area.

### **326. QUALITY ASSURANCE (QA)**

1. QA concepts and techniques for contracted range/UXO surveys can be found in Chapter 4.

## **SECTION 8 CONTRACTED RANGE/UXO CLEARANCE**

### **327. GENERAL**

1. A range/UXO clearance entails the physical removal/destruction of UXO and scrap to a level and depth required to reduce the UXO risk to an acceptable level for the stated site usage. A range/UXO clearance is the most hazardous and time/resource intensive of all range clearance/UXO activities. Contracted UXO clearances are the preferred method used for legacy sites and has been adopted for many range and training areas on DND sites.

### **328. CONCEPT**

1. A range/UXO clearance is undertaken when all other techniques to reduce the UXO risk to an acceptable level for the stated site usage are deemed inappropriate. It is important that the purpose and level and depth of clearance required, and results desired from the clearance, be clearly conveyed to and understood by the contractor through the SOW/SOR. Sample generic clearance depth guidelines are available for planning purposes in Annex E to Chapter 1.

### **329. METHODOLOGY**

1. Methodologies used for range/UXO clearances will vary depending on many factors (site conditions, types of UXO suspected, whether surface or subsurface, the depth (if subsurface), degree of scrap removal required, etc.). A listing of expected duties normally associated with DND contracted range/UXO clearances can be found at Annex A. The DND PM can ascertain by reviewing the contractor's Work Plan whether the organizations, technologies and work proposed by the contractor will provide the results requested in the SOW/SOR in a safe and effective manner. DEEM 2 is available to assist CF Formations, Bases and Wings in the preparation and execution of contracted clearance tasks/projects on DND sites.

### **330. QUALITY ASSURANCE (QA)**

1. QA concepts and techniques for contracted range/UXO clearances can be found in Chapter 4.

## **ANNEX A TO CHAPTER 3 PERSONNEL QUALIFICATIONS FOR CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES**

### **3A01. GENERAL**

1. Safety is of paramount importance when conducting any type of range clearance/UXO activity. In order to ensure the safest possible work environment it is imperative that personnel involved in the process are properly qualified to the positions in which they are to be employed. To ensure that this requirement is met all personnel employed on DND range clearance/UXO activities must hold the relevant qualification, experience level and abilities/skills for the position they have been appointed. Contractors are responsible to ensure their personnel meet these qualification requirements and must have appropriate documentation on hand for verification of qualifications.
2. Contractor certification that the qualifications of the contracted personnel working on DND range clearance/UXO activities meet the requirement must be reviewed and accepted by DND prior to the commencement of any work. These include both UXO and non-UXO qualifications required to complete the UXO activity..

### **3A02. AIM**

1. The aim is provide direction for determining the appropriate role, qualifications, experience and required abilities for civilian personnel engaged in contracted range clearance/UXO activities on behalf of DND.

### **3A03. KEY PERSONNEL**

1. **Key Personnel Identification.** The contractor shall list in their detailed proposal documents all key personnel (as well as back-ups), including their relevant qualifications, who will be employed to complete all Tasks, Requirements and Goals specified within the SOW/SOR. Verifiable documentation supporting personnel qualifications is to be available upon demand by DND/CF representatives from the Contractor. For the purposes of the SOW/SOR, Key Personnel include Project Managers, Contractor Project Leader, Technical Professionals (engineers, geophysicists, geologists, biologists, etc.) and Technical Specialists (geophysical operators, UXO/EOD technicians, GIS specialists, divers, etc.). Documents will include specific relevant qualifications and experience in addition to the level of input and responsibility for the personnel. The Contracting Authority (CA) will use this information to assure strict adherence to the accepted project Work Plan. The CA reserves the right to review detailed CVs and interview contractor employees while performing under the contract solely for the purpose of ascertaining their qualifications relative to the responsibilities identified in the contractor's proposal. The contractor shall furnish such CVs to the CA on request.
2. **Key Personnel Retention and Changes.** The contractor shall guarantee that all personnel identified in the proposal are available for the duration of the project/task. Proponents are advised that Key Personnel and back-ups named in the original Proposal shall remain in their designated roles for the duration of the project. Failure to do so may result in stop-work orders, at the contractor's expense, until such time as an approved replacement is put in place.

#### **Note**

**Depending on the scope and complexity of the project and provided safety is not compromised, not all the Key Personnel roles listed may need to be filled or some positions may be “double-hatted”. The SOW/SOR and review of the contractor’s Work Plan will provide more specific guidance**

### **3A04. KEY UXO PERSONNEL**

#### **1. Key UXO Personnel Qualifications**

- a. **General.** There is a limited source pool of qualified personnel available for the UXO industry and the DND/CF to draw upon. Historically, the large majority of civilian personnel employed within the industry who possessed the desired qualifications, skill-sets, knowledge, and experience were retired military personnel. This situation has changed significantly over the last few years with the recognition by the Directorate of Ammunition and Explosive Regulation (DAER) of graduates from select civilian training programs and suitably qualified and experienced foreign retired military personnel for employment in the industry. Specialized training, resulting in a recognized qualification, is only one pillar in the foundation of an employable UXO technician. Equally important is the experience gained by qualified personnel in the performance of the myriad of tasks related to the UXO clearance industry. It is for this reason that DAER, Directorate of Real Property Management (DRPM) 2 - DND UXO and Legacy Sites Program (UXO Legacy Sites Program), Directorate of Environmental Engineering Management (DEEM) 2, and industry have collaborated to determine the accepted minimum qualifications and experience for employment at each technical level within the Canadian UXO industry
- b. **Qualifications.** The approved DAER qualifications for contracted UXO activities were promulgated in CANFORGEN 106/07, *Civilian Equivalent Qualifications for Contracted UXO Clearance* and further amplified in Ammunition and Explosive Instruction (A&EI) 15, *Recognized Civilian Qualifications Applicable to Ammunition and Explosives Employment Change 1* and A&EI 17, *Civilian Qualifications Expiry Criteria* and are contained in this Annex. The references, in conjunction with the latest amendments/changes available from DAER, Directorate of Environmental Engineering Management (DEEM) 2 or Directorate of Real Property Management (DRPM) 2- DND UXO and Legacy Sites Program (UXO Legacy Sites Program), shall be the only qualifications accepted for contracted UXO activities. DRPM 2 - UXO Legacy Sites Program maintains the DAER approved list of all civilian UXO qualifications and equivalent military qualifications for former CF/foreign military personnel for civilians being employed on DND/CF range clearance/UXO activities work. This list is also available from DEEM 2. If a contractor has personnel they believe are qualified by a means not currently covered by the approved UXO qualification list, résumés and justification for these personnel can be submitted to the DEEM 2 or DRPM 2 - UXO Legacy Sites Program for review and a DAER decision.
- c. **Employment Time Credit Equivalencies.** For the purpose of granting employment time credit equivalency for supervisory positions to ex military personnel may be requested. The DND/CF authority managing the range clearance/UXO activity has been delegated the authority to grant employment time credit equivalency to personnel who will be employed on their projects by DAER. They are to review the military employment record of affected personnel

in order to grant experience time credits for past employment in military positions which substantially represent those of the position to which the affected person is being considered. The granting of equivalency credits is to be on a one for one basis for “like” work done at the appropriate rank level (i.e. work done as a MCpl/Sgt while in the military may be credited towards experience as a UXOTS). Submissions requesting equivalency or experience credits must be accompanied by verifiable documentation detailing the requester’s qualifications such as, CV/Resume/Course Reports/Course Certificates/Military MPRR. If any doubt with regards to equivalency assessment exists DAER is to be engaged as the final authority.

2. **Key UXO Personnel Roles, Qualifications, Experience and Abilities/Skills.** The contractor’s Key UXO Personnel fill the roles below (as required by the project) and should have, as a minimum, the qualifications, experience and abilities/skills listed below. The organization of the contractor’s UXO teams will depend on the planned methodology. Some UXO personnel may be employed in more than one position provided they have suitably qualifications/experience and completion of the work in a safe and effective manner is not jeopardized. Documentation to support such compliance shall be provided in the detailed proposal documents and Work Plan.

#### **Note**

**In special circumstances, and dependent on the complexity of the operation being performed, Contractors may nominate a candidate with less than experience levels stated in the UXOPL, UXOFS, UXOSO and UXOQCS positions below. In these cases it is the responsibility of the Contractor to approach DND/CF authority managing the range clearance/UXO activity to obtain a DAER written approval for use of the proposed candidate in the UXOPL position**

- **UXOPL Position.** A candidate with less than 5 years experience in a UXOFS or UXOSO position or a UXOTS with a minimum of 10 years.
- **UXOFS Position.** A candidate with UXOTS qualifications and a minimum of 8 years or more verifiable UXO experience.
- **UXOSO Position.** A candidate with UXOTS qualifications and a minimum of 8 years or more verifiable UXO.
- **UXOQCS Position.** A candidate with UXOTS qualifications, who is working towards attaining the required QCS certification, and has a minimum of 8 years or more verifiable UXO experience

a. **UXO Project Leader (UXOPL)**

- (1) **Role.** Responsible to the Contractor’s Project Manager to provide overall management of the contractor’s team and act as liaison between the contractor and DND (through the DND On-Site Representative/DND PM) and the CA.
- (2) **Qualifications.** UXO qualifications for the UXOPL, as approved by DAER, are:
  - (a) a graduate of a DAER recognized formal university, college or other educational institution UXO training course consisting of a minimum of 200hours of continuous instruction;

- (b) possessing a valid CF Conventional Munitions Disposal (CMD) (Basic) (formerly coded HA) qualification,
  - (c) qualified as an Ammunition Technical Officer (ATO) with a valid AEXN qualification code, or
  - (d) verifiable equivalency to the above qualifications from a foreign armed forces as approved by DAER.
- (3) **Experience.** UXOPL must have as a minimum ten (10) years of verifiable combined military/civilian EOD or range clearance/UXO activities experience with a minimum of five (5) years experience demonstrating their proficiency in the UXO field, supported through verifiable documentation. This demonstrated experience must cover all aspects of range clearance/UXO activities required for the UXO work being conducted. They must be capable of demonstrating a comprehensive understanding of safety practices associated with explosives and range clearance/UXO activities which are to be confirmed by the Contractor through refresher training on the site before contracted work begins. Position pre-requisite experience also includes a UXOFS, UXO Safety Officer (UXOSO) or UXO Quality Control Supervisor (UXOQCS) position.
- (4) **Required Abilities and Skills.** Along with proven management skills, excellent written and verbal communications skills and supervisory skills, the UXOPL must be able to:
- (a) plan and coordinate all contractor on-site UXO activities encompassing all aspects of UXO work;
  - (b) develop munitions response and removal action plans;
  - (c) direct preparation of an explosives storage plan for commercial explosives used for UXO destruction;
  - (d) prepare risk and hazards analyses;
  - (e) identify the requirement for and direct the preparation of Standard Operating Procedures (SOPs); and
  - (f) review certification documentation of range scrap prior to its removal from the work site.

b. **UXO Field Supervisor(s) (UXOFS)**

- (1) **Role.** Responsible to the UXOPL to provide on-site management and coordination.
- (2) **Qualifications.** Minimum UXO qualifications for the UXOFS are the same as those for the UXOPL.
- (3) **Experience.** UXOFS must have as a minimum eight (8) years of verifiable combined military/civilian EOD or range clearance/UXO activities experience with a minimum of three (3) years experience demonstrating their proficiency in the UXO field, supported through verifiable documentation. This demonstrated experience must cover all aspects of range clearance/UXO activities required for the UXO work being conducted. They must be capable of demonstrating a

comprehensive understanding of safety practices associated with explosives and range clearance/UXO activities which are to be confirmed by the Contractor through refresher training on the site before contracted work begins. Position pre-requisite experience also includes a UXOSO or UXOQCS position.

- (4) **Required Abilities and Skills.** Along with proven management skills, excellent written and verbal communications skills and supervisory skills, the UXOFS must be able to:
  - (a) supervise the daily work schedule and activities of all work teams to include all aspects of UXO related work;
  - (b) supervise and perform on-site destruction of UXO;
  - (c) direct and be responsible for the management of energetic materials; and
  - (d) ensure that all materials are inspected and deemed safe to move in preparation for removal from the site.

c. **UXO Safety Officer (UXOSO)**

- (1) **Role.** Responsible to the UXOPL for UXO and explosive safety and training.
- (2) **Qualifications.** Minimum UXO qualifications for the UXOSO are the same as for the UXOPL.
- (3) **Experience.** UXOSO must have as a minimum eight (8) years of verifiable combined military/civilian range clearance/UXO activities experience with a minimum of three (3) years experience demonstrating their proficiency in the UXO field, supported through verifiable documentation. This demonstrated experience must cover all aspects of range clearance/UXO activities required for the UXO work being conducted. They must be capable of demonstrating a comprehensive understanding of safety practices associated with explosives and range clearance/UXO activities which are to be confirmed by the Contractor through refresher training on the site before contracted work begins. Position pre-requisite experience also includes a UXO Technician Supervisor (UXOTS) position.
- (4) **Required Abilities and Skills.** Along with demonstrated instructional/supervisory skills, the UXOSO must be able to:
  - (a) develop and implement approved explosives and UXO health and safety program in compliance with applicable DND policy and federal, provincial, and local health and safety regulations and labour codes;
  - (b) analyze operational risks, explosive hazards and safety requirements;
  - (c) establish and ensure compliance with all site-specific explosive operations safety requirements and training standards;
  - (d) ensure all personnel working on-site meet required qualification standards;

- (e) develop and implement any site specific General Safety training as required by the contractor or DND to ensure all personnel working on-site have sufficient training to perform their jobs safely;
  - (f) monitor and enforce personnel limits and safety exclusion zones for explosives related operations;
  - (g) conduct, document, and report the results of safety inspections/investigations to ensure compliance with all applicable explosives safety policies, standards, regulations and codes;
  - (h) ensure all protective equipment is properly used within the exclusion zone are operated in a safe manner and that all other equipment used within the exclusion zone is operated safely; and
  - (i) develop safety SOPs.
- d. **UXO Quality Control Specialist (UXOQCS)**
  - (1) **Role.** Responsible to the Contractor's Project Manager and UXOPL to provide Quality Control (QC) services for all related site activities.
  - (2) **Qualifications**
    - (a) UXO qualifications for the UXOCQS are the same as those for the UXOPL; and
    - (b) certified as a Quality Professional (Certified Quality Auditor or Certified Quality Manager or the holder of a Quality Assurance Certificate) from a recognized institution/organization such as the Canadian Chapter of the American Society for Quality (ASQ). If not so certified the UXOQCS shall work under the mentorship of a recognized, certified, quality professional until such time as the necessary certification has been achieved.
  - (3) **Experience.** UXOCQS must have as a minimum eight (8) years of verifiable combined military/civilian EOD or range clearance/UXO activities experience with a minimum of three (3) years experience demonstrating their proficiency in the UXO field, supported through verifiable documentation. This demonstrated experience must cover all aspects of range clearance/UXO activities required for the UXO work being conducted. They must be capable of demonstrating a comprehensive understanding of safety practices associated with explosives and range clearance/UXO activities which are to be confirmed by the Contractor through refresher training on the site before contracted work begins. Position pre-requisite experience also includes a UXOTS position.
  - (4) **Required Abilities and Skills.** Along with demonstrated supervisory abilities, the UXOQCS must be able to perform all processes being observed for compliance and:
    - (a) conduct and document quality control surveillance audits of all UXO clearance activities to ensure compliance with established procedures;



- (b) implement and monitor non-conformance reporting, corrective action, and verification procedures to ensure feedback and follow-up processes are in use;
- (c) implement a product/process inspection/sampling methodology to ensure compliance with contract requirements;
- (d) implement a phased control system (i.e. preparatory, initial, and follow-up) requiring the contractor to plan and schedule work to ensure preparedness prior to commencing each new phase of work;
- (e) implement and develop quality improvement tools and conduct trend and root cause analysis to ensure work on site remains effective and efficient;
- (f) perform continual analysis of work processes, looking for ways to improve the quality of work product;
- (g) document, report, verify and ensure completion of all corrective actions to ensure all UXO survey and clearance operations comply with requirements;
- (h) assist in development of site SOPs; and
- (i) prepare and submit, in accordance with the SOW/SOR and accepted Work Plan, Lessons Learned from the UXO activity as required in the SOW/SOR.

e. **UXO Technician Supervisor(s) (UXOTS)**

- (1) **Role.** Responsible to the UXOFS for the supervision of range clearance/UXO activities teams.
- (2) **Qualifications.** UXO qualifications for the UXOTS the same as those for the UXOPL.
- (3) **Experience.** UXOTS must have as a minimum five (5) years of verifiable combined military/civilian EOD or range clearance/UXO activities experience demonstrating their proficiency in the UXO field, supported through verifiable documentation. This demonstrated experience must cover all aspects of range clearance/UXO activities required for the UXO work being conducted. They must be capable of demonstrating a comprehensive understanding of safety practices associated with explosives and range clearance/UXO activities which are to be confirmed by the Contractor through refresher training on the site before contracted work begins.
- (4) **Required Abilities and Skills.** Along with demonstrated instructional/supervisory abilities, the UXOTS must be able to:
  - (a) determine precise location using various techniques, such as GPS equipment or basic land navigation using topographical map and compass;
  - (b) assist in preparing risk and hazards analyses;
  - (c) properly store explosive materials per applicable guidance;

- (d) Supervise the reconnoitre, classify and identify all UXO and military munitions by type, physical characteristics and condition;
- (e) act as a search team leader for up to a five man team during clearance operations;
- (f) properly identify whether an item is Safe to Move (STM); and
- (g) perform all duties related to technical supervision of UXO Technician (UXO TECH) and UXO Assistant (UXOA personnel).

f. **UXO Technician(s) (UXO TECH)**

- (1) **Role.** Responsible to the UXOTS or higher level UXO supervisor to provide a UXO search capability and escort non-UXO/EOD qualified personnel.
- (2) **Qualifications.** UXO qualifications for the UXO TECH are the same as those for the UXOPL.
- (3) **Required Abilities and Skills.** Under the supervision of a UXOTS or higher level UXO supervisor:
  - (a) act as a search team member;
  - (b) reconnoitre, classify and identify all UXO and military munitions by type, physical characteristics and condition;
  - (c) excavate subsurface UXO;
  - (d) move and transport explosive materials and UXO that have been determined safe for transport by a UXOTS or higher level UXO supervisor over authorized routes when required;
  - (e) prepare firing systems, both electric and non-electric, for destruction operations and assist in placement of charges under direct supervision of a UXOFS;
  - (f) assist in inspecting material that potentially presents an explosive hazard;
  - (g) properly store explosive materials per applicable guidance; and
  - (h) escort personnel who are not directly involved in UXO related operations (e.g. personnel performing environmental monitoring) but have activities to perform within exclusion areas.

g. **Level One Scrap Screener**

- (1) **Role.** Conduct initial screening, under supervision and prior to movement of the scrap item(s) to the scrap collection point, as detailed in Annex D to Chapter 1 and the accepted Work Plan for:
  - (a) MS, NMS and hard target material up scrap upon finding the scrap item(s), or
  - (b) after hazardous/suspected hazardous item(s) has been destroyed.

**Note**

**Only items POSITIVELY KNOWN TO BE HARMLESS AND SAFE shall be moved or handled**

- (2) **Qualifications.** For contracted UXO activities, a Level One screener must, as a minimum, meet the qualifications, abilities/skills and criteria set out for the UXO TECH.

h. **Level Two Scrap Screener**

- (1) **Role.** Screen all recovered MS, NMS and hard target material at the scrap collection point prior to loading it on a designated scrap vehicle for movement to the temporary holding area as detailed in Annex D to Chapter 1 and the accepted Work Plan.
- (2) **Qualifications.** A Level Two screener must be qualified UXOTS or higher.

i. **Level Three Scrap Screener**

- (1) **Role.** Screen all MS, NMS and other scrap and certify MS as safe for transportation on public roads at the temporary holding area prior to loading the scrap in containers for storage and/or shipment on public roads as detailed in Annex D to Chapter 1 and the accepted Work Plan.
- (2) **Qualifications.** Minimum UXO qualifications for a Level Three screener are:
  - (a) an individual qualified UXOFS or higher,
  - (b) a retired CF member qualified ATO (qualification code AEXN),
  - (c) a retired CF Ammunition Technician Supervisor (MSOID 00139) (Sgt/QL6A or above after Sep 1996 or a WO/QL6B or above if qualified prior to Sep 1996), or
  - (d) verifiable equivalency to the above qualifications from a foreign armed forces as approved by DAER.

- j. **UXO Diving Qualifications.** Specific CSA Standards and supporting civilian UXO Diver course are being developed for the conduct of underwater UXO Clearance activities. The current CSA Standards for divers performing commercial underwater work on behalf of DND are CSA Z275.2-04 and CSA Z275.4-02. Under the new CSA Standard for UXO divers, equivalency to the CSA Standards is to be granted to serving or ex-military personnel who were MOSID 00181 Engineer, with the AFEP Combat Diver qualification, or to MOSID 00342 Clearance Divers. All personnel employed in underwater UXO tasks must hold the certification to the CSA Standards identified as well as holding the UXO qualifications for the position in which they are employed. In addition, only those personnel employed as UXO divers qualified CF CMD (Advanced) with the additional underwater specialty portion of the course are authorized to conduct underwater disposal operations. The Contractor must ensure that all divers performing underwater work meet all Federal, and Provincial workplace diving regulations and licensing requirements for the depths required on the task site prior to commencement of work. The contractor is to provide the written request to the provincial regulatory agency for authorization to commence diving operations. As a minimum, a dive team should consist of an appropriately qualified and experienced Dive Supervisor, a qualified boat operator and at least two divers. The contractor is to ensure that all dive teams have **positive communication** at all times preferably through the use of umbilical communication techniques. This means that the divers must be able to

communicate with the dive supervisor at all times. The contractor must identify the divers to be used and submit their diving qualifications, diving supervisory and UXO qualifications as part of the Key Personnel submission.

3. **Key UXO Personnel Qualification Expiry Criteria.** Contracted range clearance/UXO activities in employ a number of persons who are retired/released from the CF, foreign military forces or graduates of approved training institutions. The specialist training, although comprehensive in nature, requires ongoing exposure to real employment situations for not only currency in those skills, but to ensure the individuals retains and is given the opportunity to exercise these skills and their knowledge to perform their duties safely. The following criteria shall apply to determine the currency of UXO qualifications and the re-instatement of expired qualifications:

- a. **UXO Qualification Time Expiry Criteria.** There is a five (5) year limitation period post retirement/release from the military or graduation from a DAER approved 200 hour/5 week civilian UXO training course for the entry level UXO TECHs. In order to be considered current, individuals must have been employed for a cumulative one (1) year period within their initial 5 year employment within the industry. Their currency will continue to be recognized as long as they continue to gather experience based on a minimum of 1-years employment in each consecutive 5 year block. Individuals who allow their qualifications to lapse will forfeit their UXO employment currency and will be required to apply for re-instatement prior to being employed as part of a DND/CF range clearance/UXO activity. In exceptional circumstances personnel may request a 1 year extension to DAER to their 5 year currency employment block. These exceptions should be rare and are oriented towards situations outside the individual's control. that have kept him/her from being employed within the industry.
- b. **Re-instatement.** Re-instatement will be based on the individuals acceptance of DAER imposed employment restrictions, as well as caveats to the employer, for the restricted employment of the individual requesting re-instatement, pending on- job assessments of the individuals performance. Personnel who have allowed their currency to lapse or have been granted a one year extension must satisfy all of the following criteria:
  - (1) secure employment within 24 months of re-instatement (DND may request a letter confirming employment),
  - (2) willingness to undergo refresher training as deemed necessary by the employer, and
  - (3) the individual must not have been terminated from past UXO employment for negligence and/or unsatisfactory performance.
- c. **Disposal Operations Refresher Criteria.** In addition to the above criteria for currency of UXO qualifications, contracted UXO personnel who are authorized and designated to conduct disposal operations must be provided, by their parent company, refresher training in disposal charge preparation and placement at least once during a 12 month period prior to contract commencement in order to be considered as current for disposal operations on a DND/CF range clearance/UXO activity. Contractors must provide verification to the Ca or have it as part of their accepted Work Plan.

4. **Advancement Experience Criteria.** Advancement to supervisory positions within the UXO industry are based on experience garnered through employment, currency, and the actual

assessed managerial/supervisory skills of the individual being considered for the position. Each managerial/supervisory position has a specific qualification/skill set requirement and a pre-requisite of from 5 to 10 years affiliated UXO industry experience. This experience must be UXO related and associated with on-site work. A person who has done nothing but geophysics or office type work over his initial 5 year employment in the industry would not be considered to have gained the required experience for advancement to UXOTS. The experience being credited to the individual must be verifiable as “like” work for the position to which they are being promoted. It is the Contractor’s responsibility to ensure that personnel employed in supervisory positions meet the qualification and experience requirements of the position in which they are employed. DND may at any time demand verifiable proof, through means of employment records, course certificates etc, that the incumbent supervisors on DND/CF range clearance/UXO activities meet the pre-requisite requirements of this publication. In the case of a former or retired military member who has not garnered the requisite years of experience within the civilian UXO industry, a submission may be made by their prospective employer through the DND/CF authority managing the range clearance/UXO activity requesting that they be granted equivalency in experience based on their military employment record.

### 3A05. KEY NON-UXO PERSONNEL

1. **Key Non-UXO Roles.** The contractor’s Key Non-UXO Personnel fill the roles below (as required by the project) and should have the qualifications listed below. The organization of the contractor’s non-UXO teams will depend on the planned methodology. Some non-UXO personnel may be employed in more than one position provided they have suitably qualifications/experience and completion of the work in a safe and effective manner is not jeopardized. Documentation to support such compliance should be provided in the detailed proposal documents and Work Plan.

a. **Senior Geophysicist (Sr Geo)**

- (1) **Role.** Reports to the Contractor’s Project Manager, provides overall management of the geophysical investigation team and is wholly accountable for the content and quality of all geophysical data and interpretations.
- (2) **Qualifications**
  - (a) B.Sc. or M.Sc. degree in Geophysics, Geology, or related field from a recognized accredited institution; and
  - (b) Licensed to practice geo-science by the appropriate Provincial Professional Association
- (3) **Experience.** A minimum **seven (7) years** of professional industry experience in leading roles and demonstrate their proficiency in the field through verifiable documentation. The Sr Geo must be capable of demonstrating a high level of competence in all aspects of geophysical planning, data acquisition, processing and interpretation. The Sr Geo should also be capable of demonstrating a comprehensive understanding of UXO related data interpretations related to potential targets of concern. The Sr Geo is also expected to have knowledge and experience in project management and quality control/assurance practices commonly associated with collecting and processing geophysical data as well as an understanding of UXO activities.
- (4) **Required Abilities and Skills.** The Sr Geo must be able to:

- (a) Plan, coordinate overall project geophysical requirements;
- (b) Oversee the direction of multiple project teams that may be performing geophysical work;
- (c) Oversee the development of the geophysical collection, processing, and interpretation/analysis plans and activities;
- (d) Oversee the preparation of geo-related Standard Operating Procedures; and
- (e) Review, verify and be accountable for the content and quality of all geophysical data and interpretation throughout the data collection, reduction, processing, interpretation, analysis, presentation and reporting stages.

b. **Project Geophysicist (Project Geo)**

- (1) **Role.** Coordinates with the UXOPL on-site and provide geophysical survey design specifications and direction to the geophysical investigation team. Responsible for the content and quality of the geophysical data and ensuring that all geophysical surveys and related activities are conducted in accordance with contract documents and the work plan such that DQOs and project goals are met and maintained.
- (2) **Qualifications**
  - (a) B.Sc. or M.Sc. degree in Geophysics, Geology, or related field from a recognized accredited institution; and
  - (b) Licensed to practice geo-science by the appropriate Provincial Professional Association.
- (3) **Experience.** A minimum **three (3) years** of professional industry experience and demonstrate their proficiency in the field through verifiable documentation. The Project Geo demonstrate experience in all aspects of processes and equipment expected to be used for the proposed work plan and demonstrate a comprehensive understanding of data collection and troubleshooting related to hardware and software and must also demonstrate knowledge of DQOs related to UXO surveys.
- (4) **Required Abilities and Skills.** The Project Geo must be able to:
  - (a) Plan, coordinate all project geophysical on-site activities including the preparation of Standard Operating Procedures for geophysical related activities;
  - (b) Direct and maintain multiple project geophysical field crew/teams performing geophysical related activities in a variety of physical settings and in accordance with project guidelines and requirements as directed by the UXOPL;
  - (c) Assume responsibly for the content and quality of all survey data and reports generated by the geophysical personnel in the absence of the Sr. Geo;
  - (d) Prepare documentation and maps for excavation teams to reacquire anomalies;

- (e) Prepare survey work reports and all documentation related to quality management from a field based project on a timely basis; and
- (f) Review and verify the processing and analysis of data and quality control/quality assurance metrics and procedures.

c. **Geophysical Crew Chief (Geo CC)**

- (1) **Role.** Coordinating with the UXOPL and Project Geo to provide on-site management of the geophysical investigation team.
- (2) **Qualifications**
  - (a) B.Sc. degree or technical diploma majoring in geosciences fieldwork, survey engineering or related field from a recognized accredited institution; and
  - (b) Demonstrated knowledge of geophysical equipment (e.g. EM-61, etc.) and navigation systems (e.g. RTK GPS, etc.).
- (3) **Experience.** A minimum of twelve (12) months of verifiable experience in the operation and maintenance of the equipment expected to be used in the proposed work plan.
- (4) **Required Abilities and Skills.** The Geo CC must be able to:
  - (a) Track and maintain an up to date account of all geophysical crew activities and communicating with key project personnel;
  - (b) Assign geophysical crew responsibilities and liaising with senior UXO site staff;
  - (c) Ensure that all geophysical surveys and related activities are conducted in accordance with technical and health and safety documents;
  - (d) Contact equipment manufacturers and arrange transport, repairs etc. for geophysical equipment;
  - (e) Possess the ability to conduct general maintenance and troubleshooting of all equipment used ensuring the basic QC/QA of data collected.
  - (f) Ensure that daily calibration and quality controls measures are being implemented and reported to key project personnel on a timely basis;
  - (g) Ensure that any acquisition or other field-related problems are immediately communicated to key personnel; and
  - (h) Direct multiple project teams performing geophysical related activities in accordance with project guidelines and requirements as directed by the UXOPL; and
  - (i) Able to produce detailed, professional daily quality reports that relate to the project DQO.

d. **Geophysical Technician(s)/Operator(s) (Geo Tech/Op)**

- (1) **Role.** Provide, under supervision of the Geo CC, geophysical and positioning support and data acquisition.
  - (2) **Qualifications**
    - (a) Should have a B.Sc. or technical diploma majoring in geosciences fieldwork and or survey engineering; and
    - (b) Demonstrated knowledge of geophysical equipment (e.g. EM-61, etc.) and navigation systems (e.g. RTK GPS, etc.).
  - (3) **Experience.** A minimum of six to twelve (6-12) months of verifiable experience in the operations of the equipment expected to be used on the proposed operations. The Geo Tech/Op should have extensive experience in a field based work environment and be comfortable with compass and GPS navigation, field safety techniques, digital electronic equipment and basic data reduction skills.
  - (4) **Required Abilities and Skills.** The Geo Tech/Op must be able to:
    - (a) Collect high-quality geophysical and geo-positioning data;
    - (b) Conduct Basic data dumping and reduction of digital data;
    - (c) Troubleshoot hardware and software problems related to data acquisition;
    - (d) Conduct general maintenance of all equipment used in order to ensure quality of data collected; and
    - (e) Prepare of daily reports and other documents as required.
- e. **Equipment Supervisor**
- (1) **Role.** Provide supervision to the equipment operators and advice to the Project Leader on equipment related matters.
  - (2) **Qualifications.** Possess a valid provincial equipment operator certificate.
  - (3) **Experience.** A minimum of five (5) years relevant field experience on the proposed equipment.
  - (4) **Required Abilities and Skills.** Demonstrated supervisory skills.
- f. **Equipment Operators**
- (1) **Role.** Operate equipment.
  - (2) **Qualifications.** Possess a valid provincial equipment operator certificate for the equipment they are to operate

### 3A06. UXO ASSISTANT (UXOA)

1. **General.** The UXOA position encompasses all those not listed above, does not entail a formal UXO qualification and are generally unskilled labourers or those who operate machinery/equipment that does not require a license or certification. The UXOA shall not have intentional contact with UXO, ammunition or explosives.

a. **UXOA Details**



- (1) **Role.** Reports to a UXOTS (or higher level UXO supervisor) and provides a workforce for non-UXO skilled tasks within the Danger/Exclusion zone.
  - (2) **Qualifications.** Non-specific but may be a retired CF or foreign military member or civilian who shall have all requisite job and site specific training as detailed in the accepted Work Plan. This training shall, as a minimum, contain the following:
    - (a) explosives and industrial safety;
    - (b) recognition of ammunition and explosives, particularly UXO, with emphasis on site specific munitions;
    - (c) operation of equipment required on the site; and
    - (d) proper use of Personal Protective Equipment.
  - (3) **Required Abilities and Skills.** Under supervision of a UXOTS (or higher level UXO supervisor), the UXOA must be able to:
    - (a) Act as an assistant to the UXOTS in actions that:
      - i. **DO NOT** involve explosives activities, and
      - ii. **DO NOT** place the UXOA in intentional physical contact with ammunition, explosives or UXO; and
    - (b) Operate machinery and equipment for which they have received specific operations and safety training, including the handling of Geophysical equipment.
- b. **Danger/Exclusion Zone.** While in the UXO Danger/Exclusion zone, the UXOA will be escorted at all times by a UXO TECH or higher and must be supervised by a UXOTS or higher UXO qualified person. When continuous supervision is not available, the UXOA shall be removed from the danger/exclusion zone.

### 3A07. TRAINING AND SUPERVISION

#### 1. UXO Personnel

- a. **Training.** Prior to commencing site work, all UXO personnel shall receive site specific training detailing the specific UXO risks/procedures/actions and other site particular issues. As well, refresher training during work shall be conducted. The contractor's shall submit a Training Plan for DND acceptance which includes these and any other training requirements stipulated in the SOW/SOR and accepted Work Plan/SOPs.
- b. **Supervision.** The contractor shall submit in the Work Plan the supervisory requirements and organization for each task in the project for DND acceptance. For safety, no one shall enter the site alone. Supervisory roles may be combined so long as safety and effective completion of the project are not jeopardized.

#### 2. Non-UXO Personnel

- a. **Training.** Prior to commencing site work, all non-UXO personnel shall receive site specific training detailing the specific UXO risks and other site particular issues consisting of an **accepted course of instruction** as submitted in the Training Plan. This training should include, but is not limited to the following:

- (1) Generic training such as the following to be conducted prior to commencing work:
    - (a) natures of ammunition;
    - (b) associated ammunition and UXO hazards;
    - (c) UXO recognition cues and features;
    - (d) procedures if UXO or suspected UXO are encountered;
    - (e) actions/procedures in a UXO/suspected UXO affected area; and
  - (2) Site specific training to include the topics above, but directed towards known or expected UXO risks and specific site conditions and environment. This training must be conducted at the work site immediately prior to commencement of work with daily refresher training and updates.
- b. **Supervision.** All non-UXO qualified personnel working on the site in the danger zone must be escorted by at least a UXO TECH and must be supervised by a UXOTS or higher qualified person. When continuous supervision is not available, the non-UXO qualified personnel shall be removed from the danger/exclusion zone.

### 3A08. UXO AVOIDANCE

1. **UXO Avoidance Personnel.** As with any UXO activity, the number of personnel within a danger/exclusion zone should always be the minimum required to safely conduct the task. Normally, the UXO Avoidance Team consists of a Team Leader with Surface and Electronic/Subsurface Sweeper(s). For small tasks the team is a minimum of two personnel where one conducts a visual sweep to locate any surface items and the second operates the detection device to locate subsurface items. If the UXO avoidance task involves confirming the absence of potential UXO while conducting bore holing/small sampling excavations/etc., a single UXO qualified person, as accepted by the DND PM, may be acceptable provided at least one other person/individual is present and all other safety and risk factors permit this. For larger tasks, up to five sweepers can form a team to conduct both visual surface and electronic subsurface searches. The table below provides a template for a UXO avoidance team. Actual site and task requirements will govern the final team organization required.

Qualifications <sup>(1)</sup>	Role	Training	Remarks
<b>Team Leader</b> a. Small Tasks (2 personnel)—UXO Technician (UXO TECH) b. Larger Tasks (> 2 personnel)—UXO Technician Supervisor (UXOTS)	Lead UXO Avoidance Team	All team members shall receive refresher training in UXO recognition and safety practices for the specific site.	a. DAER approved civilian qualifications for UXOTS, UXO TECH and UXOA are available from DEEM 2 or DND UXO and Legacy Sites Program. b. Team may include Marker(s) if the size of the safe lane and/or

Qualifications <sup>(1)</sup>	Role	Training	Remarks
<b>Surface and Electronic/Subsurface Sweeper(s)</b> —UXO TECH or UXO Assistant (UXOA)	Search visually and electronically to locate then report the finding of surface and subsurface UXO, suspected UXO and scrap	As per above, plus specific training on the use/care of electronic equipment used to search for/locate buried items.	number of UXO expected exceeds the capability of the Sweeper(s) to mark.
<b>Marker(s)</b> —UXOA or higher	Marks items designated as suspected UXO, lanes, safe routes, etc.	As per above, plus specific training on the marking requirements.	As required

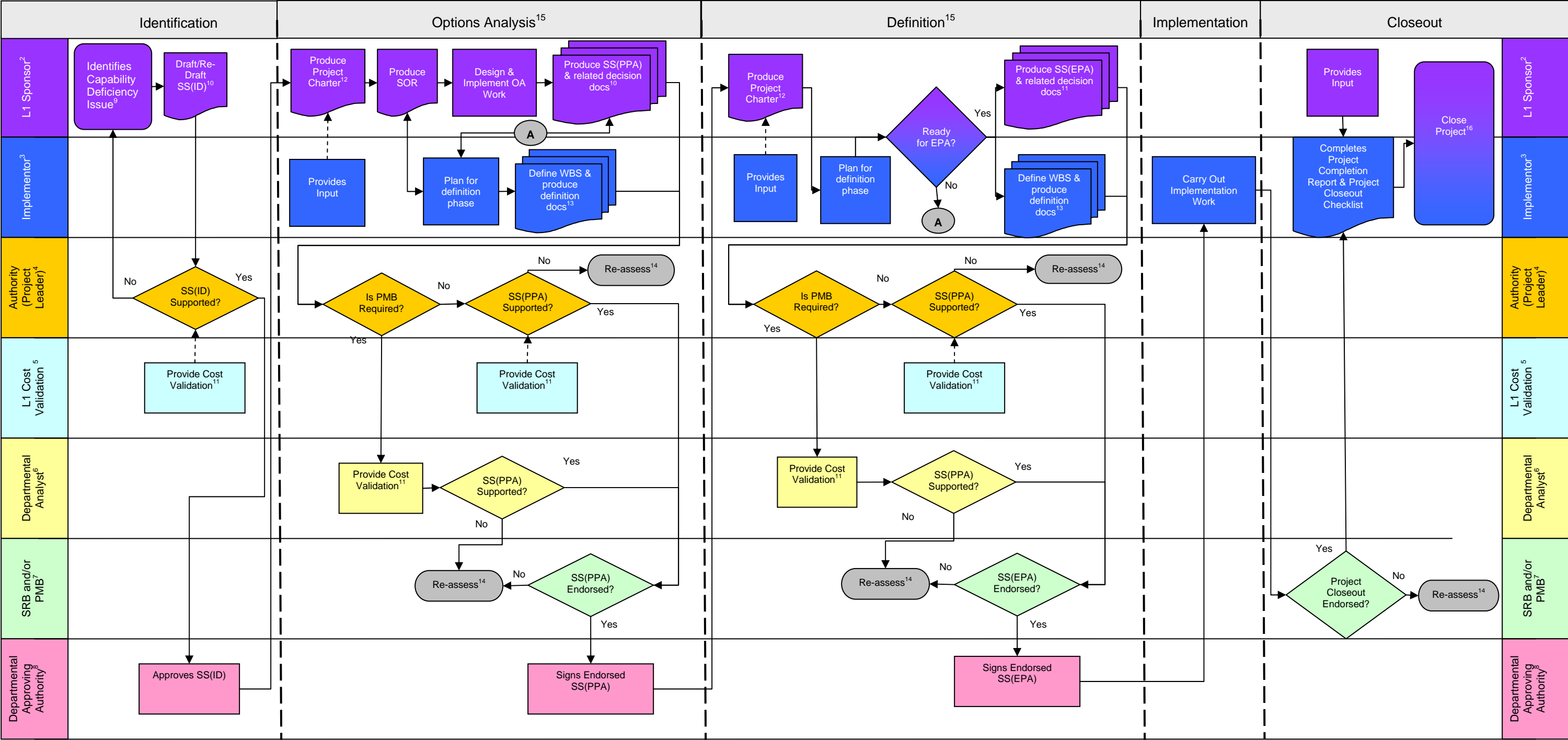
Table 3A-1: UXO Avoidance Team Template

**Note**

For sites that have been previously cleared or have a minimum risk for surface UXO, the personnel qualification for small UXO avoidance tasks (two personnel) may, with DND PM concurrence, be reduced



ANNEX B TO CHAPTER 3 - UNEXPLODED EXPLOSIVE ORDNANCE (UXO) PROCESS MAP FOR PAG (IE)<sup>1</sup>



**Notes:**

- While this process map is focused at major projects (>\$1M), the Steps described and types documentation required is the same for projects/activities that are <\$1M. Only the scope and complexity of the documentation should differ commensurate with the approval level and complexity.
- L1 sponsor will normally be the designated L1 custodian organization for DND sites or ADM(IE) for Legacy sites. The L1 sponsor appoints the Project Director.
- For projects >\$1M, the implementer may be from ADM(IE)/DGME or the custodial L1.
- The Project Leader represents the Project Authority. Depending on the phase of the project, the Project Leader may be from the Project Sponsor or Implementer.
- Depending on the project sponsor and governance, the cost validation for documentation will be done by DIECS (for ADM(IE) projects) or the custodial L1 Comptroller.
- Depending on the complexity and value of the project, the Analyst may be from VCDS or the L1 sponsor.
- Depending on the complexity of the project, an SRB will be required and be chaired at the appropriate level within ADM(IE) or the custodial L1.
- Depending on the complexity and delegations of authorities, the Dept Approval Authority may be PMB, ADM(IE) or custodial L1.
- Capability deficiency may be a result of change of land/RTA use, periodic maintenance, sustainable development, property disposal and/or UXO risk reduction/mitigation on DND or non-DND (i.e. Legacy) sites.
- Formal approval/decision documents are required regardless of the value of the project/activity. PAG documents such as SS(ID)/SS(PPA)/SS(EPA) are listed here.
- TBD
- The format and extent of detail required in the Project Charter and other project/activity management documents will depend on the complexity of the project/activity and its level of review/approval required.
- Project Management Plan, PPRA & PCRA (as applicable), Cost Est., WBS, Schedule.
- Re-Assess = Potential outcomes: revise SOR, Definition Phase, Implementation Plans, Delay Project, Revise Project Structure/Org., Revise Options Analysis.
- IAW the proposed OA phase for Environmental projects, the UXO OA phase should answer "Do I really need to do field type work to better define problem". This leads into the Definition phase for the bulk of the survey/investigative activity under the SS(PPA).
- Close-out entails closing the current project/activity and does not necessarily imply that the liability for DND is over and ongoing activity at a site (periodic risk re-assessment, etc) is not required.



## **ANNEX C TO CHAPTER 3**

### **SUGGESTED WORK PLAN/REPORT FORMAT GUIDELINES FOR CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES**

#### **3C01. GENERAL**

1. Consistent formats and content for Work Plans and reports greatly eases their production by contractors as well as the review and acceptance process by DND. The following formats are provided as guidelines for Work Plans and reports from contracted range clearance/UXO activities. Individual task/project SOW/SORs must specify the details of what DND expects from the contractor in their Work Plans and reports for specific sites. Further details and information can be obtained from Directorate of Environmental Engineering (DEEM) 2 or the Directorate of Real Property Management (DRPM) 2 - DND UXO and Legacy Sites Program (UXO Legacy Sites Program).

#### **3C02. AIM**

1. The aim is to provide suggested Work Plan and report format guidelines for range clearance/UXO activities.

#### **3C03. SUGGESTED WORK PLAN FORMAT GUIDELINES**

1. **General.** A Work Plan shall be prepared and submitted by the Contractor to DND and Contracting Authority (CA) for all UXO related projects following award of the contract or in response to against a call-up on a Supply Arrangement, Standing Offer Agreement or other contracting instrument. The Work Plan expands on the information provided in the Contractors bid submission. The review and acceptance by DND of the Work Plan allows DND, the CA and Contractor to develop a common understanding of how the work will be completed. The Work Plan also provides a medium through which the Contractor can inform his work force of the goals, roles, responsibilities and procedures for the project.

#### **Note**

**DND review and acceptance of the contractor's Work Plan does not relieve the contractor of responsibility for the completeness and accuracy of their work**

2. **Structure.** A standardized Work Plan structure and format should be used as this will facilitate both the preparation and review process by the Contractor, DND and CA respectively. The most current outline as well as further details and information on the structure, format and content of Work Plans can be obtained from DEEM 2 or DRPM 2 - UXO Legacy Sites Program. A suggested outline structure is provided below:

- a. **Introduction.** The Introduction provides a brief description of the intent, objectives, scope and other topics that generally characterizes the site and anticipated work. It should include, but is not limited to, the following topics:
  - (1) Project Authorization,
  - (2) Purpose and Scope,
  - (3) Site Location(s),
  - (4) Site Description(s),
  - (5) Site History and Past Usage,

- (6) Current and Future Intended Usage,
  - (7) Topography,
  - (8) Climate and Anticipated Weather.
  - (9) Previous UXO Clearance Activities on the Site(s),
  - (10) Initial UXO Risk Summary, and
  - (11) Other general topics as required for the specific site/project.
- b. **Project Management.** This section provides guidance on the procedures the Contractor intends on using to manage the project. It should include, but is not limited to, the following topics:
- (1) Project Organization,
  - (2) Key Personnel Roles and Responsibilities,
  - (3) Mobilization and Site Set-Up,
  - (4) Site Access,
  - (5) Communications and Reporting,
  - (6) Document Control Process,
  - (7) Sub-Contractor Management,
  - (8) Field Operations Management.
  - (9) Project GIS,
  - (10) Digital Imaging Cataloguing,
  - (11) Digital Data management and transfer,
  - (12) Project Database,
  - (13) Project Scheduling,
  - (14) Project Deliverables,
  - (15) Costing and Billing, and
  - (16) Other management topics as required for the specific site/project
- c. **Technical Management.** This section provides guidance on the technical methods and procedures the Contractor intends on using to complete each definable work element during the project. It should include, but is not limited to, the following topics:
- (1) Technical Overview,
  - (2) Personnel Roles and Responsibilities,
  - (3) Personnel Transportation,
  - (4) Work Hours,
  - (5) Tasks,
  - (6) Field Data Collection and Information Transfer,
  - (7) Site Security, and



- (8) Other topics as required for the specific site/project.
- d. **Geophysical Management.** This section provides guidance on the technical methods and procedures the Contractor intends on using to complete the geophysical elements of the project. For projects with large and/or complex geophysical elements, it should be separate from the overall Technical Management section. For smaller, less complex projects, it may be incorporated as a sub-section of the overall Technical Management section. Regardless of its location, it should include, but is not limited to, the following topics:
- (1) Geophysical Overview,
  - (2) Methodology,
  - (3) Personnel Roles and Responsibilities,
  - (4) Sensor(s) and Platform(s),
  - (5) Sensor Calibration,
  - (6) Geophysical Soft Prove Out,
  - (7) Data Collection and Processing,
  - (8) Dig Sheet Development
  - (9) Anomaly Re-acquisition,
  - (10) Geophysical Mapping,
  - (11) Deliverables, and
  - (12) Other geophysical related topics as required for the specific site/project.
- e. **Intrusive Investigation Management.** This section provides guidance on the technical methods and procedures the Contractor intends on using to complete the intrusive investigation elements of the project. For projects with large and/or complex intrusive investigation elements, it should be separate from the overall Technical Management section. For smaller, less complex projects, it may be incorporated as a sub-section of the overall Technical Management section. Regardless of its location, it should include, but is not limited to, the following topics:
- (1) General Methodology and Overview,
  - (2) Personnel Roles and Responsibilities,
  - (3) UXO Excavation Procedures,
  - (4) Minimum Separation Distance,
  - (5) Maximum Greatest Fragmentation Distances,
  - (6) Exclusion Zone,
  - (7) UXO/Anomaly Identification,
  - (8) Accounting, Tracking and Chain of Custody Documentation
  - (9) Non-Working Hours Explosive Ordnance (EO) Security,
  - (10) Level One and Two Scrap Screening (if scrap handling is not in a separate section), and

- (11) Other topics as required for the specific site/project.
- f. **Explosive Ordnance (EO) Management.** This section provides guidance on the technical methods and procedures the Contractor intends on using to manage the handling of EO items and the destruction of UXO during the project. For projects with large and/or complex EO elements, it should be separate from the overall Technical Management section. For smaller, less complex projects, it may be incorporated as a sub-section of the overall Technical Management section. Regardless of its location, it should include, but is not limited to, the following topics:
- (1) General Methodology and Overview,
  - (2) Personnel Roles and Responsibilities,
  - (3) Personnel Qualification,
  - (4) EO Accountability and Records,
  - (5) Disposal/Destruction Methods and Planning,
  - (6) Alternate Disposal/Destruction Methods and Planning,
  - (7) EO Transportation and Storage,
  - (8) Management and Storage of Demolition Materials,
  - (9) Accounting, Tracking and Chain of Custody Documentation
  - (10) Security,
  - (11) Level Three Scrap Screening (if scrap handling is not in a separate section), and
  - (12) Other EO related topics as required for the specific site/project.
- g. **Scrap Handling Management.** This section provides guidance on the technical methods and procedures the Contractor intends on using to complete the scrap (munitions scrap (MS), non-munitions scrap (NMS) and hard target material) handling, screening and storage elements of the project. For projects large and/or complex scrap elements, it should be separate from the overall Technical Management section. For smaller, less complex projects, it may be incorporated as sub-sections of the Intrusive Investigation Management (for Level One and Two screening), EO Management (for Level Three screening) or as a sub-section of the overall Technical Management section. Regardless of its location, it should include, but is not limited to, the following topics:
- (1) General Methodology and Overview,
  - (2) Personnel Roles and Responsibilities,
  - (3) Scrap Handling Procedures -
    - (a) Level One, Two and Three Scrap Screening Procedures,
    - (b) Scrap Storage Procedures, and
    - (c) Scrap Accounting, Tracking and Chain of Custody Documentation,
  - (4) Minimum Separation Distance,
  - (5) Maximum Greatest Fragmentation Distances,

- (6) Exclusion Zone,
  - (7) UXO/Anomaly Identification and Handling Procedures, and
  - (8) Other topics as required for the specific site/project.
- h. **Explosive Siting Management.** This section provides guidance on the technical methods and procedures the Contractor intends on using to store explosive material/items during the project. For projects with large and/or complex explosive siting elements, it should be separate from the overall Technical Management section. For smaller, less complex projects, it may be incorporated as a sub-section of the overall Technical Management section. Regardless of its location, it should include, but is not limited to, the following topics:
- (1) General Methodology and Overview,
  - (2) Consolidation and Holding Area(s),
  - (3) Management and Storage of Demolition Materials,
  - (4) Explosive Storage Magazines,
  - (5) Site maps,
  - (6) Security, and
  - (7) Other related topics as required for the specific site/project.
- i. **Quality Control (QC) Management.** This section provides guidance on the technical methods and procedures the Contractor intends on using to conduct QC on all aspects of the work for the duration the project. It should include, but is not limited to, the following topics:
- (1) General Methodology and Overview,
  - (2) QC Organization Chart with Roles and Responsibilities,
  - (3) QC Process Flow Chart,
  - (4) Daily Field Activity Records,
  - (5) Daily QC Reports,
  - (6) Daily QC Inspection Reports,
  - (7) Data QC Process,
  - (8) Corrective Action Process,
  - (9) Lesson Learned Process,
  - (10) QC Summary Report, and
  - (11) Other QC related topics as required for the specific site/project.
- j. **Environmental Management.** This section provides guidance on the technical methods and procedures the Contractor intends on using to meet the requirements of the Environmental Assessment (a screening or comprehensive study in accordance with due diligence or regulations) and the action/mitigations on discovery of environmental contamination during the project. It should include, but is not limited to, the following topics:
- (1) General Methodology and Overview,

- (2) Environmentally Sensitive Areas,
- (3) Species At Risk,
- (4) Vegetation Removal,
- (5) Site Disturbance Mitigation Procedures,
- (6) Procedures on Discovery of Environmental, Historical, Cultural, Archaeological or Aboriginal Issues of Concern,
- (7) Summary Report, and
- (8) Other related topics as required for the specific site/project.

k. **Communications Management.** This section provides guidance on the responsibilities, methods and procedures, as directed in the SOW/SOR, the Contractor intends on using for internal (within the Contractor's work force and DND/CA project team) and external (public/other stakeholders) communications for the duration the project. It should include, but is not limited to, the following topics:

- (1) Purpose and Scope,
- (2) Roles and Responsibilities,
- (3) Points of Contact,
- (4) Coordination and Review,
- (5) Road Closures and Service Interruptions,
- (6) Re-location Procedures,
- (7) Stakeholder, Public and Media Communications,
- (8) Lesson Learned Process,
- (9) Communications Summary Report, and
- (10) Other QC related topics as required for the specific site/project.

l. **Health, Safety and Emergency Response Management.** This section provides guidance on the methods and procedures the Contractor intends on using to promote and to ensure health and safety standards are emphasized and maintained concerning all aspects of the work for the duration the project. Training plays a large role in health and safety and may, for small projects, be included in this section. For larger projects, a separate section will be required. The health, safety and emergency response section should include, but is not limited to, the following topics:

- (1) Organization, Qualifications, Roles and Responsibilities,
- (2) Site Description,
- (3) Hazard Analysis and Risk Assessment,
- (4) Health and Safety Programs,
- (5) Personal Protection Equipment,
- (6) Emergency Response and Contingency Plan,
- (7) Emergency Equipment and First Aid Requirements,

- (8) Heat/Cold Stress and Fatigue Monitoring,
  - (9) Accident/Incident Protection and Prevention, and
  - (10) Other QC related topics as required for the specific site/project.
- m. **Training Plan.** This section provides guidance on the methods and procedures the Contractor intends on using to promote and ensure adequate training (initial and refresher) for all aspects of the work and maintained for the duration the project. Training plays a large role in health and safety and may, for small projects be included in the health and safety section. For larger projects, a separate section will be required. The Training Plan should include, but is not limited to, the following topics:
- (1) Organization, Qualifications, Roles and Responsibilities,
  - (2) Employee and Sub-Contractor Training,
  - (3) Visitor Training,
  - (4) Site Specific Training Process,
  - (5) Ongoing Refresher Training Process,
  - (6) Personal Protection Equipment Training,
  - (7) Emergency Response Training,
  - (8) Specific Equipment Training, and
  - (9) Other QC related topics as required for the specific site/project.
- n. **Appendices.** The appendices to the Work Plan contain reference material required for the complete understanding of the Work Plan. They should include, but is not limited to, the following topics:
- (1) SOW/SOR,
  - (2) Site Maps
  - (3) SOPs,
  - (4) Points of Contact,
  - (5) Contractor Forms, and
  - (6) Other related topics as required for the specific site/project

### 3C04. SUGGESTED REPORT FORMAT GUIDELINES

1. **Progress Reports.** Written progress reports shall be submitted in accordance with the SOW/SOR (normally weekly) during periods when the contractor is actively involved in the project. They must detail activities and expenditures for the reporting period, specify activities and expenditures planned for the next work period, and provide a general Work Plan and estimate for the remaining contract period. This updated Work Plan must be compared to the original schedule outlined in the initial Proposal and expanded upon in the detailed schedule of activities and deliverables. Discrepancies shall be discussed in detail. A suggested format and content is below:

- a. **Part I.** Answer the following questions (explain negative responses):

- (1) is the project on schedule according to the timetable agreed to by the DND PM and the CA;
    - (2) is the project within budget; and
    - (3) is the project free of any areas of concern in which the assistance or guidance of the DND PM and/or the CA may be required?
  - b. **Part II. Outline:**
    - (1) activities and expenditures undertaken in the current reporting period (may include sketches, photographs, etc, to illustrate progress and factors being discussed);
    - (2) activities and expenditures forecasted for the next work period; and
    - (3) explain variations from the original Schedule of Tasks and Work Plan.
  - c. **Part III.** Explain the general Work Plan, schedule and expenditure estimate, by month and task, for the actual and forecast work remaining in the contract period. Use own form generated locally, e.g. GANTT chart. This part would provide the basis for measuring work progress and contract performance.
  - d. **Part IV.** QA/QC documentation should be part of the reporting process.
2. **Final Draft and Final Range Clearance/UXO Activity Report.** Reports shall abide by the criteria set out in the SOW/SOR for reports. The reports should, but are not limited to the following:
  - a. **General.** The final draft and final reports shall be submitted in three copies to the CA/DND PMs for review and approval.
  - b. **Format.** The following format and minimum level of information should be included:
    - (1) Title Page — including report name, dates submitted/approved, authors/contributors by name and job titles.
    - (2) Acknowledgements.
    - (3) Executive Summary — summary of task/project, process and results (maximum one page preferred).
    - (4) Table of Contents.
    - (5) Introduction — to focus on background, site description information and operational history specifically related to UXO, report format, general description of what the project entailed, initial risk characterization, description of EO Encounter Pathways (EEPs).
    - (6) Quality Control Plan (QCP) — detailed description and analysis of Plan as executed including strengths and weaknesses.
    - (7) Conceptual Site Model (CSM) — detailed description of components, revisions and final model details.
    - (8) Geophysical Information, to include:
      - (a) Data Quality Objectives (DQO) — sources of information, restriction and threshold parameters affecting current and future clearance decisions. Specify strengths and weaknesses.

- (b) Geographic Information System (GIS) Compilation — describe data sources, accuracy, projections, formats, database structure, any processing methods or potential errors, complete and detailed list of all digital deliverables and GIS tabular structure, etc.
- (c) Geophysical Soft Prove Out (SPO) –
  - i. Describe all data (include geo-positional) quality, accuracy and precision. Identify confidence and relate to QCP.
  - ii. Describe all processing, enhancement, filters and interpretation process.
  - iii. Include detailed description of site SPO or production results. Identify and justify target selection process.
- (9) Geophysical Survey -
  - (a) Confirm rationale and justification for methods and equipment including site SPO descriptions and results.
  - (b) Describe methods, equipment and personnel specifically used in this project. Identify strengths and weaknesses, tolerances, repeats, tests, and calibrations. Relate to QCP.
- (10) Geophysical Data Analysis Hard Prove Out (HPO) -
  - (a) Describe all data (include geo-positional) quality, accuracy and precision. Identify confidence and relate to QCP.
  - (b) Describe all processing, enhancement, filters and interpretation processes. Include the target picking process and decision making.
  - (c) Include detailed description of site HPO or production results. Justify sample selection process in case of limited investigation.
  - (d) Include track logs from any survey activity.
- (11) Site UXO Model (SUM) — present risk characterization based on results and describe UXO, munitions scrap and non-munitions scrap type, distribution and frequency in 3-D. Specify confidence levels, strengths and weakness. Description to include but not limited to:
  - (a) specific location (GPS position +/- 0.25 m (in x, y, z axis), etc.) of each UXO target exposed/suspected anomaly left in place, along with the depth at which each UXO target was located or digging stopped;
  - (b) quantities and types of UXO/munitions scrap and potentially dangerous munitions scrap found, removed and/or demolished;
  - (c) generically, amounts and types of non-munitions scrap removed; and
  - (d) description of targets/anomalies not exposed/recovered and reason the target/anomaly was left in place, e.g.:
    - i. object not found (deeper than {state Depth});
    - ii. geological anomaly; or

iii. other reasons.

- (12) Field Activities and Procedures — include comparison of the Work Plan's original schedule and task methodology to actual outcomes.
- (13) Summary of earthmoving work to include hours of operation per machine, and volume and location of material moved and/or processed (GPS position of the corners/turn points, +/- 0.25 m, on x/y/z axes, etc.).
- (14) Summary of topsoil/re-seeding work to include volume of topsoil, number of truck loads (if shipment required), amount of seed and extent of seeded areas (GPS position +/- 0.25 m on x/y/z axes, etc.).

**(Note:** *Information in the body of the report should be summarized and detailed in an annex using a GIS based Conceptual Site Model format. All data collected should accompany the report on a CD and be accessible to DND in an approved format.*)

- (15) Conclusions — assess the overall success of the project with particular reference to project goal(s) and management objectives.
- (16) Recommendations — including challenges and/or experiences during the contract, steps to meet such challenges in the future, immediate mitigation measure/actions required prior to any further clearance, or residual/follow-up work. Relate to SUM including an estimate of cost (options analysis), and relate to land-usage and specify Depth of Exploration (DoE).
- (17) Annexes/Appendices (as required) — including a copy of the Request for Proposal with amendments as applicable, documentation of results, Work Plan, and any other useful information to support the main body of the report, e.g.:
  - (a) daily tests and calibrations charts and data;
  - (b) data repeats;
  - (c) data analysis and interpretation results (SUM), in dig sheet format;
  - (d) tabulated UXO investigation and clearance results (depth, orientation, item, condition, etc);
  - (e) itemized list of deliverables;
  - (f) Table of Contents for any CD delivered products; and
  - (g) scaled maps of project area, survey area(s), geophysical survey stations, processed data and interpretations, etc.

c. **Review Process.** The contractor should notify the CA/DND PMs at least one week prior to the submission of the final Draft Report. Four weeks should be allocated for the CA/DND team to review the final draft report and final report once submitted.

d. **Final Report.** The Final Report would normally be due within one week of the contractor receiving all of the final comments from CA and DND representatives.

3. **Technical Report Distribution.** The contractor should submit all Draft and Final Reports, range clearance/UXO activities Work Plans (with Annexes, SOPs, etc) and additional work deliverables (both electronic and paper versions) in two (2) copies to the DND PM and one



(1) copy to the CA. The Final Report (electronic and paper copy) must include all findings of the range clearance/UXO activity project and documentation generated throughout the project (including electronic copies of all photographs).

### 3C05. WORK PLAN/REPORT CRITERIA

1. All documents (reports, summaries, databases, etc, whether in electronic or paper copy format) produced under the contract shall remain the property of DND and shall be turned over to DND with the contractor's consent to reproduce the documentation. Unless otherwise stated in the SOW/SOR, all deliverables will be sent to the CA who will forward them to the DND PM. Generic criteria for all deliverables are:

- a. **Translation/Bilingualism.** In accordance with Government policy on bilingualism, the RFP/SOW/SOR will specify bilingualism and translation requirements.
- b. **Printed Deliverables.** All printed or hard copy deliverables should be produced on 8.5 x11 inch bond paper. Foldouts may be on 11 x 17 inch bond paper. Annotated maps should be at an appropriate scale with a scale bar and North arrow visible. Maps, images and graphics should be in colour to easily distinguish the various features, however, the contractor must ensure that critical data is not lost due to black and white reproduction. All pages must be sequentially numbered with Chapter number followed by the page (1-1, 1-2, 1-3; 2-1, 2-2; etc.). Annexes and Appendices must clearly identify the Annex or Appendix as well as the related Chapter and page.
- c. **Electronic Documents.** All printed/hard copy deliverables should also be provided in electronic format on CD-R compact disks. All electronic submittals should be certified "virus free" and include the statement "virus free" on the disk. Copies of all electronic information should be provided to DND in the original editable format as well as any passwords/ciphers for protected/encrypted information. The following formats (and acceptable file extensions) should be used to submit all geo-referenced raw and processed data and interpretations, in addition to EO data collected during the course of the UXO survey and/or clearance activities:
  - (1) **Word Processing** — MS WORD 2000, \*.doc;
  - (2) **Scanned Documents** — Adobe, \*.pdf;
  - (3) **Drawings** — Latest DND Version of AUTOCAD, \*.dw;
  - (4) **Spreadsheets** — MS EXCEL 2000, \*.xls;
  - (5) **Schedules** — MS Project 2000, \*.mpp;
  - (6) **Presentations** — MS POWERPOINT 2000, \*.ppt;
  - (7) **Graphics/Photographs/Images** — JPEG, \*.jpg (minimum 30 0DPI with an image scale visible (cm or m));
  - (8) **Databases** — MS ACCESS 2000, \*.mdb;
  - (9) **Geophysical** — Geosoft, \*.xyz (.gdb or ASCII\*.txt, \*.dat);
  - (10) **Geospatial Grids** — Geosoft, \*.grd; and

- (11) **GIS** — compatible to DND/CF accepted and supported tools that meet DND/CF GIS standards and guidelines.
2. Specifications for digital data recording, presentation, and delivery should be as follows:
  - a. All digital data should be recorded, stored, and delivered in:
    - (1) metric units;
    - (2) accurately geo-referenced format (Universal Transverse Mercator (UTM NADxx Canada) specific to the site location); and
    - (3) industry standard formats as specified in the Deliverables section of the SOW/SOR.
  - b. All geophysical interpretations, UXO-related points and other pertinent spatial data should be located with an accuracy of {provide accuracy requirements – (+/- 0.25m on x/y/z axes, etc.)}.
  - c. All data layers should be compiled in a logical and systematic structure (hydrological, roads, utilities, etc.). A partial list of digital layers that may be included in a GIS compilation would be:
    - (1) positively identified UXO;
    - (2) positively identified archaeological sites;
    - (3) geodetic monuments (with IDs);
    - (4) property boundaries (with IDs);
    - (5) (paths, roads, highways, rail lines and related transportation infrastructure;
    - (6) buildings, parking lots and other infrastructure (on, above and below the surface);
    - (7) power lines, utilities and fences;
    - (8) environmental sample pits, well sites, etc.;
    - (9) coastlines, lakes/ponds/sloughs and waterways (rivers, streams, canals, creeks, etc);
    - (10) forests, trees, shrubs or other relevant vegetation;
    - (11) past, current and future land use classifications;
    - (12) geomorphologic features;
    - (13) bathymetry; and
    - (14) topography.
  - d. Where appropriate, point and polygon data should be linked to a logical and systematic structured database (described in project reports) for the purpose of digital queries.
  - e. All maps should be compiled at an appropriate scale, annotated with geographic coordinates, and contain a minimum of a scale bar and North arrow.
  - f. Any approved deviation from industry standards shall be fully specified in documentation and reports relating to the project.

## ANNEX D TO CHAPTER 3 PROCEDURES FOR UXO, AMMUNITION AND EXPLOSIVES ACCIDENT/INCIDENT REPORTING

### 3D01. GENERAL

1. **General.** This annex summarizes Chapters 1 through 3 of A-GG-040-006/AG-002 *DND Ammunition or Explosives Accidents/Incidents/Defects/Malfunctions Reporting* and has been modified for use during contracted range clearance/UXO activities. It is designed to serve as an aide-memoire for contractors and DND PM staff in the event of an ammunition and/or explosives accident/incident involving UXO or explosives/explosive stores being used during any range clearance/UXO activity. Where the next level in the reporting process described herein is not readily available, the senior level present shall assume responsibility for notifications and gathering the required information until such time as the appropriate level in the reporting process can assume control. DAOD 3002-4, *Ammunition or Explosives Accident, Incident, Defect or Malfunction Reporting*, along with A-GG-040-006/AG-002 and Ammunition and Explosive Instruction (A&EI) 07, *Ammunition and Explosives Accident/Incident Investigation and Reporting*, remain the governing publications for ammunition and explosives accidents or incidents and shall be applied as it relates to contracted UXO work.

#### **NOTE**

**In order to avoid confusion with the use of A-GG-040-006/AG-002 for DND/CF ammunition and explosives accidents/incidents during training, operations or administrative handling, the term UXO accident or incident includes ammunition and /or explosives/explosive stores being used during any UXO clearance activity while all items referring to weapons or weapon systems are removed**

2. **Ammunition Accident and Incident Definition.** In accordance with A-GG-040-006/AG-002, accidents and incidents involving UXO, ammunition or explosives are defined as:

- a. **Ammunition or Explosives Accident** - means any undesired event involving the premature or unintended detonation or initiation of an ammunition, explosive or UXO that results in personal injury or death, or materiel losses
- b. **Ammunition or Explosives Incident** - means any undesired event involving ammunition, explosives or UXO that could, but does not, result in personal injury or death, or materiel losses. This includes theft

#### **NOTE**

**In order to assist with the determination of whether a hazardous occurrence should be treated as an Ammunition or Explosives Incident, the following list (list is not all inclusive) shall all be reported as UXO Ammunition or Explosives Incidents:**

- (1) Any event involving the unintentional or premature detonation, initiation or ignition of UXO, ammunition or explosives not resulting in personal injury, death or material loss;
- (2) Any unauthorized use or unapproved method of use of UXO, ammunition or explosives not resulting in personal injury, death or material loss;
- (3) Any event involving the theft or loss of UXO, ammunition or explosives from the work site;
- (4) Any event resulting in damage or suspected damage to UXO, ammunition or explosives;

- (5) Unauthorized modifications or alterations to UXO, ammunition or explosives;
- (6) Unauthorized use or storage of UXO, ammunition, explosives or munitions scrap (MS) on the work site;
- (7) Unauthorized transportation of UXO, ammunition, explosives or MS
- (8) Unauthorized or improper handling of ammunition and explosives; and
- (9) Any hazardous or potentially hazardous situation resulting from UXO activities or ammunition and/or explosives defect or malfunction.

### 3D02. REQUIREMENTS

1. All accidents or incidents involving UXO, ammunition, explosives or explosive stores being used during any range clearance/UXO activity shall be reported in accordance with DND procedures in A-GG-040-006/AG-002, A&EI 07 and DAOD 3002-4.
2. Any individual involved in, witnessing or knowledgeable of an UXO, ammunition or explosives accident or incident shall ensure that it is reported to their superior immediately.
3. The investigation and reporting of all UXO, ammunition or explosives accidents or incidents is mandatory and must take place as soon as possible after an occurrence. They shall include those causing near misses, hazardous situations and even the slightest of injuries.
4. Contracted UXO activities shall ensure that:
  - a. reliable and efficient procedures for reporting UXO, ammunition or explosives accident or incidents are instituted,
  - b. reports and notifications are dispatched expeditiously, and
  - c. personnel involved in the UXO activity fully understand the notification and reporting procedures required for UXO, ammunition or explosives accidents/incidents and immediate actions to be taken in the event of an accident or incident.

### 3D03. REPORTING RESPONSIBILITIES

1. **Contractor.** The contractor shall report all UXO, ammunition or explosives accidents/incidents to the DND PM through the designated DND On-Site Representative (On-Site Rep).
2. **DND PM.** The DND PM, through the designated DND On-Site Rep, shall ensure protection of the UXO, ammunition or explosives accident/incident site as per Appendix 1 until the designated DND Authority (i.e. DND Site Base/Wing/Area Support Unit (ASU) Commander or their designated staff for DND Sites or the designated DND/CF supporting base/wing/ASU Ammunition Section or ATO on a Legacy Site) responds to conduct the necessary investigation. The designated DND On-Site Rep will also be responsible for notifying the appropriate DND/CF Authority as per Appendix 2.
3. **DND/CF Authority.** The DND Site Commander (for DND Sites)/designated DND/CF supporting base/wing/ASU (for Legacy Sites) shall be responsible for the investigation and submitting the completed reports, through the chain of command to NDHQ/DAER in accordance with A-GG-040-006/AG-002.

RESPONSIBILITY OF	RESPONSIBILITY
Individuals	Immediately report all UXO, ammunition or explosives Accidents or Incidents to their supervisors.
Contractors	Establishment of appropriate immediate actions and procedures for reporting of UXO, ammunition or explosives Accidents/Incidents.
DND PM (through the designated DND On-Site Rep	Ensure protection of the accident/incident site as per Appendix 1 until arrival of the designated DND/CF Authority.
	Gather and forward the information for the Notification within the prescribed time limit to the designated DND/CF Authority as per Appendix 2.
DND/CF Authority (DND Site Commander for DND Sites/designated DND/CF supporting base/wing/ASU for Legacy Sites)	Conduct investigation and drafting UXO, ammunition or explosives Accident/Incident report(s).
	Submitting the completed Preliminary and Detailed Reports in accordance with A-GG-040-006/AG-002 through the chain of command to NDHQ/DAER.
DAER	Provide regulatory oversight of Ammunition or Explosives Accident, Incident, Defect and Malfunction reporting and investigation.
	Review all Ammunition or Explosives or UXO, ammunition or explosives Accident and Incident reports, and related investigation reports, as part of the compliance function.

**Table 3C-1: UXO, Ammunition or Explosives Accident/Incident Reporting Responsibilities**

### **3D04. GENERAL SAFETY ACCIDENTS/INCIDENTS INVOLVING UXO**

1. If there is doubt whether a UXO, ammunition or explosives accident or incident should be reported as a general safety or UXO accident or incident, assistance and advice shall be sought through the DND On-Site Rep from the competent DND/CF Authority (When in doubt, **REPORT AS BOTH UNTIL DIRECTED OTHERWISE BY THE COMPETENT DND AUTHORITY**).

### **3C05. TYPES OF UXO, AMMUNITION AND EXPLOSIVES ACCIDENT OR INCIDENT REPORTS**

1. Aside from the Notification in Appendix 2, there are two types of reports in A-GG-040-006/AG-002:

- a. Ammunition/Explosives (/UXO) Preliminary Report (PRELREP) (12 hrs); and
- b. Ammunition/Explosives (/UXO) Detailed Report (7 days).

2. The preparation and dispatch by the DND/CF Authority of the reports from A-GG-040-006/AG-002 subsequent to a UXO, ammunition or explosives accident/incident is mandatory despite any other report submitted.

### **3C06. ADDITIONAL REPORTS AND ACTIONS**

1. The reports required by this Annex or A-GG-040-006/AG-002 does not obviate the need for additional reports and action if the circumstances of an UXO accident or incident so warrant. These may include but are not limited to: Labour Canada, Natural Resources Canada (NRCan) reporting; Coroners Inquest, civilian police, insurance and/or other provincial/municipal reporting requirements.

### **3D07. BASIC PROCEDURES AFTER UXO, AMMUNITION OR EXPLOSIVES ACCIDENTS/INCIDENTS OCCUR**

1. When an UXO, ammunition or explosives accident or incident occurs within a UXO work site, the designated DND On-Site Rep or senior DND or contractor person present, or until such time as the designated DND/CF support base/wing/ASU can assume control of the investigation shall:

- a. Suspend the activity being conducted at the time of the accident or incident pending positive determination of the cause, and absolute assurance that all contributing factors have been removed;
- b. Ensure that the remaining UXO/explosives involved is impounded and not used, tested, nor issued until direction is received from the DND/CF Authority;
- c. Impound any contractor or CF publication and other order, regulation and instruction (e.g. technical or training manual, contract documents (Work plan, QC Plan, SOPs, etc.), range order, etc.) being used as an authority to conduct the activity at the accident/incident site;
- d. Protect all accident or incident evidence in accordance with Appendix 1 until arrival of qualified investigators (A-GG-040-006/AG-002, Chapter 2 Figure 2-1); and
- e. Submit the Notification to the designated DND/CF Authority as per Appendix 2.

### **3D08. CIVILIAN INJURIES/DEATHS**

1. Civilian Injuries/Deaths must also be reported to the Director of Regional Labour Canada through the General Safety Officer who shall investigate and report in accordance with A-GG-040-001/AG-001 *DND General Safety Program, Volume 1 for DND Sites* or through the Contracting Authority and contractor for Legacy Sites.

## **APPENDIX 1 TO ANNEX D TO CHAPTER 3 PROTECTION OF EVIDENCE FORM UXO, AMMUNITION OR EXPLOSIVES ACCIDENTS/INCIDENTS**

### **3D101. GENERAL**

1. In order to avoid confusion with the use of A-GG-040-006/AG-002 *DND Ammunition or Explosives Accidents/Incidents/Defects/Malfunctions Reporting* for DND/CF defence explosive ordnance accidents/incidents during training, operations or administrative handling, the term UXO, ammunition or explosives accident or incident includes ammunition and/or explosives/explosive stores being used during any UXO clearance activity while all items referring to weapons or weapon systems are removed.
2. Each UXO, ammunition or explosives accident/incident indicates a failure or a defect in a person, a piece of materiel, a procedure, an environmental condition or a combination of any or all of these.
3. The investigator must examine each situation thoroughly to unearth the cause of the accident/incident. It is the responsibility of the investigator to determine all causes, primary and contributory, as well as to make constructive recommendations to correct the situation and prevent recurrence. Only after the causes have been identified can reliable preventive measures be employed to reduce or eliminate similar accidents or incidents.
4. In order to conduct a thorough investigation, all evidence at the site must be protected.

### **3C102. PROTECTION OF EVIDENCE AT A UXO, AMMUNITION OR EXPLOSIVES ACCIDENT/INCIDENT SITE**

1. It is extremely important that all evidence at an UXO accident or incident site be protected as is until an inquiry, qualified investigator or DAER authorizes its removal.
2. The following steps shall be taken to provide maximum possible protection of evidence at an UXO, ammunition or explosives accident or incident site:
  - a. The senior DND or contractor person present will ensure that a cordon is established which is manageable and of sufficient size to encapsulate the probable extent of the evidence and maintain a positive safety distance until such time as the area can be made safe;
  - b. A thorough search, if possible by a qualified DND/CF investigator, or if not available the designated DND On-Site Rep or, as a minimum, a contracted UXO Tech Supervisor will be made for UXO/explosives and/or UXO/explosives fragments. Untrained DND or contractor personnel shall not conduct the search. If any are found, the following procedures shall be followed:
    - (1) located items **ARE NOT TO BE TOUCHED**. They are to be marked and remain in situ for investigative purposes; or
    - (2) if it is necessary to move an item it should be undertaken by persons properly trained in the collection of evidence and it is essential to ensure that:
      - (a) the item has been determined safe to move by a competent technical authority,

- (b) the locations of all pieces are recorded accurately by map, GPS, sketch, video or photograph (or all these means) in relation to the accident point,

**NOTE**

**Maximum use should be made of video or photography and drawings as soon as possible after an accident or incident has occurred**

- (c) they are manipulated to the least possible extent utilizing surgical gloves and proper personnel protective equipment to preserve fingerprints, prevent cross contamination of material, protect the integrity of the evidence so as to withstand judicial or scientific scrutiny;
- (d) they are tagged and identified by evidence number, nomenclature (if known), date, time, location of collection and name of person collecting the evidence;
- (e) chain of custody of all evidence must be maintained and documented at all times; and
- (f) restrict suspect lots of explosives pending release by DND/CF Authority (DND Site Commander for DND Sites or designated DND/CF support base/wing/ASU for Legacy Sites).



## APPENDIX 2 TO ANNEX D TO CHAPTER 3 NOTIFICATION OF UXO, AMMUNITION OR EXPLOSIVES ACCIDENTS/INCIDENTS AND INFORMATION GATHERING GUIDELINES

### 3D201. GENERAL

1. In order to avoid confusion with the use of A-GG-040-006/AG-002 *DND Ammunition or Explosives Accidents/Incidents/Defects/ Malfunctions Reporting* for DND/CF defence explosive ordnance accidents/incidents during training, operations or administrative handling, the term UXO, ammunition or explosives accident or incident includes ammunition and/or explosives/explosive stores being used during any UXO clearance activity while all items referring to weapons or weapon systems are removed.
2. A Notification provides early advice to various higher authorities that an UXO, ammunition or explosives accident or incident has occurred. Information from the Notification by the designated DND On-Site Rep to the designated DND/CF Authority (DND Site Commander for DND Sites or DND/CF support base/wing/ASU for Legacy Sites) may be sent by telephone but it must be confirmed by an appropriate follow-up message/FAX.
3. The protection of evidence guidelines in Appendix 1 must be followed in gathering the information for Notification.

### 3D202. UXO ACCIDENT/INCIDENT NOTIFICATION FORMAT

1. **Information Contents.** The submission shall commence with the subject title UXO , Ammunition or Explosives *{as appropriate}* Accident or Incident *{as appropriate}* Notification and it must include as much of the following information as is available at the time without placing untrained or contracted UXO personnel at risk:

- a. Contractor (name) involved and project identifier (project name and number);
- b. Location, date and time of the occurrence;
- c. Details of the facilities and materiel involved;
- d. Description of the occurrence;
- e. Numbers of the persons injured or killed (if applicable);

#### NOTE

**The UXO, Ammunition or Explosives Accident/Incident Notification shall not provide details of individual identities. In accordance with the Reference, the DND/CF Ammunition or Explosive Accident/Incident Detailed report, completed by the DND/CF Investigator shall record the particulars of all individuals involved**

- f. Particulars of any loss or damage to materiel or facilities (if applicable);
- g. Known/probable cause(s);
- h. Hazardous conditions created or remaining;
- i. Rectification or preventative action being taken;
- j. UXO/explosives involved including type, nomenclature, NSN, AIC and lot number (where pertinent and available);

- k. Name, rank (if military), appointment, classification/trade/occupation and contact information (telephone number, etc.) of the person designated to conduct a local accident/incident investigation; and
- l. State whether further investigations/inquiries (Board of Inquiry, Summary Investigation, etc.) will be ordered (if known).

2. **Information Distribution.** The Notification must be sent as soon as possible following the accident/incident to the designated DND/CF Authority. An information copy must also be provided to the DND PM and the Contracting Authority within 12 hours.

### 3D203. INFORMATION GATHERING GUIDELINES

1. In order to assist the gathering of the required information for the Notification, the following list of technical factors that generally must be considered and be recorded for most types of investigations into UXO, ammunition or explosives accidents/incidents are provided below:

g. **General Factors**

- (1) Contractor/Sub-contractor/Work Unit(s) involved,
- (2) Date, time and location of the accident,
- (3) Weather and topography of the firing point/training area or accident site,
- (4) Any radio frequency (RF) or static electricity hazards in the area, and
- (5) Any other unusual matters that may be pertinent to the investigation.

b. **Damage and Casualties**

- (1) Personnel involved in the accident:

**NOTE**

**Names and other personal identification information are not to be included in the Notification Report but to be kept confidential until being turned over to the designated DND Investigator**

- (a) injured (Employee ID/Number, name, position, role, location in relation to the accident, description of the injuries),
  - (b) killed (Employee ID/Number, name, position, role, location in relation to the accident, cause of death), and
  - (c) witnesses (Employee ID/Number, name, position, role, what they witnessed (explosion, incorrect drill, aftermath, etc.)), and
- (2) Description of damage to materiel or facilities.

c. **Personnel Factors**

- (1) Supervisor's and operator's experience on the UXO/explosives, equipment, and drills and procedures related to the accident,
- (2) If a crew is involved, state how long they had been training as a team
- (3) State how long the operator(s) had been on duty and how many hours they had been on duty during the 48 hours preceding the accident,

- (4) A medical opinion on the effects of the pace of training personnel prior to the accident,; and
- (5) Mental state or attitude of operator(s) (low morale, personal problems, etc).

d. **Equipment Factors**

- (1) State what equipment was involved;
- (2) State if new equipment was involved; and
- (3) State if any other equipment or materiel handling equipment (MHE) was involved, and when was it last tested, checked or calibrated.

e. **UXO/Explosives Factors**

- (1) UXO/Explosives and Net Explosives Quantity (NEQ) involved;
- (2) Technical details of the UXO/explosives involved, including attachments of the applicable CFTOs, drawings, technical manuals, fact sheets, etc.;
- (3) Type of storage used for the UXO/explosives prior to the accident/incident;
- (4) State condition of UXO/explosives prior to the accident/incident;
- (5) Details of any proof or inspection completed on the explosives lot involved before and/or after the accident/incident (if known); and
- (6) State the temperature of the UXO/explosives at the time of the accident (if available).

f. **Drill or Procedure Factors**

- (1) Type of operation being performed;
- (2) Description of drills or procedures being followed that are significant to the accident;
- (3) State how long the drill or procedures had been in use and if any change had been made recently;
- (4) State if technical orders, instructions, check lists, etc. were available and up-to-date; and
- (5) Explosives firing details:
  - (a) Initiation method(s) (i.e. electric, non-electric), and
  - (b) Initiation mechanism(s) (direct insertion, shock tube, detonating cord, etc.);

g. **Investigation Summary**

- (1) A detailed statement by the DND investigator as to the cause of the accident/incident (faulty explosives, explosives accessory, drill or procedures, etc.);
- (2) From all available information describe what the investigator believes happened in the accident/incident;

- (3) Statement of fact of any immediate action taken at the site to prevent recurrence;
- (4) A statement detailing any further or parallel investigations being completed (police investigation, DND Summary Investigation/Board of Inquiry, other technical investigation, etc.); and
- (5) A diagram of the accident/incident area showing position of fragments in relation to the point of the explosion complete with photographs (if applicable).

## **ANNEX E TO CHAPTER 3 PROCEDURES FOR HANDLING AND DISPOSAL OF UXO DURING CONTRACTED UXO WORK**

### **3E01. GENERAL**

1. In Canada, contracted Unexploded Explosive Ordnance (UXO) services are the normal means of conducting surveys, site investigations, locating, exposing and identifying UXO on DND/CF active sites or on legacy sites. On legacy sites, the contracting of the handling and disposal of the UXO found on the sites is the norm and it may be considered as an option on active DND/CF sites.
2. As well, UXO contractors may, on a case by case basis, be contracted to respond to and conduct the handling and disposal of defence EO found by the public or others in the immediate vicinity of a contracted UXO site on public lands in order to alleviate the workload on DND/CF EO Disposal (EOD) teams. These actions shall only be undertaken when authorized in the Statement of Work (SOW)/Statement of Requirement (SOR) and shall be conducted in with accordance prearranged coordination measures with CFEOD, Canada Command and the applicable Joint Task Force Headquarters.
3. If the handling and/or disposal of UXO are to be done by a contractor, the Project Authority shall ensure that all provisions laid out in Chapter 1 Section 2 for security and the handling/disposal of Controlled Goods are followed.

#### **Note**

**Guidelines, Procedures and Regulations for contracted response for the Disposal of EO within the vicinity of the UXO site will be issued separately as required**

### **3E02. AIM**

1. The aim is to provide guidelines and procedures that augment and clarify the regulations contained in C-09-008-001/FP-000 *Destruction of Surplus, Obsolete and Deteriorated Ammunition*, C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas* and C-09-008-003/FP-000, *Ammunition and Explosives Procedural Manual – Explosive ordnance Disposal - Disposal of Stray Ammunition* with respect to the handling and disposal of UXO by appropriately qualified designated contract civilian UXO personnel that has been found and located by the contractor during contracted DND/CF range clearance/UXO activities.

#### **Note**

**This Annex must be read in conjunction with C-09-008-001/FP-000, C-09-008-002/FP-000 and C-09-008-003/FP-000**

### **3E03. GUIDELINES**

1. **General.** UXO is likely to be encountered under many different and unpredictable circumstances. It is difficult to specify standard methods of disposal, which would be adequate for each situation. Therefore, the instructions contained here cannot be regarded as fully comprehensive. Consequently, this Annex provides a general guide to qualified designated contracted civilian UXO personnel and ensures the minimum hazard to life, livestock, property, and the environment during the UXO handling and disposal process. It is essential that they be applied with sound judgement and common sense and should be amplified as necessary by the

qualified designated contracted civilian UXO personnel concerned, utilizing their training, technical knowledge and experience of ammunition and explosives, to address peculiarities of any particular task. Amplifying this Annex, the Appendices provide additional detailed guidance on the following:

- a. **Guidelines for Identification of UXO.** Appendix 1 augments and clarifies the information in the references to aid in indentifying UXO;
- b. **Guidelines for UXO Disposal Procedures.** Appendix 2 augments and clarifies the information in the references concerning UXO disposal procedures;
- c. **Guidelines for UXO Disposal Methods.** Appendix 3 augments and clarifies the information in the references concerning UXO disposal methods; and
- d. **Guidelines for Blast/Fragmentation Mitigation/Danger Area Reduction Measures.** Appendix 4 augments and clarifies the information in the references concerning use of engineered control measures to reduce the blast/fragmentation effects during UXO disposals,

**Note**

**These guidelines and procedures in this Annex and its Appendices apply only UXO handling and disposal by contracted civilian UXO personnel found and located by the contractor during contracted UXO activities**

2. **Safety.** Every effort shall be made to prevent accidents or incidents involving UXO. Safety considerations shall include those required for the designated contracted civilian UXO personnel to dispose of the UXO as well as those required to ensure the safety of the public and property. Aside from normal work place safety requirements and those detailed in Chapter 1, Annex C and the contract SOW/SOR for UXO activities, specific UXO safety measures related to UXO disposal for the following locations shall be used as additional safety guidance for contracted UXO disposal activities:

- a. **DND/CF Sites.** Range and training area (RTA) Standing Orders and C-09-008-002/FP-000; and
- b. **Outside DND/CF Sites.** Local/Provincial/Federal explosive/workplace safety regulations and C-09-008-003/FP-000.

3. **Explosives Related Accident/Incident Reporting/Investigation.** The reporting and investigation of any explosives related accident or incident during any UXO disposal activity shall be reported in accordance with Annex D, A&EI 07 *Ammunition Accident/Incident Investigation and Reporting* and A-GG-040-006/AG-002 *DND Ammunition or Explosives Accident/Incident/Defect/Malfunction Reporting*.

4. **Terminology.** The terminology used in this Annex can be found in the Glossary.

5. **Explosives Stores/Material/Equipment for Disposal Actions.** DND/CF personnel shall use only approved in-service explosives, explosives accessories and equipment as detailed in the appropriate DND/CF regulations. Civilian UXO contractors may use commercial equivalent explosives stores, material and equipment as detailed in the SOW/SOR and accepted in the Work Plan which has been approved for use in Canada by Natural Resources Canada (NRCan).

**Note**

**Commercial equivalent items shall be used in accordance with the original manufacturers' instructions**

6. **CRBN/Suspected CBRN UXO/Material.** Any UXO item that contains or is suspected to contain CBRN material shall be handled in accordance with DND/CF policies and regulations. If CBRN UXO or suspected CBRN UXO is found, the guidance outlined in Chapter 1 Annex C is to be followed. Contracted civilian UXO personnel **SHALL NOT** undertake any handling or disposal actions of actual or suspected UXO resulting from CBRN ammunition.

7. **Unfamiliar/Unidentifiable UXO.** Guidance on identifying items is contained in Appendix 1. Qualified designated contracted civilian UXO personnel may be called upon to deal with UXO with which they are not familiar with or cannot identify (obsolete or foreign natures, etc.). Information on these vintage, obsolete and foreign items may be found in old Technical Manuals and archived documents. Where no information can be found on a suspected item, it shall be referred through the chain of command for positive identification prior to disposal action being undertaken. For contracted UXO activities, these details will be specified in the SOW/SOR and may be available from the Directorate of Environmental Engineering Management (DEEM) 2 or Directorate of Real Property management (DRPM) 2 - DND UXO and Legacy Sites Program (UXO Legacy Sites Program) through the designated DND On-Site Representative (On-Site Rep).

**Note**

**Positive identification is achieved by the confirmation of a minimum of two data points (permanent in nature) in any configuration such as, documented and confirmed physical features, known and measured physical characteristics/dimensions, permanent markings (stamped, engraved, embossed, cast etc). Colour coding and or legible markings denoting the nomenclature may be indicators of proper identification, however they shall not be solely or in conjunction with each other relied upon to make a positively identification of a UXO. Colour coding and less permanent type markings may fade over time and/or have been re-marked incorrectly**

8. **Movement of UXO/Suspected UXO.** A contractor shall only move UXO/suspected UXO if the item has been positively identified as safe to move by appropriately qualified UXO personnel and if permitted in the SOW/SOR.

**Note**

**Only DND/CF EOD personnel are authorized to transport suspected live EO/UXO on public roads in accordance with A&EI 04 Change 1 *Transportation of Ammunition and Explosives Recovered from Domestic Explosive Ordnance Disposal Operations***

9. **Non-Ammunition Items.** Qualified designated contracted civilian UXO personnel are responsible for the inspection, collection and disposal of UXO and UXO related items detailed in the SOW/SOR only. They should not collect non-ammunition items, including weapons, unless specifically authorized and directed to do so in the SOW/SOR or the item concerned contains UXO or explosive residue.

10. **Security.** Strict security precautions are to be taken to ensure the safe handling and custody of all ammunition, explosives or UXO for disposal, both in transit and storage. For contracted UXO activities, NRCan regulations and licensing requirements will pertain for storage of UXO and explosives. UXO, being military ammunition, falls under Group 2 of the Controlled Goods provisions of the *Defence Production Act* (R.S. 1985, c.D-1). As such, the Project Authority must ensure that the appropriate security considerations are annotated in the Security Clearance Checklist (SRCL) prior release of the Request for Proposal. The contractor **shall not** handle or move UXO/suspected UXO unless directed in the SOW/SOR and registered with the PWGSC Controlled Goods Directorate or exempted under ADM(IE) Standard 1606-4000.1-S01-

023 *The Identification and Communication of Security Requirements for Realty Projects*  
paragraph 1.6.

11. **Work Plan and SOPs.** These guidelines and procedures are to be included in the Work Plan and SOPs of Contractors engaged in disposal of UXO. They are to be amplified as necessary to meet local requirements.

12. **Location of UXO.** The locations within Canada where UXO may be found are virtually limitless. Designated contracted civilian UXO personnel **shall only** respond to UXO that the contractor has found on the UXO work site as directed in the SOW/SOR. Experience has shown that in the majority of cases UXO outside of active DND/CF sites/RTAs are reported as having been found in many of the following situations:

- a. On Legacy Sites, either as part of an ongoing DRPM 2 - UXO Legacy Sites Program risk mitigation activity or when discovered by the public as follows:
  - (1) On former CF RTAs previously used for live firing, particularly where such land is now used for agricultural, forestry purposes or other uses,
  - (2) In coastal areas and inland waterways where ammunition previously dumped or used in surface firings has been washed up onto the shore or is visible in the shallows,
  - (3) On property previously owned or occupied by DND which is undergoing redevelopment, and
  - (4) On or around sites where accidents involving military vehicles, aircraft, ships may have occurred in the past;

**Note**

**Information on the location and status of known or suspected legacy sites is contained in the Legacy Sites Database and is available from DRPM 2 - UXO Legacy Sites Program**

- b. In scrap metal yards, where explosive items have inadvertently been included in salvage material; and
- c. Dredging sites and aggregate yards, where the raw aggregate has been suctioned or dredged from the lake/river/seabed near coastal/inland waterways defence locations or sea/inland water ranges.

13. **Condition of UXO.** It will be evident from the situations described above that items found will vary in external condition from recognizable with markings and colours intact, to those whose markings or colours have faded or are missing from being buried in the ground or subject to environmental conditions for a considerable period of time. Consequently the item may be so corroded that positive identification of the item may be very difficult or impossible. The internal condition of UXO may also vary from that which is perfectly safe to that which is highly dangerous. It is important that UXO, wherever encountered, should always be treated with suspicion. Nothing must be taken for granted and the opinions, suppositions and conjectures advanced by unqualified persons, must be treated with reservation by designated contracted civilian UXO personnel. This information should not be completely disregarded but should be considered as part of the overall risk assessment process.

**WARNING**

**Always treat UXO with suspicion. DO NOT take anything for granted, including the opinions of unqualified persons**



14. **Quality Control/Quality Assurance (QC/QA).** It is essential that the contractor's QC Plan and the project QA include the appropriate checks after and during each discrete step of the destruction process.
15. **Reporting.** Reporting of UXO will be as per the guidance provided in the SOW/SOR.
16. **Accountability/Tracking.** In order to maximize the safety and reliability of the Range/UXO process, an auditable accounting trail shall be enforced from the UXO grid/cell location through to the final disposal of the items. Each level and transfer point along the chain of custody shall be identified using the appropriate documentation and sign-off procedures. Documentation based on the sample UXO Identification, Scrap Accounting/Tracking, Scrap Chain of Custody and Daily Diary forms, in hard/paper and/or electronic/PDA formats, provided in Annex F may be used. Specific direction as to the level, type and frequency of accounting/tracking is provided in the SOW/SOR.

#### 3E04. PERSONNEL

1. **General.** As indicated above, the handling, storage, transportation, disposal and accounting for UXO can occur during varying times and work activities depending on the nature and conditions of the site. As with any UXO related activity, the number of personnel within a danger/exclusion zone should always be the minimum required to conduct the task safely.
2. **Qualifications.** At each level and phase of the procedures, only those personnel meeting roles and the DAER approved UXO qualifications described in Annex A shall fill the positions involved in the procedures described here.
3. **Team Composition.** The organization of the contractor's teams will depend on the planned methodology. Some personnel may be employed in more than one position provided they have suitably qualifications/experience and completion of the work in a safe and effective manner is not jeopardized. Documentation to support such compliance must be provided in the detailed proposal documents and Work Plan.

#### 3E05. PROCEDURES

1. **General.** The procedures provided are only for designated contracted civilian UXO personnel engaged in contracted UXO work for DND to assist the contractor in formulating their Work Plan and SOPs. These procedures are focussed mainly on Legacy or sites outside of DND/CF RTAs. The procedures detailed by RTA Standing Orders and applicable DND/CF regulations such as those in C-09-008-002/FP-000 will normally take precedence over those specified here during contracted UXO work on a DND/CF site. Where there are safety concerns regarding the DND/CF regulations on DND/CF sites, these conflicts shall be brought to the attention of the DND On-Site Rep who will seek resolution through the DND chain. The following procedures shall be followed unless specifically amended by the appropriate authority:
  - a. **Work Initiation/Start-Up Procedures.** These common procedures are outlined in Steps 1 through 4 below.
  - b. **Initial Finding of UXO Procedures.** Procedures to be followed after finding a UXO/suspected UXO item during surface sweep/clearance activities are outlined in Steps 5 through 9.
  - c. **Re-acquisition of Located UXO Procedures.** Procedures to be followed for re-acquisition of UXO/suspected UXO are outlined in Steps 10 through 12.

- d. **Exposing and Identification of Located UXO Procedures.** Procedures for exposing buried/covered items and the identification of UXO/suspected UXO are outlined in Steps 13 through 16. Guidance on identification is contained in Appendix 1.
- e. **UXO Disposal Procedures.** Procedures for disposal of UXO/suspected UXO through destruction or perforation are Steps 18 through 24. Guidance on disposal procedures and methods as well as protective measures are contained in Appendix 2, 3 and 4 respectively.
- f. **CBRN/Suspected CBRN UXO/Material Procedures.** Any UXO item that contains or is suspected to contain CBRN material shall be handled in accordance with DND/CF policies and regulations. If CBRN UXO or suspected CBRN UXO is found, the procedures outlined in Chapter 1 Annex C are to be followed. Contracted civilian UXO personnel **SHALL NOT** undertake any disposal actions of actual or suspected UXO resulting from CBRN ammunition

**Note**

**Contracted civilian UXO personnel SHALL NOT undertake any disposal actions on CBRN/suspected CBRN UXO/material**

**Common Work Initiation/Start-Up Procedures**

Step 1	The authority to commence work is coordinated and scheduled through site-specific SOPs, Range Standing Orders/Daily Range Orders, and SOW/SOR/Work Plan as applicable prior to commencement of work
Frequency	Daily
Instructions	None

Step 2	The Team Leader (Ldr) will conduct a general work and safety briefing and address specific topics prior to commencement of work
Frequency	Daily
Instructions	<ol style="list-style-type: none"> <li>1. Specific topics to be covered as a minimum:               <ol style="list-style-type: none"> <li>a. general health and safety rules;</li> <li>b. safety procedures;</li> <li>c. confirmation that adequate PPE is available and worn;</li> <li>d. review task allocations (screeners, visual sweeper, electronic sweeper, UXO recognition, etc.) and methods;</li> <li>e. review boundaries, marking and rate of work, etc;</li> <li>f. review documentation and chain of custody procedures;</li> <li>g. coordination with non-UXO qualified personnel and their activities (equipment operations, drivers, etc.);</li> <li>h. review hazards and actions/drills/SOPs ("Do's and Don'ts",</li> </ol> </li> </ol>

	<p>what to do if UXO is found, etc.);</p> <p>i. review any environmental, archaeological, cultural, or other concerns that may affect the task; and</p> <p>j. any other significant information required for the day's task.</p>
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Step 3	Conduct equipment checks/calibration.
Frequency	Daily and as specified.
Instructions	Manufacturers operation instructions shall be followed, defects/discrepancies documented, and non-serviceable equipment isolated.

Step 4	The Team Ldr will notify the superior chain of command/supervisors that the team is ready to commence range clearance/UXO activity.
Frequency	Daily
Instructions	None

#### Initial Finding of UXO Handling Procedures

Step 5	Action on finding a UXO/suspected UXO item during surface sweeps/clearances
Frequency	As required
Instructions	<p>1. Upon finding a UXO/suspected UXO item, appropriately qualified sweepers/searchers shall stop and notify the Team Ldr in accordance with the accepted Work Plan/SOPs. The finder may be able to identify the item but if not appropriately qualified or any doubt exists as to the identity of the item, the appropriately qualified UXO personnel shall be consulted. Considerations should include the identification process guidelines/factors outlined in Step 14 below and Appendix 1.</p> <p>2. UXO/suspected UXO or items containing or suspected of containing explosive residue shall be appropriately marked and left for the UXO Destruction team to action. <b>UXO OR SUSPECTED UXO SHALL NOT BE HANDLED OR MOVED</b> by anyone other than those appropriately qualified and designated in the accepted Work Plan/SOPs.</p>

Step 6	Marking of UXO/suspected UXO location(s)
Frequency	As required

Instructions	<ol style="list-style-type: none"> <li>1. All UXO/suspected UXO items shall be marked and/or recorded in accordance with the accepted Work Plan/SOPs.</li> <li>2. For surface sweeps or UXO/suspected UXO that is partially covered/buried, a visual surface marking/"flagging" may be used.</li> </ol> <p style="text-align: center;"><b>Note</b></p> <p><b>If the UXO/suspected UXO is to remain in location for some time or there is a risk that the public may have access to the site, the marking should be done using an "off-set" method to reduce the chances of unauthorized handling</b></p>
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Step 7	Excavating partially buried items
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. Unless authorized in the accepted Work Plan/SOPs, Search Teams members <b>shall not</b> excavate UXO suspected UXO items.</li> <li>2. Considerations should include the excavation process guidelines/factors outlined in Step 13 below and Appendix 1</li> </ol>

Step 8	UXO/Suspected UXO accounting and tracking
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. The Sweep/Search Team Ldr shall accounted for and track the UXO/suspected UXO items found in their grids/cells using the appropriate UXO Identification Form (Note - Sample documentation based on the sample UXO Identification Form for contracted UXO work contained in Annex F, in hard/paper and/or electronic/PDA formats, may to be used).</li> <li>2. Accounting and tracking will be by item with as much detail as to the nature of the item that is practicable being provided.</li> <li>3. The UXO Identification Form shall remain with the Team Ldr and be passed on to the UXO Destruction Team as per the accepted Work Plan/SOPs.</li> </ol>

Step 9	Repeat Steps 5 through 8 as required until the task is completed.
Frequency	As required
Instructions	None

### Re-acquisition of Located UXO Procedures

Step 10	Preparation for re-acquisition/subsequent handling of located UXO/suspected UXO
Frequency	As required
Instructions	<p>1. The appropriately qualified personnel shall:</p> <ol style="list-style-type: none"> <li>Review the direction provided in the SOW/SOR, accepted Work Plan/SOPs;</li> <li>if possible, use the same type of sensor equipment as the original find; and</li> <li>Ensure all required equipment has been checked and calibrated.</li> </ol> <p style="text-align: center;"><b>WARNING</b></p> <p><b>Designated contracted civilian UXO personnel must always go to the location of the reported UXO and never permit UXO to be brought to them</b></p>

Step 11	Arrival at the UXO/incident/RV point/site
Frequency	As required
Instructions	<p>1. For planned UXO disposal responses, the appropriately qualified contracted civilian UXO personnel designated to handle/dispose of UXO shall follow the direction provided in the SOW/SOR and the accepted Work Plan/SOPs for handling and disposal of UXO. The Work Plan/SOPs should include the following items for direction on arrival at the UXO/incident/RV point/site:</p> <ol style="list-style-type: none"> <li>Contact DND On-Site Rep(if required in the SOW/SOR) and grid/cell Team Ldr (as specified in Work Plan/SOPs), obtain any UXO Identification Forms that have been started and become familiar with the situation (i.e. review UXO Identification Form and discuss with the on-site Sweep/Search Team Ldr as appropriate);</li> <li>Verify safety distances and danger/exclusion zone and the evacuation of none essential personnel, if required, has been completed; and</li> <li>Locate the UXO/suspected UXO (if on the surface or visually marked/"flagged") and ensure that it remains undisturbed until a full safe examination can be carried out.</li> </ol> <p style="text-align: center;"><b>Note</b></p> <p><b>Do not permit yourself to be pressured into hasty action. If any doubt exists, refer the matter up to a higher authority as detailed in the accepted Work Plan/ SOPs</b></p>

Step 12	Re-acquiring anomalies from geophysical data analysis and/or on dig sheets
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. Anomaly re-acquisition procedures laid out in the accepted Work Plan/SOPs shall be followed.</li> <li>2. Ideally, items that are not visually exposed but selected from geophysical data analysis and listed on dig sheets should be re-acquired using the same type of sensor used to originally detect the anomalies. If this is not possible, an area of at least 1m radius around the GPS coordinated should be searched with the re-acquisition sensor to ensure the anomaly is located.</li> </ol>

### Excavation/Identification of Located UXO Procedures

Step 13	Excavating/exposing partially covered/buried UXO/suspected UXO
Frequency	As required
Instructions	<p style="text-align: center;"><b>Note</b></p> <p style="text-align: center;"><b>Ensure appropriate safety distances commensurate with the assessed explosive risk for blast and fragmentation are adhered to prior to commencing any excavation and/or handling/movement UXO/suspected UXO</b></p> <ol style="list-style-type: none"> <li>1. If an item is partially buried, any obscuring material may be carefully removed to assist in identification, providing that the object is not disturbed or its safety is not jeopardized.</li> </ol> <p style="text-align: center;"><b>WARNING</b></p> <p style="text-align: center;"><b>No attempt is to be made to move or handle any object until every effort has been made to establish its identity and condition. All items must be positively identified to exclude the presence of Biological or chemical fillers. Unless specifically authorized in the SOW/SOR, <u>only properly qualified CF EOD personnel</u> shall move any UXO/suspected UXO not positively identified as safe to move (STM)</b></p> <ol style="list-style-type: none"> <li>2. Excavating/exposing partially covered/buried UXO/suspected UXO procedures laid out in the accepted Work Plan/SOPs shall be followed.</li> </ol>

Step 14	Identification of UXO/suspected UXO
Frequency	As required

Instructions	<p>1. In order to reach a decision on the safest method of disposal, it is most important that the item in question is positively identified. The Ordnance Identification Guide (OIG) provided in the contract SOW/SOR will assist. Further information from other sources such can be obtained from the DND PM through the DND On-Site Rep. The identification must be made after careful analysis of all the evidence available. The identification procedures laid out in the accepted Work Plan/SOPs shall be followed.</p> <p>2. A full examination of the UXO/suspected UXO shall be carried out with all other unnecessary persons at a safe distance (outside the safety distance) or behind or under suitable protective cover.</p> <p>2. The principles to be applied and the factors to be considered when identifying UXO are contained in Appendix 1. A combination of the factors will help designated contracted civilian UXO personnel make a positive identification or enable them to make a comparison with a known item or type of ammunition. The factors are summarized below:</p> <ol style="list-style-type: none"> <li>Markings/colour;</li> <li>Shape;</li> <li>Size; and</li> <li>Visible fittings/physical characteristics</li> </ol> <p style="text-align: center;"><b>Note</b></p> <p><b>Positive identification is achieved by the confirmation of a minimum of two data points (permanent in nature) in any configuration such as, documented and confirmed physical features, known and measured physical characteristics/ dimensions, permanent markings (stamped, engraved, embossed, cast etc). Colour coding and or legible markings denoting the nomenclature may be indicators of proper identification, however they shall not be solely or in conjunction with each other relied upon to make a positively identification of a UXO. Colour coding and less permanent type markings may fade over time and/or have been re-marked incorrectly</b></p> <p style="text-align: center;"><b>WARNING</b></p> <p><b>No attempt is to be made to move or handle any object until every effort has been made to establish its identity and condition. All items must be positively identified to exclude the presence of Biological or chemical fillers. Unless specifically authorized in the SOW/SOR, <u>only CF EOD personnel</u> shall move any suspected UXO not positively identified as safe</b></p>
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Step 15	Inconclusive identification
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Frequency	As required
Instructions	<p>1. Where an item cannot be positively identified, procedures laid out in the accepted Work Plan/SOPs shall be followed.</p> <p>2. Photographs and measurements should be taken together with notes of any additional features that may aid identification. Full use should be made of any historic publications or IT database info available and by referring up to DND through the DND On-Site Rep for advice and assistance. Appropriately qualified contracted civilian UXO personnel may, <b>if authorized in the SOW/SOR</b>, perforate or expose the fill of suspected UXO to positively identify whether there are any explosives or energetic material present in the item only once it has been determined that it does not contain a biological or chemical filler. Where an item is suspected to or is positively identified as containing biological or chemical filler, all work shall cease and DND shall be advised so that proper reporting and subsequent mitigation of the item may be undertaken under the Chemical Weapons Convention mandated procedures. Procedures for exposing the fill/perforation of UXO/suspected UXO are found in Step 22 below and Appendix 2.</p> <p style="text-align: center;"><b>Note</b></p> <p><b>Any item not positively confirmed whether it contains any energetic material shall be treated as live UXO. Any item not positively identified as being STM shall be destroyed in situ or be perforated to expose the fill as long as it can be determined that it does not contain a biological or chemical filler</b></p>

Step 16	UXO/Suspected UXO accounting and tracking
Frequency	As required
Instructions	<p>1. The Destruction Team Ldr shall account for and track the UXO/suspected UXO items using the appropriate UXO Identification Form (Note - Sample documentation based on the sample UXO Identification Form for contracted UXO work contained in Annex F, in hard/paper and/or electronic/PDA formats, may to be used).</p> <p>2. Accounting and tracking will be by item with as much detail as to the nature of the item that is practicable being provided.</p> <p>3. The UXO Identification Form shall remain with the Team Ldr and be passed on to the UXO Destruction Team as per the accepted Work Plan/SOPs.</p>

Step 17	Repeat Steps 10 through 16 as required until the task is completed.
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Frequency	As required
Instructions	None

### UXO Disposal Procedures

Step 18	Preparation for disposal of located UXO/suspected UXO
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. The appropriately qualified personnel shall: <ol style="list-style-type: none"> <li>a. Review the direction provided in the SOW/SOR, accepted Work Plan/SOPs;</li> <li>b. Review factors for consideration contained in Appendix 2 and disposal methods outlined in Appendix 3</li> <li>c. Ensure all required equipment has been checked and calibrated.</li> </ol> </li> </ol>

Step 19	Planning for disposal of located UXO/suspected UXO
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. Each disposal action shall be planned in accordance with the accepted Work Plan/SOPs.</li> <li>2. Considerations should include the disposal planning guidelines/factors outlined in Appendices 2 and 3.</li> </ol>

Step 20	Selection of disposal method procedures and location
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. The selection of the disposal method will depend on the assessment of the situation on the scene by the designated UXO personnel and shall be in accordance with the accepted Work Plan/SOPs and the guidelines/factors outlined in Appendices 2 and 3.</li> <li>2. Normally, UXO/suspected UXO will be destroyed in situ as per the accepted Work Plan/SOPs and guidelines for destruction in Appendices 2 and 3.</li> <li>3. If the SOW/SOR permits and circumstance warrant (site characterization needs information as to whether the fill is explosive or inert, high order destruction is not preferred, etc.), the UXO suspected UXO may be explosively perforated to expose the fill. The directions in the accepted Work Plan/SOPs and guidelines in Appendix 2 and 3 shall</li> </ol>

	<p>be followed.</p> <p>4. If the required by external elements or it is the preferred methodology for the project in the accepted Work Plan/SOPs, the UXO/suspected UXO may, if it is STM, be moved to a centralized disposal area in accordance with the procedures in Step 21.</p> <p>3. The decision on whether to destroy in situ, move to a central disposal/destruction area and/or to expose the fill/perforate of the item shall be based on safety and risk considerations. Any perforation action shall intentionally attack both the initiation system and main filling. If any doubt exists, the DND PM shall be requested, through the DND On-Site Rep for further direction.</p> <p style="text-align: center;"><b>Note</b></p> <p style="text-align: center;"><b>The effects of blast and fragmentation may be mitigated in areas close to buildings or other high value infrastructure to reduce the Danger Area and risk to the public by using Engineer Controls as specified in Appendix 4</b></p>
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Step 21	UXO/suspected UXO movement procedures
Frequency	As required
Instructions	<p>1. Any movement of UXO/suspected UXO shall be in accordance with the accepted Work Plan/SOPs and the guidelines/factors outlined in Appendices 2 and 3.</p> <p style="text-align: center;"><b>Note</b></p> <p style="text-align: center;"><b>Designated contracted civilian UXO personnel shall <u>ONLY</u> be permitted to move UXO/suspected UXO positively identified as STM when permitted in the SOW/SOR</b></p> <p style="text-align: center;"><b>WARNING</b></p> <p style="text-align: center;"><b><u>Only DND/CF personnel shall transport UXO/suspected UXO on public roads.</u> Unless specifically authorized in the SOW/SOR, <u>only DND/CF EOD</u> personnel shall move any UXO/suspected UXO not positively identified as STM</b></p> <p>2. The decision on whether to move the item shall be based on safety and risk consideration. If any doubt exists, the DND PM shall be requested, through the DND On-Site Rep for further direction.</p> <p style="text-align: center;"><b>WARNING</b></p> <p style="text-align: center;"><b>After all other options have been exhausted, only CF EOD personnel who are qualified CMD Advanced are authorized to move an unsafe UXO</b></p>

Step 22	Conduct selected UXO/suspected UXO disposal action
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. Only appropriately qualified UXO personnel will conduct the disposal action and only those procedures in the accepted Work Plan/SOPs and guidelines in Appendix 2 shall be used.</li> <li>2. When dealing with explosive material only the absolute minimum number of personnel shall be in the Danger/Exclusion Zone. All other personnel and equipment not directly required for the disposal shall remain outside the Danger Zone.</li> </ol>

Step 23	Concluding actions
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. On completion, the post-disposal actions shall be in accordance with the accepted Work Plan/SOPs and guidelines in Appendix 2.</li> <li>2. If any energetic material remains, the item(s) is to be treated as a suspected UXO and the process in Steps 20 through 22 are to be repeated</li> <li>3. Particular attention must be paid to collection of the fragments and processing them through the munitions scrap (MS) screening procedures laid out in the accepted Work Plan/SOPs and Annex F.</li> </ol> <p style="text-align: center;"><b>Note</b></p> <p style="text-align: center;"><b>MS to be stored locally that is only Level Two Screened must be stored in an approved licensed explosive lock-up</b></p> <p style="text-align: center;"><b>Note</b></p> <p style="text-align: center;"><b>MS screened to Level Three may to be stored locally may be stored in locally approved secure and sealable containers. MS to be transported on public roads and/or stored at a CANOSCOM designated MS storage facility shall be packaged as per Chapter 1 Annex D Appendix 2</b></p>

Step 24	UXO/Suspected UXO and MS accounting and tracking
Frequency	As required
Instructions	<ol style="list-style-type: none"> <li>1. The Destruction Team Ldr shall account for and track the UXO/suspected UXO items using the appropriate UXO Identification Form. MS shall be accounted for and tracked using the appropriate Scrap Accounting/Tracking Form (Note - Sample documentation based on the sample UXO Identification and Scrap Accounting/Tracking forms</li> </ol>

	<p>for contracted UXO work contained in Annex F, in hard/paper and/or electronic/PDA formats, may to be used).</p> <p>2. Accounting and tracking will be by item with as much detail as to the nature of the item that is practicable being provided.</p> <p>3. The Scrap Accounting/Tracking Form, once completed, shall be passed on to the Scrap Screening Team as per the accepted Work Plan/SOPs.</p> <p>3. The UXO Identification Form shall be passed to the UXOQCS for inclusion in the final report(s).</p>
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Step 25	Repeat Steps 18 through 24 as required until the task is completed.
Frequency	As required
Instructions	None

Step 26	The Team Ldrs will notify the superior chain of command that the team has completed its task and request authorization to leave the site.
Frequency	As required at the end of the day or task
Instructions	The Team Ldr will provide the chain of command a de-brief of the day's work including any documentation, lessons learned and any other significant information pertaining to the task.

### 3E06. CONCLUSION

1. The procedures above are generic in nature and are provided as guidelines to the procedures for the handling, storage, transportation, disposal and accounting for UXIO/suspected UXO resulting from range clearance/UXO activities using contracted resources. These guidelines must be read in conjunction with the references and the direction provided in the SOW/SOR. Specific site and task/project conditions and requirements, as well as the most current regulations, must be applied when planning or conducting any UXO activity.

## APPENDIX 1 TO ANNEX E TO CHAPTER 3 GUIDELINES FOR IDENTIFICATION OF UXO

### 3E101. GENERAL

1. In order to reach a decision on the safest method of handling and disposal of UXO/suspected UXO, it is necessary that the item in question is positively identified by designated contracted civilian UXO personnel. An Ordnance Identification Guide (OIG) or similar information may be provided in the contract SOW/SOR to assist in making a positive identification. Further information from other sources can be obtained from the DND PM through the DND On-Site Representative (DND On-Site Rep).

### 3E102. AIM

1. The aim is to provide guidelines that augment and clarify the information contained in C-09-008-001/FP-000 *Destruction of Surplus, Obsolete and Deteriorated Ammunition*, C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas* and C-09-008-003/FP-000, *Ammunition and Explosives Procedural Manual – Explosive Ordnance Disposal – Disposal of Stray Ammunition* with respect to the identification of UXO/suspected UXO by appropriately qualified designated contract civilian UXO personnel that has been found and located during contracted DND/CF UXO activities.

#### Note

**This Appendix must be read in conjunction with C-09-008-001/FP-000, C-09-008-002/FP-000 and C-09-008-003/FP-000**

### 3E103. FACTORS FOR CONSIDERATION

1. **General.** The identification must be made after careful analysis of all the evidence available. A combination of the factors listed below will help designated contracted civilian UXO personnel make a positive identification or enable them to make a comparison with a known item or type of ammunition. These factors will give an indication of the Net Explosive Quantity (NEQ) in the UXO thus helping to define the method of disposal and the safety distances required. In the case of ammunition other than High Explosive (HE) natures they will also provide an indication of potential hazards and precautions required to combat them.

#### Note

**Positive identification is achieved by the confirmation of a minimum of two data points (permanent in nature) in any configuration such as, documented and confirmed physical features, known and measured physical characteristics/dimensions, permanent markings (stamped, engraved, embossed, cast etc). Colour coding and or legible markings denoting the nomenclature may be indicators of proper identification, however they shall not be solely or in conjunction with each other relied upon to make a positively identification of a UXO. Colour coding and less permanent type markings may fade over time and/or have been re-marked incorrectly**

- a. Markings/colour (can include colour coding, nomenclature or other identifying permanent or non-permanent markings);
- b. Shape;
- c. Size (including confirmed measured dimensions); and

- d. Visible fittings, features or physical characteristics.

2. **Markings/Colour.** Where original and legible, markings/colour are an extremely useful aid, the designated contracted civilian UXO personnel should be aware that foreign, vintage and obsolete items may well have been re-marked an item to represent something else or simply painted an item. Further uncertainty can be caused because the object may be of foreign origin marked to an unfamiliar system or to one of the many different systems used in the past. Designated contracted civilian UXO personnel must be aware that, because of fading, corrosion or other forms of discolouration, the color of ammunition and components which have been exposed to the elements for extensive periods of time cannot always be relied upon to identify their correct nature and/or filling. Typical examples of the confusion, which could arise, are:

- a. **Light Blue overall body colour.** Under the current system identifies a Practice shell whereas under the 19–8 - 1951 system it identifies a Semi-Armour Piercing HE Shell.
- b. **Dark Blue overall body colour.** Until recently (currently a bronze colour is used) a Dummy (Drill or Cycling) Shell under the 19–8 - 1951 system or a Naval HE Armour Piercing Shell.
- c. **Yellow.** Under the present system HE whereas other systems a cast iron body.
- d. **Brown.** Under the present system Low Explosive whereas other systems a cast iron body.

#### Note

**Further details of obsolete and foreign marking systems can be obtained through the DND PM**

- 3. **Shape.** Does the item compare in measured shape to a known item of ammunition?
- 4. **Size.** Size is very important, as this will give a good indication of the quantity of explosive, which may be involved if disposal by detonation is the only safe method of disposal. Size and shape together very often lead to the elimination of certain items during the course of identification (e.g. a spherical object 350 mm in diameter could not be a hand grenade).
- 5. **Visible Fittings, Features or Physical Characteristics.** With badly corroded items, the visible fittings, features or physical characteristics of the item are sometimes the only real method to identification. However, one must take into account that fittings may be broken or partially corroded in such a manner as to resemble something quite different. For example, fuzes manufactured from Mazak when badly corroded look like a concrete plug, often leading to the item being incorrectly identified as concrete filled. Common indicators include:
  - a. **Fins.** These may be on the body of the object making an overall larger diameter or on a tail tube and of the same diameter as the body. They may be fixed fins or flexible.
  - b. **Driving, Centring or Obturating Bands.** Is there a band or bands present? Is it in an unused or used (engraved) condition? Where is it in relation to the nose or base of the object?
  - c. **Venturi.** Is there a venturi? How many are there? Is the venturi angled in relation to the body of the UXO? Is it an open venturi? Are there any leads or wires present?
  - d. **Fly-off Lever.** Is there one present? Is it secure? What material is it made of?

#### Note

**Designated contracted civilian UXO personnel should be cautious of modifications made by souvenir collectors who may have fitted incorrect fuzes into shell, attached lugs to mortar bombs or tail units or fins to shell**

### **3D104. INCONCLUSIVE IDENTIFICATION**

1. Where an item cannot be positively identified, photographs and measurements should be taken together with notes of any additional features that may aid identification. Full use should be made of any historic publications or IT database info available and by referring up to DND through the DND QAC/On-Site Rep for advice and assistance. Appropriately qualified contracted civilian UXO personnel may, **if authorized in the SOW/SOR**, perforate or expose the fill of suspected UXO to positively identify whether there are any explosives or energetic material present in the item only once it has been determined that it does not contain a biological or chemical filler. Where an item is suspected to or is positively identified as containing a biological or chemical filler, all work shall cease and DND shall be advised so that proper reporting and subsequent mitigation of the item may be undertaken under the Chemical Weapons Convention mandated procedures detailed in Annex C to Chapter 1.

#### **Note**

**Any item not positively confirmed whether it contains any energetic material shall be treated as live UXO. Any item not positively identified as being Safe to Move (STM) shall be destroyed in situ or be perforated in two locations (intentional direct attack on the initiation system and main filling) to determine the filler as long as it can be confirmed that it does not contain a biological or chemical filler**





## APPENDIX 2 TO ANNEX E TO CHAPTER 3 GUIDELINES FOR UXO DISPOSAL PROCEDURES

### 3E201. GENERAL

1. The particular method of disposal to be used can only be decided by the designated contracted UXO personnel dealing with the incident and accepted by the DND On-Site Representative (On-Site Rep) or other designated DND/CF individual(s) as directed in the Statement of Work (SOW)/Statement of Requirement (SOR). It will depend on their assessment of the situation at the scene. In making their decision, the designated contracted civilian UXO personnel will assess whether or not the item is safe to move (STM) (the general principal is that unsafe ammunition or UXO should be destroyed in situ). On Legacy Sites, destruction in situ should be the normal course of action for suspected UXO not positively identified. However, on both Legacy and other sites, if this is rigidly applied without discretion, property and installations may needlessly be destroyed or damaged.

### 3E202. AIM

1. The aim is to provide guidelines that augment and clarify the information contained in C-09-008-001/FP-000 *Destruction of Surplus, Obsolete and Deteriorated Ammunition*, C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas* and C-09-008-003/FP-000, *Ammunition and Explosives Procedural Manual – Explosive Ordnance Disposal – Disposal of Stray Ammunition* with respect to the disposal of UXO/suspected UXO by appropriately qualified designated contract civilian UXO personnel that has been found and located during contracted DND/CF UXO activities.

### 3E203. FACTORS AFFECTING DISPOSAL

1. The designated contracted civilian UXO personnel must make full use of their technical knowledge and experience when determining the method of disposal to use and should consider the following factors before reaching a decision:

- a. The construction, filling and method of functioning of the object;
- b. Visual condition (Is it a UXO? Is it STM? Etc.);
- c. Location of the object;
- d. Are protective enclosures/measures required (sandbags, other engineered control measures, etc.); and
- e. **Previous Movement/Handling of the Item.** Previous movement and/or handling of an item that cannot be positively tracked through documentation as being STM should not be moved without proper assessment and positive identification that the item is STM by appropriately qualified UXO personnel.

#### Note

**No matter if an object has been moved in the past, it should not be considered safe by virtue of that move**

### 3E204. SELECTION OF THE METHOD OF DISPOSAL

1. Having considered all the relevant factors, made positive identification of the object and assessed the risks of the situation, the designated contracted civilian UXO personnel shall, in conjunction with the accepted Work Plan and the DND On-Site Rep, decide on one of the following courses of action to be taken:

- a. **Move Item**
  - (1) **Item STM.** Item is removed by the designated contracted civilian UXO worker to a designated area for subsequent disposal (normally applied to non-ammunition items, inert and only STM explosive items) as per accepted Work Plan/SOPs;
  - (2) **Item NOT STM.** After all options are exhausted, only CF EOD personnel qualified CMD Advanced are authorized to move an unsafe item to a safe site for disposal. The contractor, through the DND On-Site Rep, shall refer the item to the DND PM for further instructions as per the SOW/SOR;
- b. Perforate the suspected UXO case or body in two locations (intentionally directed at both the initiation system and main filling) to determine if it contains any explosive material and/or the remains are safe to move (only if authorized in the SOW/SOR);
- c. Destroy in situ; and
- d. Refer task to DND/CF for CF EOD final disposal action.

### 3E205. MOVING ITEMS STM TO A SAFE AREA

1. For planned UXO disposal responses, the contractor and designated contracted civilian UXO personnel shall follow the direction provided in the SOW/SOR and the accepted Work Plan/SOPs for movement of any item positively identified as STM. Any deviations must be approved by DND through the designated DND On-Site Rep.

#### **Note**

**Designated contracted civilian UXO personnel shall ONLY be permitted to move suspected UXO positively identified as STM when permitted in the SOW/SOR**

#### **WARNING**

**Only DND/CF personnel shall transport suspected UXO on public roads. Unless specifically authorized in the SOW/SOR, only DND/CF EOD personnel shall move any suspected UXO not positively identified as STM**

### 2. Planning

- a. **Safe Area Selection**
  - (1) The distance moved should be the minimum required, and
  - (2) The Safe Area must be large enough to provide sufficient safety distances or provide sufficient protection measures to meet the potential blast and fragmentation risks specified for the item and the perforation/destruction charge(s);

- b. **Route Selection.** The route to the Safe Area should be planned with the Police or local Security personnel to make best use of unpopulated roads and uninhabited areas; and
  - c. **Firing Point Selection.** The selected Firing Point must:
    - (1) be a safe distance from the site of the disposal,
    - (2) if within the safety distance template, provide maximum frontal and overhead cover commensurate with the anticipated blast fragmentation effects for personnel carrying out the task,
    - (3) provide adequate visibility to ensure control of the disposal,
    - (4) be upwind if possible, especially in the case of White Phosphorous (WP) or toxic ammunition, and
    - (5) not contribute to increasing secondary low level fragmentation.
3. **Preparation**
- a. **Packing.** Items, which are considered safe to travel, are to be:
    - (1) packed securely in the most suitable manner for transportation,
    - (2) care should be taken to keep the item in its original attitude,
    - (3) the item must be secure during transportation to reduce unnecessary movement, and
    - (4) consideration should be given to the use of sandbags in the vehicle; and
  - b. **Labelling.** Items collected are to be labelled with task serial number and details for entry UXO.
4. **Movement.** If escort vehicles are to be used, the drivers are to be fully briefed regarding speeds to be observed, acceleration and braking, safe distances between UXO vehicle and escort vehicle(s) and clearance of other roads as necessary.

### 3E206. UXO PERFORATION/EXPOSING THE FILL

1. There may be a requirement, especially on Legacy Sites, where the suspected UXO may require perforation/exposure of the fill in order to provide further characterization of the potential UXO on the site and/or to determine whether the item is safe to move. Perforations shall intentionally attack both the initiation system and main filling. During contracted UXO activities this will be detailed in the SOW/SOR and controlled through the DND On-Site Rep. The factors that must be considered in order to conduct a safe perforation/exposure of fill on a suspected UXO are the same as those for destruction in situ provided in the following paragraphs. Details on the methods to be followed are contained in Appendix 3 and C-09-008-003/FP-000.

#### Note

**Commercial explosives and explosives accessories shall be approved for use in Canada by Natural Resources Canada (NRCan) and shall be used in accordance with the original manufacturers' instructions**

#### WARNING

**Unless otherwise authorized, only qualified designated contracted civilian personnel, specifically authorized in the SOW/SOR shall be permitted to perforate suspected UXO**

### 3E207. UXO DISPOSAL IN SITU

1. A number of factors must be considered by the qualified designated contracted civilian UXO personnel if a safe and complete disposal is to be effected with the minimum disruption to the surrounding area/community. These include, but are not limited to the following:

- a. **Net Explosive Quantity (NEQ).** Calculate the total NEQ including the demolition explosives to be used. Use only the minimum required amount of explosives or perforators to accomplish the destruction task.
- b. **Danger Area.** Determine the Danger Area from the data contained in C-09-008-002/FP-000, C-09-008-003/FP-000 or other DND approved blast/fragmentation Danger Areas as directed in the SOW/SOR. These references show the Danger Area, which shall be cleared of personnel and equipment when destroying a single ammunition item and is based on the estimated total weight of the item and disposal charge. Both blast and fragmentation effects must be considered. The greater distance of these shall be applied unless authorized in the SOW/SOR. This includes the secondary fragmentation effects resulting from the effect of the explosive blast on surrounding structures and debris (rocks, tree, glass, etc.). It is emphasized that the details given in the references are not fully comprehensive and the distances shown are not intended to provide for every possible situation. The information, therefore, is to be used only as a general guide by the qualified designated contracted civilian UXO personnel, who must deal with each case on its merits in light of their technical knowledge and experience of ammunition and explosives. The following are some of the considerations to be used:
  - (1) The Danger Areas given are those from which all personnel and animals and easily damaged moveable equipment should be removed.
  - (2) Unless adequate frontal and overhead protective cover is available, the firing point must be located outside the Danger Area. In selecting cover, which must provide full protection to personnel against splinters and ricochets expected for the largest fragment for known items, due consideration must be given to the probable angle of descent and the size of the fragments anticipated. Firing points positioned inside the Danger Area must always provide fully effective overhead cover.
  - (3) The greater of safety distances prescribed, unless otherwise authorized in the SOW/SOR or by the DND On-Site Rep, shall be observed. Where the item to be destroyed is not indicated in either of the previous references, B-GL-381-001/TS-000 *Operational Training – Part 1 - Training Safety* and the DND On-Site Rep shall be consulted. The safety distances are described "as positive safety distances" on the template for each type of land element ammunition used in the CF. For safety distance criteria for air element ammunition not provided in the above, C-07-010-011/TP-000 *CF Air Weapons Ranges* and the DND On-Site Rep shall be consulted. Likewise the Safety distances for sea element ammunition will be found in NATO AEODP (Navy) Volume 1. Access to these references will be through the DND On-Site Rep.

- (4) If the UXO is suspected of containing White Phosphorus (WP) or other toxic elements, wind speed and direction and the effects smoke are to be taken into account. The Danger Area to be cleared, although related directly to the type of object and the explosive charge to be used should be elongated in a downwind direction as burning phosphorus, together with a significant amount of highly toxic smoke, will be carried by the wind. Furthermore, the serious incendiary effect produced by WP must not be overlooked in wooded areas or those of high fire risk.
- c. **Blast/Fragmentation Mitigation/Danger Area Reduction Measures.** The effects of blast and fragmentation shall be mitigated in areas close to high value infrastructure or other public areas to reduce the Danger Area and ensure the safety of the public. Appropriate regard must be given, when assessing the Danger Area, to ensure that the protective works such as sandbags or other approved engineered controls will contain fragments and debris resulting from the demolition and to the thickness of nearby walls and the material from which they are constructed. In all areas full consideration must be given to the presence and position of windows as the danger from flying fragments of glass is a serious hazard. C-09-008-003/FP-000 and Appendix 4 shall be used to determine the considerations, design and use of protective works such as sandbags, walls, trenching, vents, mounds or surrounds. Other engineered controls, as accepted by DAER, may be used.
- d. **Safety Precautions and Risk Mitigation Measures.** The following provide some of the safety/risk mitigations measures that shall be considered during UXO disposal:
- (1) **First Aid.** The hazards and seriousness of any incident can be mitigated by being fully conversant with the appropriate First Aid treatment in the event of a hazardous situation arising. Precautions and First Aid treatment for WP, chemical, nitro-glycerine and other substances must be considered and sufficient trained personnel, equipment and evacuation vehicles shall be present at the site. Further First Aid and Health Measures are found in C-09-008-003/FP-000 and C-09-153-001/TS-000 *Ammunition and Explosives Safety Manual, Volume 1, Storage and Transportation*.
- (2) **Secondary Hazards.** Determine any Secondary Hazards and what precautions or actions are to be taken. Amongst the Secondary Hazards which may be encountered are:
- (a) Underground gas, fuel or water pipes,
  - (b) Power cables above and below ground,
  - (c) Radio, TV and Radar transmitters,

#### Note

Further information and details on Hazards of Electromagnetic Radiation to Ordnance (HERO) are contained in C-09-153-001/TS-000 *Ammunition and Explosives Safety Manual, Volume 1, Storage and Transportation*

- (d) Bulk storage tanks containing fuel or hazardous materials, above or below ground,

- (e) Low flying aircraft. Blast and debris can be extremely hazardous to occupants of aircraft. If near an airfield, it will be necessary to check whether the danger area encroaches upon flight paths in use. It may be necessary, through the Police and Air Traffic Control, to have flights diverted or delayed until completion of the task, and
  - (f) Dykes and levees.
- (3) **Fire Protection.** If local/provincial regulations and procedures do not provide direction, the designated contracted civilian UXO personnel must decide, according to the nature of the surroundings, what fire protection capability is necessary on the site to ensure that any fire resulting from the disposal action can be properly contained. This is particularly important if the UXO being dealt with contains or could possibly contain WP.
- (4) **Sentries.** Adequate sentries are required to prevent access to the danger area until final clearance has been given. They shall, if at all possible, be sited outside the danger area. If within the safety distance template, they shall be provided maximum frontal and overhead cover commensurate with the anticipated blast fragmentation effects at that location and avoid large areas of plate glass. Their field of vision must cover all approach routes to the danger area. In remote areas, overhead surveillance from fixed and/or rotary aircraft or water borne sentries may be required to prevent incursions into the danger area. Sentries must have a means of communications with the disposal control coordination site to warn of any incursions
- (5) **Briefings.** For DND contracted UXO activities, the DND On-Site Rep and all personnel involved in the disposal action must also be fully briefed as per the contract SOW/SOR and contractor's Work Plan/SOPs. These briefings must include:
  - (a) The action being taken by designated contracted civilian UXO personnel,
  - (b) The anticipated results of the action.
  - (c) Danger and All Clear signals to be used, by whom and when,
  - (d) Actions to be taken by all involved in the event of fire, medical emergency, ammunition/explosive accident/incident or other unforeseen events that may occur during the disposal phase, and
  - (e) Final actions to be taken before the All Clear is given and the area is re-opened to the public.
- (6) **Police or Security Assistance.** In cases where Police or local Security representative is required, the representative must be in possession of suitable information and resources to enable them to:
  - (a) Organize area clearance and traffic control,
  - (b) Post sentries to prevent members of the public or animals straying into danger area,

- (c) Warn occupants of buildings not cleared, to remain under cover at the furthest side of the building from the demolition, away from windows and to open windows to avoid blast damage,
  - (d) Warn the public of the disposal timing and organize the transmission of the "All Clear" to the public at the appropriate time, and
  - (e) Take action to reduce additional damage to property, such as having owners move cars to a safe area if the action in itself does not endanger the individual.
- (7) **Notification of Danger to Persons and Property.** When directed by the SOW/SOR or, in the opinion of the contractor senior UXO person (UXO Project Leader/Field Supervisor) or DND On-Site Rep there is a safety or damage hazard, the contractor shall complete a public notification form. The form in C-09-008-003/FP-000 may be used for guidance. As well, a Notification to Airmen and Mariners (NOTAM) may be required prior to detonation. This should be done before commencing UXO disposal procedures.
- (8) **Toxic Fumes/Residual Gas Hazards.** When disposal by detonation takes place in a confined environment, a safe waiting period must be observed before approaching the disposal site to allow residual gases to dissipate from the area or a confined space. Weather conditions must be taken into account. In certain situations (e.g. in a cave, a hollow or any poorly ventilated area), the safe period before re-entry could be in terms of hours or days. Alternatively, purpose manufactured, enclosed space venting devices may be employed.

### **WARNING**

**The gases produced from detonating high explosive are toxic and can kill. A safe waiting period must be observed before approaching the demolition to allow any residual gases to vent**

### **3E208. CONCLUDING ACTION(S)**

1. A number of concluding action(s) are required to be carried out to complete the UXO/suspected UXO destruction/disposal action. These include, but are not limited to the following:
  - a. The designated contracted civilian UXO personnel are to move forward alone when they are satisfied that all debris has fallen and any residual gases have dispersed to check for complete detonation and that the area is safe. Until this action is completed, all personnel shall remain out of the danger area and or under cover.
  - b. Any UXO/suspected UXO fragments resulting from the disposal action are to be treated as munitions scrap (MS). They are to be collected, removed from the area and processed through the scrap screening process as directed in the SOW/SOR, accepted Work Plan/SOPs and as detailed in Annex D to Chapter 1. As well, the appropriate Scrap Screening and Chain of Custody forms shall be used to account for/track all scrap items. MS to be stored locally that is only Level Two Screened shall be stored in an approved licensed explosive lock-up.

As well, transportation of Level Three screened MS on public roads shall be in accordance with Appendix 2 to Annex D to Chapter 1.

- c. Check the area to establish whether any claims for damages are likely to arise as a result of the disposal action. Any claim reported as such is to be inspected and fully recorded. Photographs are to be taken as necessary.
- d. If damage has been caused, the DND On-Site Rep must be informed at the earliest opportunity.
- e. Check and pack up all equipment used.
- f. When the designated contracted civilian UXO personnel is satisfied that the disposal has been carried out successfully and no other danger or hazards exist, e.g. outbreak of fire, they will inform DND On-Site Rep and the on-scene Police or local Security representative (if used) when they may re-open the area to the public and stand down any other agencies.
- g. Debrief and thank all agencies involved before departure.



### APPENDIX 3 TO ANNEX E TO CHAPTER 3 GUIDELINES FOR UXO DISPOSAL METHODS

#### 3E301. GENERAL

1. It is difficult to specify standard methods of disposal that would be adequate for all situations. However, the common methods are using detonation, open burning, perforation to expose fill and vent and burn to remove the energetic material in the fill. Certain circumstances and the presence of some specific materials or ammunition fillings require specific procedures to be adopted. Additionally, specific natures of ammunition which are no longer In-Service, but are commonly encountered, may require special precautions or disposal methods which are not covered by the Disposal Procedures contained in C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and training Areas*. These procedures are to be known as EOD Procedures and are detailed in C-09-008-003/FP-000, *Ammunition and Explosives Procedural Manual – Explosive ordnance Disposal - Disposal of Stray Ammunition*.

#### 3E302. AIM

1. The aim is to provide guidelines that augment and clarify the information contained in C-09-008-002/FP-000 and C-09-008-003/FP-000 with respect to disposal methods of UXO/suspected UXO by appropriately qualified designated contract civilian UXO personnel that has been found and located during contracted DND/CF UXO activities.

#### 3E303. PRINCIPLES

1. The principles to be adopted are based on those contained in C-09-008-002/FP-000 as amplified in C-09-008-003/FP-000 and outlined as follows:

- a. Electrical initiation is to be used, wherever possible, in preference to the non-electric method to ensure optimum control;

**Note**

**Further details on electric/non-electric initiation procedures are found in A&EI 08 Plastic Coated Tape, Explosives Safety Hazard – Electrostatic Discharge, A&EI 09 Crimping of Non-Electric Blasting Caps – Procedures and Protective Equipment, CIL Blaster's Handbook and manufacturers instructions**

- b. Where deemed suitable, alternatives to routine detonation such as deflagration techniques and the use of shaped charges or perforators should be considered;
- c. If the item cannot be moved, sandbags or other approved engineered controls should be used as detailed at Appendix 4 to mitigate blast and fragmentation;
- d. The demolition charge is to be placed as close as possible to the item without disturbing it and in the best possible position to detonate the explosive filling;
- e. Having ensured that all other persons are out of the danger area and or under cover at the firing point, carry out the final firing procedures;
- f. Disposal actions shall only to be conducted when the task can be successfully completed during daylight hours; and

- g. Only those personnel absolutely essential to carry out the destruction task shall be present in the hazard area, all other personnel shall be accounted for and withdraw to the established safe distance.

### 3E304. DISPOSAL BY DETONATION

1. The demolition charge should accomplish the complete destruction of the UXO. Utilizing the explosive filling of the UXO reduces the amount of the demolition charge that must be used. It should be remembered however, that the demolition charge used must be sufficient to penetrate the metal casing of the UXO. The considerations, safety precautions and procedures for disposal by detonation are contained in C-09-008-002/FP-000 and C-09-008-003/FP-000 using the common DND/CF plastic explosive Comp 4. Comparable commercial items shall be of sufficient quantity and strength to accomplish the destruction task safely. Considerations should include, but are not limited to the following;

- a. **Stores and Equipment.** For contracted civilian UXO disposal, commercial equivalent explosives, stores and associated accessories approved for use in Canada by Natural Resources Canada (NRCan) shall be used in accordance with the original manufacturers' instructions.

#### Note

**The tampering or altering of commercial items is not permitted**

- b. **Charge Placement.** The demolition charge should be placed in close proximity to certain critical areas as follows:
  - (1) The initiation system (fuze),
  - (2) The exploder system (main charge and booster), and
  - (3) The propulsion system.

#### CAUTION

**Only those explosive stores required for the "Specific Procedure for Disposal" shall be present in the Destruction Area when priming and laying the charge. All other demolition stores shall be strictly controlled and kept outside of the danger area**

- c. **Firing Precautions.** Prior to initiating the demolition charge the designated contracted civilian UXO personnel shall:
  - (1) perform a 360 degree visual check to ensure the area is clear. When destruction is to take place in a known flight path, aviation authorities are to be consulted;
  - (2) account for all personnel on the site;
  - (3) signal the impending detonation in all cardinal directions and warn all personnel to take cover by a pre-determined audible or visual signal;
  - (4) when all personnel are under cover, initiate the demolition charge, noting the time in order to ascertain the exact time of detonation and the subsequent elapsed time in the event the demolition charge should misfire;
  - (5) In the event of a misfire wait the prescribed time as detailed in C-09-008-002/FP-000;

- (6) After positive detonation has taken place a mandatory minimum wait time of 2 minutes shall be observed, the designated contracted civilian UXO disposal Safety Officer (SO) shall only then approach the destruction site to verify that the destruction is complete and the area is safe; and
- (7) When safe to do so the designated contracted civilian UXO disposal SO shall announce "all safe" and normal activity may continue.

### **3E305. DISPOSAL BY OPEN BURNING**

1. For contracted UXO activities disposal of explosives, propellants or pyrotechnics by burning in the open is rarely used and shall only be done by designated contracted civilian UXO personnel if specifically authorized in the contract SOW/SOR and permitted under the Environmental Assessment (a screening or comprehensive study as required by regulation or as due diligence). The method is accomplished by positioning the items on the surface of the ground, in a shallow trench, on a concrete slab, or in metal trays, and igniting them from a safe distance by means of an ignition train of combustible material. The considerations, safety precautions and procedures for disposal by burning are contained in C-09-008-003/FP-000.

#### **CAUTION**

**The maximum explosive quantity limit for a burn shall not exceed the limit established when calculating the danger area for a high order detonation**

### **3E306. PERFORATION**

1. Perforation of the UXO casing or body by a small shaped cutting or piercing charge allows the fill to be exposed thereby confirming the presence or lack of presence of explosive material and other explosive residue. Perforations shall intentionally attack both the initiation systems and main filling. This may be of particular importance on Legacy Sites in order to better characterize the UXO risks present on the site. While this process may not completely remove the explosive risk, it will allow a better determination of the risk and aid in the STM or other disposal action decisions. The considerations, safety precautions and procedures for perforation are contained in C-09-008-003/FP-000. For contracted civilian UXO disposal, commercial equivalent explosives, explosives stores and related accessories approved for use in Canada by NRCAN shall be used.

#### **WARNING**

**Under no circumstance are personnel to approach any item which is still emitting smoke**

### **3E307. DISPOSAL BY VENT AND BURN**

1. High capacity items (such as high explosive filled aircraft bombs with a high charge-weight ratio, mines, or propulsion motors such as catapults and large calibre rocket motors) may be cut open with an explosive cutting shaped charge. This method, known as VENT and BURN, is intended to sufficiently expose the filling by a low order detonation allowing the contents to deflagrate. This method may cause the filling to burn instantly or detonate. The considerations, safety precautions and procedures for disposal by vent and burn are contained in C-09-008-003/FP-000. For contracted civilian UXO disposal, commercial equivalent explosives, explosives stores and related accessories approved for use in Canada by NRCAN shall be used.

#### **CAUTION**

**The possibility of a cutting charge or perforator causing a high order detonation shall always be assumed, and the appropriate safety precautions and distances observed. Safety distances and the requirement for protection measures are to be followed**

### **3E308. SPECIAL DISPOSAL PROCEDURES**

1. **General.** Specific procedures are to be followed during UXO disposal where, as a result of information obtained or of positive identification at the scene one or a number of the following circumstances apply:

- a. Specific materials or fillings require special precautions or procedures,
- b. Other agencies are better equipped or qualified to deal with the situation,
- c. Special disposal methods are required but are not covered elsewhere,
- d. Specific procedures are required involving written agreements for payment to the Government of Canada for services rendered

2. **Special Procedures.** The following items have specific procedures as indicated:

- a. **Ammunition containing White Phosphorous (WP).** WP ammunition shall be disposed of in a controlled environment where rules and regulations exist to control access to the area and to ensure that any residual WP is cleared. The considerations, safety precautions and procedures for disposal of WP are contained in C-09-008-003/FP-000.

#### **CAUTION**

**Charge placement for UXO containing WP shall be in such a fashion that the contents of the item are blow upward exposing the WP filling to the air. Under no circumstances shall charges be placed so that the filler is blown downward into the ground**

#### **Note**

**Stores that contain red phosphorus shall be disposed of in the same manner as stores containing white phosphorus**

- b. **Biological or Chemical Agent Ammunition.** Contracted civilian UXO personnel **SHALL NOT** undertake any disposal actions of actual or suspected UXO resulting from Biological or Chemical ammunition. They are to cease activity at the site, retreat to a safe location and report any real or suspected findings of chemical munitions and/or by products to the DND On-Site Rep immediately. The DND On-Site Rep will then contact the appropriate DND and civilian authorities as per the CBRN directions given in Annex C to Chapter 1.

#### **Note**

**Safety precautions and First Aid procedures for chemical munitions are contained in C-09-008-003/FP-000**

- c. **Bulk Picric Acid.** Bulk Picric Acid is a civilian chemical explosive and as such it is the responsibility NRCan to effect disposal. If confronted with a situation involving Picric Acid, the designated contracted civilian UXO personnel should request NRCan response through the DND On-Site Rep. Situations may arise where NRCan cannot provide the necessary response for various reasons, in these circumstances, disposal will be by detonation. Further details on Picric Acid are contained in C-09-008-003/FP-000.

**WARNING**

**Under no circumstances is any attempt to be made to remove the closing lids of containers of Picric Acid**

- d. **Commercial Explosives and Demolition Accessories.** Unless otherwise specifically directed in the contract SOW/SOR, contracted civilian UXO personnel shall **NOT** undertake any disposal actions of commercial explosives and demolition accessories. They are to cease activity at the site, retreat to a safe location and report any real or suspected findings of commercial explosives and demolition accessories to the DND On-Site Rep immediately. The DND On-Site Rep will then contact the appropriate DND and civilian authorities. Further details on commercial explosives are contained in C-09-008-003/FP-000.
- e. **Ammunition Fitted with Piezo-Electric Fuzes.** A piezo-electric fuze is one which incorporates a piezo-electric element. This element contains chemical crystals which are hypersensitive, when stressed, can produce an electric charge sufficient to initiate the explosive. Any piezo-electric element that has been stressed by impact is sensitive to sudden changes in temperature. A rapid temperature change of one or two degrees Celsius could cause functioning of the fuze. The following precautions are to be observed during disposal action:
  - (1) Do not allow a shadow to fall across the ammunition,
  - (2) Do not commence disposal procedures during periods of alternating sunshine and shade, and
  - (3) Do not move the ammunition.
- f. **Markers Location Marine (MLM).** MLM are floating marine location markers which contain a main filling of red phosphorous. They are launched from air or surface craft to provide day or night reference points on water by producing white smoke and yellow flame for 40 - 60 minutes. MLM are intended to sink after functioning. However, in many instances misfired and partially expended MLM may be found on shores and in shallow waters. The considerations, safety precautions and procedures for disposal of MLM are contained in C-09-008-003/FP-000.



## APPENDIX 4 TO ANNEX E TO CHAPTER 3

### GUIDELINES FOR BLAST/FRAGMENTATION MITIGATION/DANGER AREA REDUCTION MEASURES

#### 3E401. GENERAL

1. **General.** Public areas present a particular challenge when destroying UXO/suspected UXO. For safety reasons, it is preferred that any UXO/suspected UXO discovered during UXO activities be destroyed in situ. In some cases, where the UXO/suspected UXO is not deemed safe to move (STM), destruction in situ is the only safe option but limited distances to structures, public works, residential areas, people and historical/considerations greatly affect the options available to UXO personnel. A safe means to mitigate blast and fragmentation within these constraints and provide a level of confidence in their effectiveness are necessary if the DND/CF is to fulfill their mandate and commitments. The protective measures employed must be capable of stopping fragmentation and reducing blast to acceptable levels without unduly affecting daily life. The authorized method for constructing protective enclosures is contained in C-09-005-004/TS-000, *Ammunition and Explosives Safety Manual – Volume 4 – De-militarization and Disposal*.

2. **Background.** The protective surrounds found in C-09-008-003/FP-000, *Ammunition and Explosives Procedural Manual – Explosive Ordnance Disposal - Disposal of Stray Ammunition* provided protection against blast and splinters from small UXO weighing up to 2.3 kg has been limiting when applied in public areas and on UXO sites. The requirement, with proper safety considerations for Category C (Legacy) sites, can require protection against the effects of High Explosive (HE) and projectiles up to and including 155 mm. Some other form of protection such as walls, mounds or barricades while conducting destruction operations in inhabited public areas would be needed.

#### 3E402. AIM

1. The aim is to provide guidelines to augment information contained in C-09-005-004/TS-000 and *Ammunition and Explosive Instruction (A&EI) 14 Mitigation of Blast and Fragmentation Effects Utilizing Sandbags* concerning the use of engineered controls/protective enclosures during destruction operations conducted on contracted DND/CF UXO activities.

#### 3E403. PRINCIPLES

1. The principles are based on those contained in C-09-008-002/FP-000 and C-09-008-003/FP-000. Appropriate regard must be given, when assessing the Danger Area, to ensure that the protective works will contain fragments and debris resulting from the demolition. In all areas full consideration must be given to the presence and position of windows as the danger from flying fragments of glass is a serious hazard.

2. C-09-005-004/TS-000, A&EI 14 and this Appendix shall be used to determine the considerations, design and use of protective works such as sandbags, walls, trenching, vents, mounds or surrounds. Other engineered controls, as accepted by DAER, may be used when approved.

#### Note

**Only those measures/engineered controls contained this Appendix and detailed in the contractor's accepted Work Plan/SOPs shall be used. Any variances must be approved prior to implementation**

### 3E404. SCOPE

1. **General.** The scope of this Appendix is limited to contracted UXO activities. This Appendix augments C-09-008-003/FP-000 and replaces A&EI 14 with respect to blast/fragment mitigation/danger area reduction measures during the destruction of UXO/suspected UXO by appropriately qualified designated contract civilian UXO personnel that has been found and located during the contracted DND/CF UXO activities. The only engineered control currently accepted by DAER as a blast/fragment mitigation/danger area reduction measures for contracted UXO activities is the sandbag enclosure based work completed by the US Army Corps of Engineers (USACE). Other engineered control measures may be approved in the future.

2. **Applicability**

- a. This Appendix applies solely to destruction operations conducted during contracted UXO activities.
- b. This Appendix does not apply to:
  - (1) destruction operations conducted at C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas*. The destruction operations on active CF Ranges and training areas is a controlled task whereby qualified personnel have the ability to achieve the optimum safety distances for an intentional detonation of surface ammunition; or
  - (2) the destruction of unsafe piezio-electric or all-ways acting fuzes and hung strikers. When these items are encountered they shall be destroyed in accordance with C-09-008-002/FP-000, C-09-008-003/FP-000 and Appendix 3.

### 3E405. SANDBAG ENCLOSURE ENGINEERED CONTROL MEASURE

1. **General.** The effects of blast and fragmentation in areas close to buildings or other high value infrastructure will require mitigation to reduce the Danger Area and risk to the public. The USACE sandbag enclosure described in HNC-ED-CS-S-98-7 *Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions* August 1998 addresses these issues with clarity and confidence. The USACE reference provided an extensive testing program centered around the disposal of uncovered and discarded ordnance and explosives on public and private lands. Key measurements of that research and testing identified overpressures at varied intervals, sandbag throw distances, depth of fragment penetration and noise levels, all significant factors which would encourage or negate the use of sandbag enclosures as engineered protective works. Source documents used to support the research, which determined vital factors such as the methods used to predict primary fragmentation of cased munitions and fragmentation characteristics, were reviewed and found to be not only pertinent but also currently acceptable amongst subject matter experts.

2. **Requirement.** The optimal result desired is that, the fragments from the UXO (High Explosive (HE) and shot projectiles up to and including 155mm) must strike the sandbags before the blast wave so that the fragments are penetrating undisturbed sand. To ensure that this will occur, it is necessary to reduce the coupling between the explosive charge and the surrounding soil. This coupling is dependent on the separation distance between the charge and the soil. Full coupling implies that the maximum amount of energy, or velocity, is transferred from the explosive into the soil immediately adjacent to the charge. If an explosive



charge is placed in a cavity, so that an air gap exists between the charge and the walls of the cavity, coupling between the explosive and soil is reduced. Therefore, a standoff of some distance is required to reduce the coupling effect. Calculations to determine the velocity of sand particles from a buried explosion were performed. The velocity of the sand particles was compared to the velocity of the design fragment through sand. These calculations suggest that at a distance between 16 and 31 cm (6 and 12 inches) from the explosion, the fragment velocity exceeds the particle velocity. Confirmation testing conducted by the USACE solidified this theory and is considered effective when the enclosure is properly constructed and the applicable safety distances are applied

### 3. Enclosure Construction Method

- a. The enclosure construction method shown at Figure 3E4-1 illustrates a typical enclosure. Figure 3E4-2 illustrates layers at elevation. Table 3E4-1 identifies the minimum required wall/ roof thickness and safety distance criteria for personnel. The enclosures construction must be done with care and attention to the correct wall/roof thickness, staggering of layers and standoff are considered critical if the enclosure is to perform its intended function.
- b. The sandbag fabric should be woven polypropylene. Each bag should have a nominal volume of 0.15 m<sup>3</sup> (0.5 ft<sup>3</sup>) and a minimum weight when full of 23 kg (50 lb). The bags should be filled with washed sand, either dry or in saturated surface dry (that is, slightly moist) condition. Wet sand should not be used. Pre-filled sandbags should be protected from the rain by storage on pallets, off the ground surface, and by covering them with a plastic tarpaulin or similar cover to prevent them from becoming saturated with water. The gradations and physical composition of the sand are not critical but it should be at least typical of local construction practice for sand used in foundations and backfill. Minor inclusions of clay or soils materials can be permitted. However, no rocks or stones shall be placed in the sandbags as they may become a secondary fragmentation hazards.
- c. Four walls of identical thickness should surround the UXO. The minimum wall thickness is identified at Table 1 and shall be the minimum acceptable standard. The sandbag walls should be stacked to maintain a clear standoff distance of 16 cm (6 inches) between the shell and the inside face of each wall. The interior face of each wall should be vertical but the exterior face can be built with a 1:6 slope 5 cm (2 inches) horizontal to 31 cm (12 inches) vertical. If a sloped outer face is used, the thickness of the wall, at the nominal "top" of the wall, 16 cm (6 inches) above the top of the UXO, must be no less than the specified required thickness.
- d. The sandbags shall be placed tightly against each other. All vertical joints shall be staggered, so there is no clear line of sight from the UXO to the exterior. As the wall is built, each new layer of sandbags shall run in opposite direction to the layer below, so that the layers are interlocked (see Figure 3E4-2).
- e. At a minimum, a double layer of sandbags shall be used. For example, when a 31 cm (12 inches) thickness is required, the sandbags should be oriented so that two sandbags are necessary to achieve this thickness.
- f. After the walls are constructed to a height of 16 cm (6 inches) above the upper surface of the UXO, the charge should be placed on the projectile. Ideally, the use of shaped charges is recommended. These add very little to the total charge

weight for each detonation, given the highly directional nature of the effects of the shaped charge and reduced amount of explosives required to initiate the UXO. The charge should be located either on top of the UXO or on its side. If it is located on the side of the round, the charge should be tilted downward sufficiently to ensure that the shaped charge penetrates the round and is directed into the ground, rather than into the opposite sandbag wall. Generally, a small mound of sand next to the UXO can be used to establish this orientation.

- g. Prior to the placement of the sheet of 19 mm ( $\frac{3}{4}$  inch) thick Douglas Fir (or equivalent) plywood detailed below, a small space suitably large enough to accommodate the passage of initiation system shall be created. The charge shall be primed using cord detonating or similar commercial product. Electric initiation is to be used whenever possible in preference to the non-electric method to ensure optimum control. Where the electric means of detonation is used, the final connection between the firing cable and leg-wires of the electric blasting cap shall only be made immediately before the electric blasting cap is to be placed on the cradle of the cord detonating or similar commercial product. Likewise, for the non-electric means of detonation, placement of the cap blasting non-electric to the cradle of the cord detonating similar commercial product shall only be performed immediately before firing.

**Note**

**Commercial equivalent items shall be used in accordance with the original manufacturers' instructions**

- h. A sheet of 19 mm ( $\frac{3}{4}$  inch) thick Douglas Fir (or equivalent) plywood is to be cut to the dimensions of the cavity between the walls, plus 31 cm (12 inches) in each direction. The plywood sheet is then centered on the walls so that it bears on 16 cm (6 inches) of each wall. The additional sandbags that make up the roof of the enclosure are then placed on top. As with the sidewalls, the roof sandbags should be stacked with staggered horizontal joints and alternating directions in each layer. The exterior sides of the roof may also be vertical or have a 1:6 slope. The thickness of the sandbag roof, above the plywood panel, must be the same as the required wall thickness identified at Table 3E4-1.
- i. After the sandbag layers of the roof have been placed to the correct height, the enclosure is complete and the UXO may be detonated.

**4. Safety**

**WARNING**

**Under no circumstance are personnel to approach any item which is still emitting smoke**

**CAUTION**

**The possibility of a cutting charge or perforator causing a high order detonation shall always be assumed, and the appropriate safety precautions and distances observed**

**5. Distances**

- a. A safety distance is necessary for any detonation. These safety distances apply to everyone, both non-essential and operational personnel and must be strictly enforced. Where necessary the use of law enforcement may be required in public areas to maintain these distances or provide assistance in carrying out evacuation of specific areas. The minimum safety distances at Table 3D4-1

identify mandatory safety distances during detonation for both non-essential and operational personnel appropriate to the size of projectile to be destroyed. Every type of possible UXO is not listed at Table 3D4-1, when items are encountered that are not listed, destruction personnel shall select the next larger distance. For example, if a projectile 90 mm in size is to be destroyed then the distances for 105 mm shall be selected. Safety distances identified at C-09-008-002/FP-000 shall be observed and applied for all non-essential personnel during the preparation of the sandbag enclosure. Once the enclosure is in place the distances at Table 3D4-1 shall be observed.

- b. The application of these safety distances does not negate the requirement for all personnel to seek frontal and overhead protection against secondary fragmentation. This requirement cannot be stressed enough, particularly while operating in public areas where injury to civilians or damage to structures and public works (i.e. gas mains, power lines) are possible. Natural ground topography may be utilized to achieve this when permitted by the location. In public areas where brick structures provide the suitable cover, personnel shall be suitable removed from glass window areas.

#### 6. **Considerations.**

- a. The normal destruction procedures, misfire drills and safety considerations expressed at C-09-008-002/FP-000, C-09-008-003/FP-000 and other appendices in Annex E shall be observed while employing the methods described here. These are considered the minimum acceptable standard and where deemed necessary by the operator that, additional safety precautions are necessary based on the presented situation, they shall take the necessary action in the interest of safety. Where uncertainty exists, they shall refer up to next higher level of supervision/expertise and the DND On-Site Representative prior to taking positive action.
- b. The preparation time spent on the target shall be kept to a minimum. This may be achieved by preparing the necessary sandbags and equipment prior to construction of the enclosure.
- c. Only those essential personnel necessary shall assist with the preparation of the enclosure. All other personnel shall retire outside of the prescribed safety distances until the destruction is complete and the area deemed safe.
- d. Particular care shall be taken during the construction of the enclosure so as not to jar or move the item being destroyed.

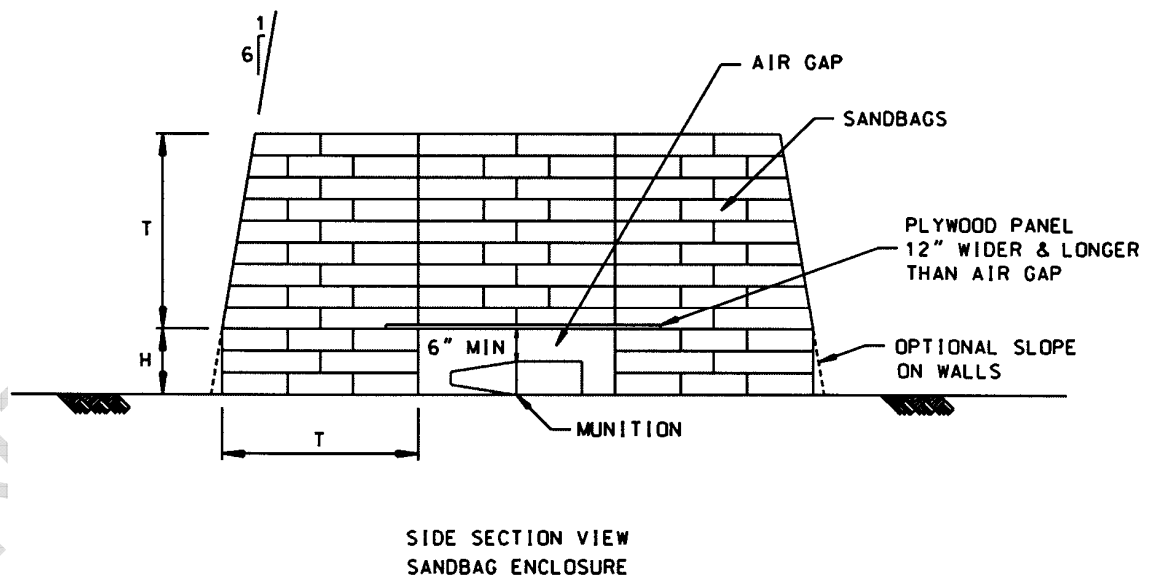
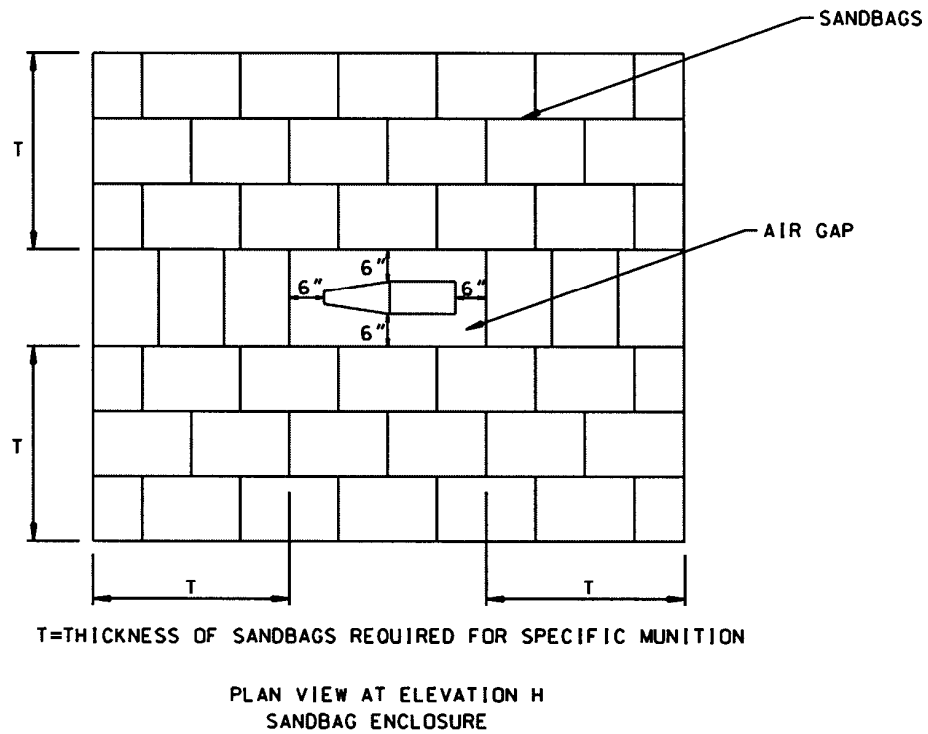


Figure 3E4-1: Typical Enclosure Construction

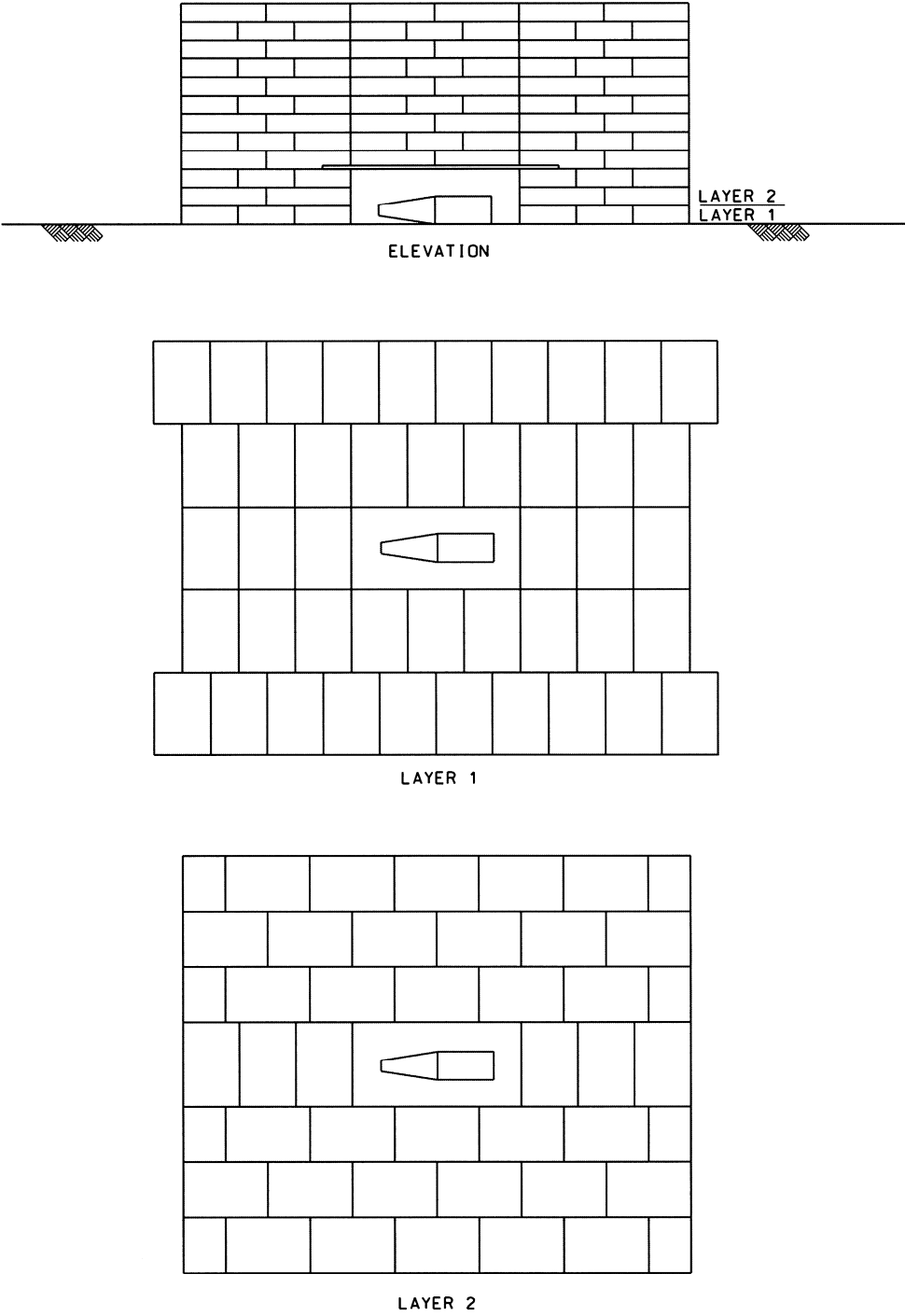


Figure 3E-2: Sandbag Layers at Elevation

UXO Item	Required Wall and Roof Sandbag Thickness (T), (cm)	Expected Maximum Sandbag Throw Distance, (m)	Safety Distance for Non-Essential Personnel (m)	Safety Distance for Operational Personnel (m)
155-mm	91.44	67.05	150	100
105-mm	60.96	41.15	125	75
Up to 81-mm	50.8	38.1	110	60
60-mm and below	30.48	7.62	75	25

**Table 3E-1: Required Wall and Roof Thicknesses for Sandbag Enclosures and Safety Distances****3E406. OTHER ENGINEERED CONTROL MEASURES**

1. Other engineered control measures, as approved by DAER will promulgated through A&EIs. The latest DAER approved measures shall be detailed in the SOW/SOR and are available from DAER, DEEM 2 or the DND UXO and Legacy Sites Program.

## ANNEX F TO CHAPTER 3 SAMPLE UXO ACTIVITIES FORMS

### Sample UXO Identification Form

<b>UXO Identification Form</b>																											
<b>A. For UXO Search Initial Discovery</b> (Fill out only the section for your activity. Fill in every block.)																											
<b>Name:</b>	<b>Contract Number:</b>	<b>Grid/Cell ID:</b>  _ _ _ _ _ _ _ _ _ _	<b>Date:</b>																								
<b>Control No.:</b>  (check one)  <input type="checkbox"/> <b>Surface</b> <input type="checkbox"/> <b>Subsurface</b>	<b>UXO Type (check one and add qty/details on type, etc. if available):</b> <table style="width: 100%; border: none;"> <tr> <td><input type="checkbox"/> Mortar Bomb</td> <td><input type="checkbox"/> Guided Missile</td> <td><input type="checkbox"/> 20mm (Qty) _____</td> </tr> <tr> <td><input type="checkbox"/> Arty Projectile</td> <td><input type="checkbox"/> Aerial Rocket</td> <td><input type="checkbox"/> Small Arms (Qty) _____</td> </tr> <tr> <td><input type="checkbox"/> AT Projectile</td> <td><input type="checkbox"/> Aerial Bomb</td> <td><input type="checkbox"/> Pyrotechnic _____</td> </tr> <tr> <td><input type="checkbox"/> Projectile, Other _____</td> <td><input type="checkbox"/> Sub-munitions _____</td> <td><input type="checkbox"/> Other _____</td> </tr> <tr> <td><input type="checkbox"/> Grenade, Hand</td> <td><input type="checkbox"/> Propellant</td> <td><input type="checkbox"/> Unknown _____</td> </tr> <tr> <td><input type="checkbox"/> Grenade, Other _____</td> <td><input type="checkbox"/> Raw Explosives</td> <td><input type="checkbox"/> Fragments _____</td> </tr> <tr> <td><input type="checkbox"/> AT Rocket</td> <td><input type="checkbox"/> OE Component</td> <td></td> </tr> </table>			<input type="checkbox"/> Mortar Bomb	<input type="checkbox"/> Guided Missile	<input type="checkbox"/> 20mm (Qty) _____	<input type="checkbox"/> Arty Projectile	<input type="checkbox"/> Aerial Rocket	<input type="checkbox"/> Small Arms (Qty) _____	<input type="checkbox"/> AT Projectile	<input type="checkbox"/> Aerial Bomb	<input type="checkbox"/> Pyrotechnic _____	<input type="checkbox"/> Projectile, Other _____	<input type="checkbox"/> Sub-munitions _____	<input type="checkbox"/> Other _____	<input type="checkbox"/> Grenade, Hand	<input type="checkbox"/> Propellant	<input type="checkbox"/> Unknown _____	<input type="checkbox"/> Grenade, Other _____	<input type="checkbox"/> Raw Explosives	<input type="checkbox"/> Fragments _____	<input type="checkbox"/> AT Rocket	<input type="checkbox"/> OE Component				
<input type="checkbox"/> Mortar Bomb	<input type="checkbox"/> Guided Missile	<input type="checkbox"/> 20mm (Qty) _____																									
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<input type="checkbox"/> Grenade, Hand	<input type="checkbox"/> Propellant	<input type="checkbox"/> Unknown _____																									
<input type="checkbox"/> Grenade, Other _____	<input type="checkbox"/> Raw Explosives	<input type="checkbox"/> Fragments _____																									
<input type="checkbox"/> AT Rocket	<input type="checkbox"/> OE Component																										
<b>Location (fill all):</b> X (Easting): _____ (m)    Y (Northing): _____ (m)    Depth or Z: _____ (cm)																											
<b>B. For UXO Exposing and Identification Use</b> (Fill out only the section for your activity. Fill in every block.)																											
<b>Name:</b>		<b>Comments:</b>																									
<b>Destruction Tracking Code:</b>																											
<b>UXO Category (check one):</b> <input type="checkbox"/> Functioned as Designed <input type="checkbox"/> UXO Fired <input type="checkbox"/> Inert <input type="checkbox"/> Unfired <input type="checkbox"/> Unknown																											
<b>Ordnance Filler (check one):</b> <input type="checkbox"/> Explosive <input type="checkbox"/> Inert <input type="checkbox"/> Propellant <input type="checkbox"/> Pyrotechnic <input type="checkbox"/> WP <input type="checkbox"/> Unknown																											
<b>Fusing Type(s):</b> <input type="checkbox"/> <b>No Fuze Present or check all that apply:</b> <table style="width: 100%; border: none;"> <tr> <td><input type="checkbox"/> All-ways Acting</td> <td><input type="checkbox"/> Electric</td> <td><input type="checkbox"/> Impact</td> <td><input type="checkbox"/> Impact Delay (ID)</td> </tr> <tr> <td><input type="checkbox"/> ID, long delay</td> <td><input type="checkbox"/> ID, medium delay</td> <td><input type="checkbox"/> ID, short delay</td> <td><input type="checkbox"/> Impact Inertia</td> </tr> <tr> <td><input type="checkbox"/> Influence</td> <td><input type="checkbox"/> Mechanical Time</td> <td><input type="checkbox"/> Non-delay</td> <td><input type="checkbox"/> Point Detonating (PD)</td> </tr> <tr> <td><input type="checkbox"/> PD Super quick</td> <td><input type="checkbox"/> Percussion</td> <td><input type="checkbox"/> PD Supersensitive</td> <td><input type="checkbox"/> Self-destroying</td> </tr> <tr> <td><input type="checkbox"/> Semi-all-way</td> <td><input type="checkbox"/> Spit-back</td> <td><input type="checkbox"/> Time Fuze</td> <td><input type="checkbox"/> Time and Super quick</td> </tr> <tr> <td><input type="checkbox"/> Pressure</td> <td><input type="checkbox"/> Point-initiating, Base-detonating</td> <td><input type="checkbox"/> Base Detonating</td> <td><input type="checkbox"/> Unknown</td> </tr> </table>				<input type="checkbox"/> All-ways Acting	<input type="checkbox"/> Electric	<input type="checkbox"/> Impact	<input type="checkbox"/> Impact Delay (ID)	<input type="checkbox"/> ID, long delay	<input type="checkbox"/> ID, medium delay	<input type="checkbox"/> ID, short delay	<input type="checkbox"/> Impact Inertia	<input type="checkbox"/> Influence	<input type="checkbox"/> Mechanical Time	<input type="checkbox"/> Non-delay	<input type="checkbox"/> Point Detonating (PD)	<input type="checkbox"/> PD Super quick	<input type="checkbox"/> Percussion	<input type="checkbox"/> PD Supersensitive	<input type="checkbox"/> Self-destroying	<input type="checkbox"/> Semi-all-way	<input type="checkbox"/> Spit-back	<input type="checkbox"/> Time Fuze	<input type="checkbox"/> Time and Super quick	<input type="checkbox"/> Pressure	<input type="checkbox"/> Point-initiating, Base-detonating	<input type="checkbox"/> Base Detonating	<input type="checkbox"/> Unknown
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<input type="checkbox"/> Influence	<input type="checkbox"/> Mechanical Time	<input type="checkbox"/> Non-delay	<input type="checkbox"/> Point Detonating (PD)																								
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<input type="checkbox"/> Pressure	<input type="checkbox"/> Point-initiating, Base-detonating	<input type="checkbox"/> Base Detonating	<input type="checkbox"/> Unknown																								
<b>Orientation (check one):</b> <input type="checkbox"/> Horizontal <input type="checkbox"/> Vertical, nose up <input type="checkbox"/> Vertical, nose down <input type="checkbox"/> Angle from horizontal: ____ (Deg) <input type="checkbox"/> Angle from vertical: ____ (Deg)																											
<b>UXO Nomenclature (if applicable):</b>		<b>Total N.E.Q. (n/a for 20mm or below):</b>																									
<b>Recommended Disposition (check one):</b> <input type="checkbox"/> Safe to Move (STM) <input type="checkbox"/> Refer to Higher Authority <input type="checkbox"/> Destroy in situ		<b>Photo ID:</b> (use story board with location and ID num clearly visible)																									
<b>Remarks (optional):</b>																											
<b>Signature:</b> _____ UXO Tech Supervisor/Field Supervisor																											
<b>C. For UXO Destruction Manager Use</b>																											
<b>Disposition (check one):</b> <input type="checkbox"/> Concur with Destroy in situ <input type="checkbox"/> Approve STM <input type="checkbox"/> Concur with Referral			<b>Date:</b>																								
Moved From (GPS) Location: X (Easting): _____ Y (Northing): _____		Moved To: (GPS) Location: X (Easting): _____ Y (Northing): _____																									
Date: _____																											
<b>Remarks (optional):</b>																											
<b>Signature:</b> _____ UXO Destruction Manager/Project Leader																											

## Sample Scrap Accounting/Tracking Form

<b>Scrap Accounting/Tracking Form (Fill out only the section for your activity)</b>			
<b>A. For Level One Screening/Sweep/Search Team (Initial Discovery). (Fill in every block)</b>			
Team Leader Name:	Contract/Project Number:	Grid/Cell ID:  _ _ _ _ _ _ _ _	Form Control No.:
Container ID:	Contents:		
Team Leader Signature: _____		Date: _____	
<b>B. For Level Two Screening Team (Intermediary Point) (Fill in every block)</b>			
LEVEL ONE SCREENED ACCEPTED BY: _____ (Name)		Signature: _____	Date: _____
Container ID:	Contents:		
MS Container ID:	Contents:		
Total Number of MS Containers: _____			
NMS	Contents:	Weight:	
Total Number of NMS Containers: _____		Total NMS Weight: _____	
Hard Tgt Material Container ID	Contents:		
Total Number of Hard Target Material Containers/large items: _____			
Level Two Screening Team Leader Signature: _____		Date: _____	
<b>C. For Level Three Screening Team (Fill in every block)</b>			
LEVEL TWO SCREENED ACCEPTED BY: (Level Three Screening Team Leader)		Signature: _____	Date: _____
MS Container ID:	Contents:		Weight:
Total Number of MS Containers: _____		Total MS Weight: _____	
NMS	Contents:	Weight:	
Total Number of NMS Containers: _____		Total NMS Weight: _____	
Hard Target Material	Contents:	Weight:	
Total Number of Hard Target Material Containers/large items: _____		Total Hard Target material Weight: _____	
Level Three Screening Team Leader Signature: _____		Date: _____	
Level Three Screener Name: _____		Signature: _____	Date: _____
<b>D. For Material Released for Disposal (Fill in every block.)</b>			
MATERIAL SCREENED LEVEL ____ ACCEPTED BY:		Signature: _____	Date: _____
UXO Safety Officer (Name)			
MATERIAL SCREENED LEVEL ____ ACCEPTED BY:		Signature: _____	Date: _____
UXO Quality Control Supervisor (Name)			



## Sample MS De-Militarization Treatment Accounting/Tracking Form

<b>Munitions Scrap De-Militarization Treatment Accounting/Tracking Form</b>									
<b>Contract/Project Number:</b>					<b>Form Control No.:</b>				
<b>Level Three Screened Container IDs</b>									
<b>A. For Initial Screening/Inspection Team (Initial Step)</b> (Fill out only the section for your activity. Fill in every block.)									
Level Three Screened MS Accepted by: _____ (Name)					Signature: _____			Date: _____	
<b>Container ID:</b>	<b>Contents:</b> (Sort by munitions/material type, if energetic material present and by further treatment needed)							<b>Weight:</b>	
Screening Team Leader Signature: _____					Date: _____				
<b>B. For Bomb/BDU/Projectile Pre-Treatment Team</b> (Fill out only the section for your activity. Fill in every block.)									
Screened MS Accepted by: _____ (Name)					Signature: _____			Date: _____	
Pre-Treatment Completed by: _____ (Name)					Signature: _____			Date: _____	
<b>C. For Thermal Treatment Screening Team</b> (Fill out only the section for your activity. Fill in every block.)									
Screened/Pre-Treated MS Accepted by: _____ (Name)					Signature: _____			Date: _____	
<b>Container ID:</b>	<b>Contents:</b> (Include as much detail as possible as per above)							<b>Weight:</b>	
Thermal Treatment Screening Team Leader Signature: _____					Date: _____				
<b>D. For Thermal Treatment</b> (Fill out only the section for your activity. Fill in every block.)									
Screened Accepted by: _____ (Name)					Signature: _____			Date: _____	
Thermal Treatment Completed by: _____ (Name)					Signature: _____			Date: _____	
<b>E. For Physical Rendering Screening Team</b> (Fill out only the section for your activity. Fill in every block.)									
Thermal Treatd/Screened MS Accepted by: _____ (Name)					Signature: _____			Date: _____	
<b>Container ID:</b>	<b>Contents:</b> (Include as much detail as possible as per above)							<b>Weight:</b>	
Physical Rendering Screening Team Leader Signature: _____					Date: _____				
<b>F. For Physical Rendering Treatment</b> (Fill out only the section for your activity. Fill in every block.)									
Screened Accepted by: _____ (Name)					Signature: _____			Date: _____	
Physical Rendering Completed by: _____ (Name)					Signature: _____			Date: _____	
<b>G. For Level Four Screening Team</b> (Fill out only the section for your activity. Fill in every block.)									
Treated MS Accepted by: _____ (Name)					Signature: _____			Date: _____	
<b>Container ID:</b>	<b>Contents:</b> (Include as much detail as possible as per above)							<b>Weight:</b>	
Level Four Screening Team Leader Signature: _____					Date: _____				
<b>H. For Physical Rendering Treatment</b> (Fill out only the section for your activity. Fill in every block.)									
Screened Accepted by: _____ (Name)					Signature: _____			Date: _____	
Physical Rendering Completed by: _____ (Name)					Signature: _____			Date: _____	
<b>I. For Material Released for Disposal</b> (Fill out only the section for your activity. Fill in every block.)									
TREATED MATERIAL ACCEPTED BY: _____ <b>UXO Safety Officer</b> (Name)					Signature: _____			Date: _____	
TREATED MATERIAL ACCEPTED BY: _____ <b>UXO Quality Control Specialist</b> (Name)					Signature: _____			Date: _____	

Sample Scrap Chain of Custody Form

Scrap Chain of Custody Form			
Form Control Number	Releasing Organization	Contract Number/Project Name	
Container Number(s)	Transport Name (Name of Transport Agency/Company/Unit)		
	Seal Numbers		
Description			
<p>The Inspectors/Certifiers certify and verify that, to the best of their belief, the material listed above is free of dangerous materials and has been inspected or treated as marked below (check one):</p> <p><input type="checkbox"/> Ammunition, explosives, other dangerous articles and/or residue has (check the following as applicable):</p> <p> <input type="checkbox"/> not been thermally treated  <input type="checkbox"/> been thermally treated  <input type="checkbox"/> not been rendered unrecognizable as defence explosive ordnance (EO)  <input type="checkbox"/> been rendered unrecognizable as defence EO         </p> <p> <input type="checkbox"/> Hard Target Materials  <input type="checkbox"/> Scrap metal  <input type="checkbox"/> Garbage/Wood/Plastic materials         </p> <p>DND 2286/Level Three Screening Certificate(s) attached: <input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable</p>			
Inspector/Certifier - UXO Safety officer			
Print/Type Name	ID No.	Signature	Month/Day Year
Inspector/Certifier - UXO Quality Control Supervisor			
Print/Type Name	ID No.	Signature	Month/Day Year
Inspector/Certifier – DND Technical Representative			
Print/Type Name	ID No.	Signature	Month/Day Year
Material Released to Transporters by UXO Contractor			
Print/Type Name	ID No.	Signature	Month/Day Year
Material Accepted by Transporter			
Print/Type Name	ID No.	Signature	Month/Day Year
Material Accepted by Transporter			
Print/Type Name	ID No.	Signature	Month/Day Year
Material Accepted by Final Recipient			
Print/Type Name	ID No.	Signature	Month/Day Year

## Sample Daily Diary Report

DAILY DIARY FORM			
<b>A. Project Information / Weather</b>		(Fill out as applicable)	
<b>Field Supervisor:</b>	<b>Contract Number:</b>	<b>Report for work done on:</b> Date:	<b>Date submitted:</b>
<b>Weather Conditions:</b> <input type="checkbox"/> Sunny <input type="checkbox"/> Partly Cloudy <input type="checkbox"/> Cloudy <input type="checkbox"/> Overcast <input type="checkbox"/> Morning Fog <input type="checkbox"/> Foggy <input type="checkbox"/> Showers <input type="checkbox"/> Light Rain <input type="checkbox"/> Heavy Rain Average Days Temp: _____ Relative Humidity (if avail) _____ <b>Comment:</b>			
<b>B. Day's activity:</b>			
<b>Activity</b> <input type="checkbox"/> Site Prep <input type="checkbox"/> Vegetation Removal <input type="checkbox"/> Geo Survey <input type="checkbox"/> Surface Clearance <input type="checkbox"/> Subsurface Clearance(reacquire/invest) <input type="checkbox"/> Target Removal <input type="checkbox"/> Demolition Prep <input type="checkbox"/> Destruction <input type="checkbox"/> Scrap Screening <input type="checkbox"/> De-Militarization <input type="checkbox"/> Other		<b>Comments:</b>	
<b>UXO Discovery:</b> <input type="checkbox"/> No <input type="checkbox"/> Yes Qty. _____ <input type="checkbox"/> Identification Sheet Completed for each Item <input type="checkbox"/> Photos <input type="checkbox"/> GPS location.			
<b>Large Target Items:</b> <input type="checkbox"/> No <input type="checkbox"/> Yes		<b>Comment:</b>	
<b>Problems Encountered:</b> <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Production <input type="checkbox"/> Equipment <input type="checkbox"/> Other			
<b>Description of problems:</b>			
<b>Solutions or Corrective actions Imposed:</b>			
<b>Overall Comments:</b>			
<b>Author of Report:</b> _____ <div style="display: flex; justify-content: space-between;"> <span>Name (Print)</span> <span>Signature</span> <span>Date</span> </div>			



## ANNEX G TO CHAPTER 3

### GEOPHYSICAL GUIDELINES FOR CONTRACTED RANGE CLEARANCE/UXO ACTIVITIES

#### 3G01. GENERAL

1. **General.** The introduction of sustainable range programs for DND sites and the Directorate of Real Property management (DRPM) 2 - DND UXO and Legacy Sites Program (UXO Legacy Sites Program) Legacy Sites Database requires establishing and maintaining for the duration of the project a Site UXO Model (SUM) as part of an overall Conceptual Site Model (CSM). This layered compilation of geo-referenced information shall include a Geographic Information System (GIS) that accurately incorporates maps, images and data from existing contract or other documents from public and government sources as well as from UXO activities using approved DND/CF tools, standards and architecture in the formats compatible to DND/CF information systems
2. **Terminology.** For UXO-related work involving geophysical investigations, the definitions contained in the comprehensive Glossary of range clearance/UXO activity terms available from DRPP 5 - ADM(IE) RTA/UXO Coord (DWAN - [http://admie.ottawa-hull.mil.ca/dgme/RTA-Mgr/uxo\\_activities\\_e.html](http://admie.ottawa-hull.mil.ca/dgme/RTA-Mgr/uxo_activities_e.html)) or DEEM 2 (DWAN - [http://admie.ottawa-hull.mil.ca/dgme/deem/uxo\\_e.asp](http://admie.ottawa-hull.mil.ca/dgme/deem/uxo_e.asp)) are applicable.

#### 3G02. AIM

1. The aim is to provide guidelines specifying geophysical work and GIS in support of contracted range clearance/UXO activities.

#### 3G02. GUIDELINES

1. **General.** The guidelines provided must be tailored to the individual site/project and site specific changes/deviations must be specified in the Statement of Work (SOW)/Statement of Requirement (SOR).
2. **Project Geophysical System.** The contractor shall describe the system assigned to meet the requirements of the SOW/SOR including the execution of the Soft Prove Out (SPO) and the geophysical work. The description should include, but is not limited, to the following:
  - a. **Methodology.** A detailed analysis of methodology including rationale supported by a clear technical knowledge of the project site is required. It is of utmost importance that the contractor demonstrates a clear, consistent and reasonable methodology by which all subsequent conclusions can be achieved and defended. In particular, the Contractor shall document procedures used to confidently and accurately reacquire selected land and/or marine geophysical targets.
  - b. **Equipment.** Detailed specifications, design, accuracy, and images of each survey platform used for data acquisition and Global Positioning System (GPS) should be provided. Equipment description must also include a statement defining the swath width of each sensor and the total swath width of the geophysical system. This value will be used in identifying line path coverage.
  - c. **Personnel.** In accordance with Annex A, the Contractor shall provide a list of personnel involved in all geophysical aspects of the project. For each person, include relevant experience that demonstrates the person is qualified to complete

all Tasks, Requirements and Goals specified in the SOW/SOR and other accompanying tender documents.

3. **Soft Prove-Out (SPO).** Prior to commencement of any geophysical work, a geophysical SPO must be conducted. The area selected for a SPO must have been previously scanned in order to screen out the existence of buried metallic objects or cultural interference. Guidelines for SPOs developed by the DND UXO and Legacy Site Program are contained in Appendix 1 and summarized below:

- a. **Design and Layout.** The SPO site shall contain a justified number of items to properly define detection limitations of the system and ordnance expected throughout the project. Emplaced items can be inert or simulated ordnance of varying size and orientation, at incremental depths consistent with the project DOE and in straight repeatable lines.
- b. **Methodology.** In accordance with the SPO requirements defined within this document, the Work Plan must include a detailed description of how the SPO will be performed. It shall include contingency plans and corrective measures in the event of failure. The SPO shall also identify data noise envelopes of all geophysical data that will act as a baseline for the duration of the project. The resulting responses recorded from the SPO will be used to establish and justify a datum by which “targets” are identified for each site.
- c. **Detection.** Based on the specified DOE for each site, the Contractor must present a GSA incorporating ammunition data from this SOW/SOR and the CSM. An explicit statement must declare the smallest ordnance item that can be detected at the specified DOE justified by SPO results.
- d. **SPO Deliverables.** All SPO details shall be included in the SPO Letter report as per requirements of the SOW/SOR along with all relevant geophysical data in digital format. Each emplaced item must be tabulated with the following information: emplaced parameters (item description, actual GPS coordinates, emplaced depth and orientation), survey results (geophysical response, survey path coordinates) and data interpretation (estimated target location, offset distance from the emplaced location, interpreted depth to the top of the item and suggested orientation). If the geophysical system changes in any way throughout the course of the project, a repeat of the SPO must be conducted in order to ensure consistency of response.

4. **Geophysical Work Specifications.** The Contractor shall include a clear, well-justified and detailed description of Geophysical work procedures that will achieve project goals. Project-specific items will include, but are not limited to:

- a. **Geophysical Work Specifications.** Contractor shall clearly define overall coverage needs for all possible terrain/vegetation/obstruction conditions on-site. Methods of checking coverage include, but are not limited to, reviewing track plots (non line-and-fiducial methods), calculating sizes of data gaps, implementing a blind seeding program using small metallic objects, and visual observations of line-and-fiducial, odometer and analog surveys. The plan shall include details regarding the survey line spacing, flying altitude (if applicable), grid layout and size, etc.
- b. **Daily Function Checks.** The purpose of these checks is to verify that the geophysical system has not malfunctioned. Applicable tests shall include repeatability tests, standard response tests, positional accuracy tests, 6-line

tests, octant tests, etc. All daily calibrations / tests shall be documented in a digital table format to verify the consistency of each instrument. The table shall include, at a minimum, date, time, relevant measurements and degree of deviation from the baseline or norm.

- c. **Data Processing.** Provide a detailed description of each process used to correct the raw geophysical data into its final format (e.g., filtering, drift, heading, lag, diurnal, interpolation, etc.).
- d. **Target Selection.** The contractor must justify the parameters (response cut-offs, noise levels, target priority, etc.) used to select dig picks. This justification must incorporate results from the SPO.
- e. **Reacquisition.** The contractor shall verify detected and selected anomalies marked for excavation. Reacquisition shall be completed using the same equipment as in the first survey. This should be checked by setting Pass/Fail anomaly repeatability criteria, setting Pass/Fail maximum allowable offset distances and testing efficacy of procedures for marking all localized anomalies during project planning and/or the SPO.

5. **Quality Control Plan (QCP).** A detailed, structured QCP that is inclusive of Geophysical Work specifications and data quality objectives (DQO) shall be provided. The QCP will contain all quality assurance (QA) metrics to ensure that project goals are met in a defensible manner and clearly relate the associated Quality Control (QC) protocol. A key component of the QCP is data and survey tolerances and corrective actions that will be undertaken, to ensure that all DQO are met and maintained throughout the project. The QCP Plan will be an Appendix to the Work Plan.

6. **Target Model.** A data analysis model that details how targets and their associated Mode information are generated. Provisional data analyses must be compiled in tables and digital geo-referenced databases and submitted to the DND PM prior to clearance for review and acceptance. The DND PM or designate may use this data for a QA review. The Contractor shall perform a reacquisition and physical investigation of the accepted targets list to ascertain the physical attributes of each Target. The results shall be compiled and used to revise the draft SUM into a final SUM.

7. **Data Accuracy.** The Contractor must record all data in a highly accurate and precise manner. The Contractor shall use personnel who are knowledgeable and competent in the applied survey procedures and equipment. The Geophysical Survey component of the UXO Survey Work Plan is integral to the project and the qualifications and experience of the individuals involved will be examined closely.

8. **Data Deliverables.** Formats and details on the deliverables are contained in the SOW/SOR. No digital data, with the exception of photographs, shall be in a compressed format (.ZIP, .RAR, etc.).

## 9. **Data Specifications**

### a. **General Geophysical Specifications**

#### (1) **Line Path**

- (a) Coverage of an area (based on line path and sensor swath width) must meet the requirements of the SOW/SOR within the defined project boundaries.

- (b) The distance between adjacent lines of a 100% investigation will not exceed the sensor swatch width unless impeded by fixed objects or topographic features. These areas shall be confirmed manually.
  - (c) Line breaks, within a 100% investigation, greater than the sensor swatch width will be re-surveyed at the expense of the contractor.
- (2) **GPS.** A static GPS test will be conducted daily where data readings are recorded over a 5 minute period. If more than 5% of the data readings fall outside the instrument's operational threshold (to be specified by the contractor at onset of the project), the equipment will be deemed to have failed the test and must be corrected or replaced prior to further investigation.
- (3) **System Test.** A static test shall be performed at the start and end of each of data collection, using an appropriate object placed at a predetermined distance from the geophysical sensor. The resulting signal response from the test object must be within 10% of a value designated as the norm at the start of a job. This baseline norm shall be justified including a description of how it was obtained.
- (4) **Lag Test**
  - (a) A lag test shall be performed by towing the geophysical system over a known target (either conductive and/or magnetic), in two opposing directions. The lag correction shall be determined and applied to the data, minimizing any offsets in the response.
  - (b) This lag test shall be performed, at a minimum, prior to any geophysical surveying and will be repeated if any major component of the data acquisition system is modified or replaced. If variable lag is observed at any point during the investigation, a daily lag test shall be performed.

10. **Electromagnetic Specifications**

- a. All EM data shall be levelled to a standard baseline.
- b. EM Data (all coils and channels) shall be corrected to account for temperature and equipment drift.

11. **Project Geophysical System.** The contractor shall describe the Project Geophysical System. The contractor shall describe the peak to peak noise levels in the electro-magnetic (EM) data which shall not exceed maximum thresholds established during the SPO prior to commencement of the work (excluding power line or other man-made cultural EM noise). Any significantly affected areas will be re-investigated unless it is deemed that lower noise levels cannot be achieved.

12. **Magnetic Specifications**

- a. **Diurnal Activity.** The contractor must account for diurnal activity and magnetic storms and justify the method used in removing these effects from investigation data.
- b. **Magnetic Data**



- (1) By default, noise levels of unfiltered magnetic data will be monitored using the fourth difference. However, a similar justified method can be used upon approval of the DND PM.
- (2) Re-coverage will be required if the chosen method exceeds maximum thresholds established during the SPO prior to commencement of the work, excluding areas where this specification is exceeded due to natural anomalies or data spikes.
- (3) Data that is affected by a loss of sensor lock resulting in significant dropouts or data gaps beyond the means of filtering and interpolation will require re-coverage at the contractor's expense.

### 13. **GIS Specifications**

- a. Data must be captured in specific layers and compiled in a logical and systematic structure. For example a GIS compilation may contain the following layers of Geo-referenced background (raster or vector) data at appropriate scales:
  - (1) Infrastructure (paths, roads, buildings, power lines, utilities, fences, etc.),
  - (2) Terrain (coastlines, lakes, waterways, forest, trees, shrubs, etc.),
  - (3) Land Use (past, current, future classifications, environmental sample pits, monitoring wells, archaeological sites, geodetic monuments, property boundaries, etc.),
  - (4) Culture (anything that may materially affect field procedures or data quality), and
  - (5) GPS (tracks, waypoints, defence EO/UXO, MS and NMS locations, base stations, etc.).
- b. A site assessment of the investigation area will identify all areas with physical obstructions that prevent the geophysical system from properly operation. These areas must be recorded, digitized and provided as individual points or polygons depending on the obstruction.
- c. All data must be compiled, recorded, stored and delivered in metric units.
- d. All data must be compiled, recorded, stored and delivered in an accurately geo-referenced NAD83 (UTM) format.
- e. Corner coordinates of entire investigation area must be provided as polygon data in NAD83 (UTM) format.
- f. Spatial accuracy of reacquired targets shall be within  $\pm 0.25$  m of expected coordinates as per the draft SUM. Site-specific characteristics (terrain, topographic features, equipment, etc.) that prevent this specification from being met shall be identified and justified in the Work Plan. On reacquisition the target offset must be recorded as key indicator for quality control of positional accuracy.

14. **Quality Assurance.** The Contracting Authority (CA) may conduct a geophysical audit. An example of a generic sample of a geophysical audit format is provided at Appendix 2.



## APPENDIX 1 TO ANNEX G TO CHAPTER 3 GUIDELINES FOR CONDUCTING SOFT PROVE OUT (SPO)

### 3G101. GENERAL

1. **General.** Geophysical surveys have become an integral component of the site evaluation process. The surveys are used to detect near-surface and subsurface anomalies that can be related to unexploded explosive ordnance (UXO) and munitions scrap (MS). The detection capabilities of geophysical equipment used under the site specific conditions is critical to the overall success of a given geophysical investigation. If the items can not be detected under site specific conditions, they can not be removed and the level of risk can not be defined. These guidelines were developed by the DND UXO and Legacy Sites Program. The most current version can be obtained from DEEM 2 or the DND UXO and Legacy Sites Program.

2. **SPO Requirement.** Before conducting a geophysical survey of a particular site, a site specific SPO is conducted to test, evaluate, and demonstrate the geophysical systems that will be used. The information collected during the SPO is analyzed and used to select or confirm the selection of a geophysical system, and to establish the performance requirements for the geophysical survey. While the standardized test site information provides valuable guidance about basic technological capabilities of geophysical systems, but this information is not sufficient for making site-specific decisions. The following are some of the reasons for conducting a SPO:

- a. **Site-Specific Conditions.** Site-specific conditions, such as the types of munitions present; depth of interest; soil composition; vegetation; terrain; and cultural interferences, all influence the effectiveness of geophysical surveys, often in unpredictable ways. The geophysical system must also be capable of distinguishing the item of interest from background noise and of identifying or selecting the item's signature within the raw data as an anomaly. On some large sites, multiple geophysical systems and approaches could potentially be used to detect surface and subsurface anomalies.
- b. **Geophysical Approach.** Further, a particular geophysical approach has inherent strengths and weaknesses, and very seldom does one instrument or approach yield the best performance in all categories. Therefore, the SPO is a vital step in evaluating the strengths and weaknesses of each geophysical system under consideration. On large sites, more than one SPO may be required. For example, widely differing terrain, geology, or the nature and previous use of the range may require that multiple prove out locations be established in order to gather sufficient information to evaluate systems against those varying site conditions unless a single prove-out area can be established that incorporates those differing site characteristics.
- c. **Other Reasons.** Other reasons for performing more than one SPO can include multiple field seasons where remobilization and reestablishment of prove-out parameters are required, new information about site conditions that causes revisions to conceptual site models and geophysical methods (e.g. changing geophysical sensors), or non-conformance problems that require re-evaluation of equipment and/or process team elements.

3. **Summary.** Therefore, before conducting geophysical surveys on the site, the consultant should conduct a SPO to demonstrate that the geophysical sensor system, sensor platform, particular survey approaches and the processing methodology are able to meet the project

objectives. Usually, the SPO Letter Report has to be submitted and approved by the Project Management Team (PMT) before the consultant will be authorized to start the full scale geophysical surveys

### 3G102. AIM

1. The aim is to provide general guidelines for the conduct of the SPO and contents of the SPO letter report.

### 3G103. SPO OBJECTIVES

1. **Main Objective.** The main objective for conducting the SPO is to determine whether a particular geophysical investigation approach will work on a given site. However, often the specific objectives for conducting SPOs may differ due to the unique site characteristics and/or there may be different reasons for conducting the SPO. The possible objectives of a SPO vary from site to site and often it may be designed to serve multiple objectives such as:
  - a. **Selection and/ or Comparison of Geophysical Systems.** All geophysical approaches have inherent strengths and weaknesses, and it is very rare that one instrument or approach is found to be the best (that is, the best absolute detection rate, lowest false alarm rate, highest production rate, and the lowest cost). Therefore, a SPO may be used for selection and/ or comparison of geophysical systems under site specific conditions. In this case, every seeded item becomes an individual test of each system's capabilities. The results from individual system on each target can be directly compared and analyzed to identify its relative strengths and weaknesses. Sometimes, it may also be desirable to select representative targets and to bury them beyond the predicted detection depths so that the detection capabilities of sensor systems can be evaluated.
  - b. **Demonstrate Geophysical System Capabilities.** Often, the objective of the SPO is to demonstrate the capabilities of selected geophysical system to meet the project specific data quality objectives (DQOs). This requires testing the entire system - the specific sensor, the specific personnel performing the sensor data acquisition and data processing; and all the procedures to be used on the production survey. These individual components of the selected geophysical system may be critical to achieving consistent performance from the system and achieving this objective requires that the system be evaluated as a whole.
  - c. **Document Functional Checks.** The function check is conducted to ensure that the equipment, operator, software, and computer models to be deployed for the analysis would work under the site specific conditions. The functional checks may be conducted whenever a piece of the equipment of the changed or modified during the production surveys, and these can also be performed as part of the daily calibration before the data acquisition.
2. **Other considerations.** Whatever geophysical system is deployed in the field, while conducting SPO, consideration should be given to the following aspects:
  - a. Document the capabilities and limitations of each geophysical detection instrument selected for consideration at the site-specific SPO;
  - b. Confirm the detection capabilities and confidence levels or confidence intervals to support decision making at the site;

- c. Observe each geophysical detection instrument operating in the consultant's configuration, using the consultant's personnel and methodologies;
- d. Evaluate the consultant's data collection, data transfer quality, and data QC method(s);
- e. Evaluate the consultant's method(s) of data analysis and evaluation;
- f. Evaluate estimated field production rates and estimated false positive ratios, as related to project cost;
- g. Establish anomaly selection criteria; and
- h. Document system reliability.

### 3G104. SPO IMPLEMENTATION

1. **General.** A number of steps are involved in the implantation of a SPO, and many of these steps are based on the specific project objectives and site specific conditions. However, in general, the following steps need to be considered:

- a. Construction;
- b. Field procedures;
- c. Data analysis; and
- d. Evaluation of results.

2. **SPO Construction.** SPO construction, involves site selection and preparation, and all the activities that are necessary for the emplacement of seed items.

- a. **Site Selection.** Site selection is one of the critical parameters for a successful SPO. This is because the selected location should be representative of the conditions that are expected throughout the survey regions, and ensures that the SPO and production survey can be implemented safely and effectively. Some of the parameters that need to be considered include the following:
  - (1) Terrain and vegetation conditions for the selected site should be similar to those across the survey area;
  - (2) Geophysical noise conditions that are present at the SPO site should be similar to those expected across the survey area, and these may include: noise sources such as, soil type, soil moisture, magnetic susceptibility, electrical conductivity, and surrounding cultural noise, etc.;
  - (3) The site should be large enough to provide sufficient spacing of the seeded items so as to minimize the ambiguities in scoring and data analysis; and also if necessary to accommodate different types of sensors and platforms;
  - (4) The location should be in close proximity to the actual survey so that functional checks of the equipment can be carried out if necessary; and also that the site is easily accessible by the project management team; and
  - (5) Furthermore, a SPO located at a suitable site allows the consultant to demonstrate the sensor capability, and determine the detectability of the seeded items (surrogate items that are representative of those likely to be

found in the area), document signal strengths (threshold levels), and deal with the issues under controlled conditions that may arise during the production stage surveys. Under the test area scenario, the consultant not only demonstrates the technology and methodology, but also the capability under site specific challenges, such as those associated with the terrain, vegetation, clutter conditions, and interferences from power lines, fences and other sources.

- b. **Site Preparation.** The site preparation tasks may include the following, but all of these may not be needed at all the sites:

- (1) **Establish SPO Boundary.** The extent of the survey needed to establish a SPO depends on the scope and complexity, and the available topographic data for the site. As a minimum, the SPO site boundary should be marked and surveyed and a land survey marker or benchmark located. The survey marker should have both horizontal and vertical controls. Depending on the positioning system being deployed, a survey marker may also need to be placed within line of sight of the test areas. If the topographical information is not available, a land survey should be conducted across the site to locate physiographic and man-made features (tree lines, telephone lines, utilities, or other features) of interest that may interfere with the geophysical surveys. The datum and coordinate system used during the survey should be documented and used consistently throughout the entire SPO process.
- (2) **Surface Clearance.** If there is a potential for hazardous munitions on the SPO site, surface and subsurface clearances must be carried out as required. This is necessary to obtain uncorrupted signals from the seeded items. Furthermore, anomaly avoidance measures must be followed when selecting seed item burial locations. The SPO Work Plan must specify how inert munitions items, scrap, fragments, and other surface clutter items will be addressed during surface clearance. In most instances, all surface items are removed from the site during the surface sweep. Any clutter needed for the prove-out can then be placed back into the test plot during seed item emplacement.
- (3) **Vegetation Clearance.** The conditions of the SPO site should mimic those found in the production area. If necessary, the vegetation removal should be conducted to duplicate the production area conditions.
- (4) **Baseline Survey.** The baseline geophysical survey of the SPO site is conducted before seed item emplacement to determine the presence or absence of existing anomalies and to establish background geophysical responses. Existing anomalies can be removed or documented. In addition, any soil sampling, soil property measurements, and/ or soil moisture levels determined by the geophysical team that require characterization to support the prove-out can also be conducted at this time.

- c. **Seed Item Selection and Emplacement.** The seed items selected for a SPO should be site specific and should reflect the anticipated conditions in the production area. This would dictate the types of seed items, the quantity and the placement of individual items (location, depth, and orientation), and the amount of clutter items to be used if any. Further, some of these decisions are guided by

the data quality objectives of the individual surveys (wide area assessments, risk mitigation, site characterization, and/ or clearance surveys). Some of the parameters of concerns include the following:

- (1) **Type.** Based on the historical research about the survey area, the seed items used in the SPO should reflect the types of munitions expected; and it should include the items most difficult to detect, which is often the smallest item of interest. In order to make the SPO realistic, inert items should be used; however, if these are not available, surrogates of approximately equal size, shape, and material composition may be used. However, when using surrogates, care must be taken to ensure that the geophysical signatures of surrogate items are similar to the signatures of items that are likely to be encountered at the site.
- (2) **Quantity and Placement.** A sufficient number of seed items should be placed to meet the project objectives, i.e., there should sufficient number of items to be able to evaluate the performance of the geophysical system given the variability of site specific conditions, including: the types of munitions of interest, detection depths and orientation. Moreover, there should be sufficient numbers of seeds to capture to random factors, such as relative orientation, line placement, and site specific performance metrics, such as the probability of detection and the confidence levels associate with those detections. With regards to emplacement depths, some consideration should be given the depths that the individual items are likely to penetrate. Once the items have been emplaced, their locations (coordinates and depth, i.e., the x, y and z), and attitudes (inclination and declination) must be accurately recorded.
- (3) **Clutter.** Clutter items may be added to the SPO to address detection and discrimination issues. The amount and type of clutter seeded should be representative of that is likely to be found in the production site, so that the team can maximize discrimination effectiveness.

### 3G105. SPO FIELD PROCEDURES

1. **General.** Depending on the goals and site specific DQOs, the SPO Work Plan should address the following, and it must be reviewed and approved prior to site construction. After the SPO is designed and constructed, geophysical systems are tested in accordance with the Work Plan. Because the ultimate goal of the SPO is to confirm that the selected geophysical survey equipment and methods are appropriate for the site, it is imperative that the SPO survey be conducted in a similar manner as the production survey. Therefore, the SPO should be implemented using key geophysical personnel, equipment types and configurations, survey procedures, data analysis, and anomaly identification and reacquisition methods in the same manner as that planned for the production survey. This helps maintain the integrity of the SPO and adds validity to the SPO process and the data collected.

2. **Field Mapping and Data Acquisition.** Field mapping and data acquisition at the SPO site is conducted using the same approach that would be utilized to survey the entire site. The SPO report should fully document the equipment used, survey speed, survey coverage, and data acquisition rates. In addition, the function checks and setup procedures for all acquisition and sensor equipment should be documented, and any deviances should be noted. For mag and flag surveys, the procedures, equipment settings, and search patterns used should be noted for exact duplication during the production survey.

3. **Data Management and Documentation.** The SPO survey data should be collected and managed using the procedures that will be used during the actual production surveys and that have been documented in the Work Plan.

### 3G106. DATA ANALYSIS

1. **General.** The raw digital geophysical data collected during the SPO site survey should be processed, analyzed and interpreted to select the anomalies resulting from the seeded items. All the processing steps, including data transformations/ conversions, corrections and filtering, and other functional tests performed for the detection of anomalies should be documented (e.g, conversion from binary to ASCII, creation of database for processing, levelling of electromagnetic signals, lag corrections, base station corrections, diurnal corrections, median filtering, spike removal, and data dropout detection, etc.). The processed data are analyzed to establish a threshold (or minimum signal strength/ response), which is based on the geophysical signatures of the items of interest buried at specific depths, and may also depend on the background geologic noise level of the site. Signal responses above and below the established threshold are selected and reviewed to minimize false positive responses and false negative responses respectively.

2. **Anomaly Selection.** Based on the threshold level, the anomalies may be selected using, either the profiles or gridded data. It should be pointed out that consultants use a number of algorithms that are available for target picking (either from profiles or gridded data, or both); and these must be well documented. During this analysis, all of the identified anomalies are recorded on a dig sheet, and subsequently maps may be produced to show the location of those anomalies. Dig sheets are to include all information available on the instrument response to the targets. Dig sheets may vary in format but always include northing/easting coordinates, anomaly number, and signal levels (e.g., nT or mV, etc.) above the selected threshold values. In some situations, depending on the instrument(s) deployed, information about anomaly depth, size, and orientation may also be presented.

3. **Anomaly Reacquisition.** Whenever digital geophysical surveys are conducted at a site, the anomaly reacquisition is the last field activity for SPO. The purpose of this step is to demonstrate the ability to accurately record the location of the selected anomaly, navigate back to the selected anomaly, and then determine the precise anomaly location using a geophysical sensor. This is accomplished by a search around the identified anomaly within a predetermined radius. Once the anomaly is reacquired, its exact location is marked with a pin or flag and the precise X and Y coordinates are determined. This marked location is used to score the ability to reacquire the anomaly, the interpretative location, the reacquisition location, and assess the results of the SPO. This allows the geophysical team to determine any spatial (and/ or depth) offsets that may exist between the location of the geophysical anomaly and the location of the emplaced item (target). Again, the intent here is to evaluate and verify the geophysical system in its present configuration as well as the contractor's field procedures that would be used for production surveys over the entire site. Ideally, the reacquisition of anomalies is done with the same sensor system that was used initially to acquire the anomaly; however, in many instances, it is not possible, and as a result, an alternate sensor system may be deployed with pre-determined search radius.

4. **Discrepancy Resolution.** Any discrepancies that may occur in the location of anomaly and actual targets should be resolved with the modification of geophysical procedures and/ or be discussed and resolved with the DMD PM before the commencement of production surveys on the site.



5. **Mag & Flag.** In the absence of digital geophysical mapping such as that associated with a mag and flag survey, data analysis consists of the UXO technician making an interpretation of audio and visual signals in real time, and placing a flag at the appropriate location.

### 3G107. EVALUATION OF SPO RESULTS

1. **General.** Each seeded item can be scored as a “pass” or “fail” based on whether the emplaced item was successfully detected and relocated within the maximum allowable radius for positioning accuracy as described by the data quality objectives. It is worth noting that these data quality objectives are largely based on the objectives of the geophysical survey (namely, wide area assessment, risk assessment, site characterization, followed by complete clearance) and they should take site specific conditions into consideration. Depending on the objectives and the results of the SPO, the PMT may have to adjust the DQOs. It may not be reasonable or practical to expect 100% detection of the smallest item buried at a certain depth. In such a case, the threshold level may need to be adjusted. However, lowering of the threshold level would result in a lot of small scrap material being grouped as targets of interest (increased false positives) and increasing in threshold level would mean that a number of smaller items might be completely missed (not detected). As well, in some cases artefacts of the algorithms used for anomaly detection may result in false positives. Furthermore, because site-specific conditions and the types of munitions of interest affect different geophysical systems differently, evaluating the results of a SPO to compare different geophysical systems at the same site can be difficult. Consequently, the geophysical team should use the SPO information in a trade-off analysis to select the optimal geophysical approach for the project. These trade-offs must be communicated to the PMT before a final decision is made.

2. **Performance Metrics.** Often, in the SOW/SOR, it is indicated that the geophysical system used at a specific site should meet certain DQOs, as defined by the performance metrics. Some of these performance metrics include: Probability of Detection (Pd), Confidence Level (CL), False Alarm Rate (both the false positive and false negative rates), Signal-to-Noise Ratio (SNR), Depth of the item vs. Diameter, etc. However, it should be noted that it may not be possible to calculate many of these performance metrics during the SPO because, *in strict sense*, many of these parameters are determined on the basis of statistical analysis and they would require a large population of seed items (i.e., significantly large number of items of the same type) to be emplaced so that all have the same chance of being detected, and also it captures the random processes that effect detectability. Use of such a large number of seed items may not be practical at the SPO stage.

3. **QA/QC Documentation.** All of the procedures used throughout the SPO process should be documented, and should include discussions of the following:

- a. equipment functional checks: standard response tests, static test, shake test, repeat data tests, etc.;
- b. data collection procedures;
- c. target parameters;
- d. positioning system operations/ limitations/ accuracy; and
- e. data management and processing.

4. **Conclusions.** This section should include a statement as to whether the geophysical system, approach and methodology used at the particular site would meet the project specific objectives or not. If there are any limitations and those must be stated. A statement must also be made as to the data quality objectives and whether they will be attained. If the DQOs can

not be attained, there must be a discussion as to why not and recommendations as to what modifications would be required to bring the system into compliance, or alternatively suggestions as to possible modifications to the DQOs.

### 3G108. DELIVERABLES

1. **General.** All the geophysical data collected by the contractor during the implementation of the SPO is the property of the Department of the National Defence. Consequently the deliverables to include: a letter report and the raw digital data acquired during the implementation of SPO.

2. **SPO Letter Report** The contractor shall submit a SPO Letter Report for approval by the PMT before the production survey can begin. This serves as a dry run for the contractor as to what is expected in terms of deliverables and DQOs when the production survey starts. It also gives the PMT an opportunity to decide whether the project objectives will be achieved or not, and whether the consultant should be using a different geophysical sensor system and different methodology. The contents of the SPO Letter Report may include the following:

- a. Introduction;
- b. SPO Objectives;
- c. SPO Implementation:
  - (1) SPO Construction,
  - (2) SPO Field Procedure,
  - (3) Data Analysis, and
  - (4) Evaluation of results;
- d. Conclusions;
- e. Attachments:
  - (1) Annex A - SPO Seed items,
  - (2) Annex B - Raw and Processed Data, and
  - (3) Annex C - Dig Sheets.

3. **Digital Deliverables.** All of the digital geophysical data collected for the implementation of SPO and the supporting material must be delivered in electronic format to the PMT. This includes the raw and processed geophysical data, dig list, digital photographs of the seed items as well as drawings and specifications of surrogate seed items and field photographs (if any). .

### 3G109. BASIC SITE SPECIFIC SPO CRITERIA

1. Although the intent of this document is to provide guidelines for conducting the SPO, many of the design criteria are influenced by: the project objectives, the project site, the technology to be deployed, spatial accuracy required to meet the project objectives, and finally the cost considerations. The SPO is the field demonstration and a confirmation that the proposed geophysical systems will meet the project requirements. It must be successful before the production survey can start at site. In evaluating the SPO results, the DND PM should be prepared to make adjustments to the overall project objectives and/ or be prepared to suggest or encourage the consultant to explore an alternate approach and methodology. The table below provides some of the parameters that may influence the SPO design criteria.

Design Criteria	Description/ Importance	SPO Parameters Influenced
Project objectives: - Wide area assessment, - Risk assessment, - Site characterization, or - Clearance	<p>The SPO design should include sufficient number of items at critical depths to achieve project objectives; and the project objectives may vary depending on the size of the site and nature of expected munitions;</p> <p>In general, the knowledge about the site increases as the areal extent decreases, with each phase, namely from Wide area assessment - Risk assessment- Site characterization – finally to Clearance.</p>	- Number of seed items - Depth of emplacement - Size, and Shape - Spatial accuracy
Nature of the Site: - Expected land use, - Site Accessibility, - Environmental sensitivity	<p>Project objectives are generally based on the expected land use and/ or its proximity to the population where people are likely to be exposed to UXO.</p>	-Size and shape - Spatial accuracy - Number of seeds
Sensor technology and sensor platform to be deployed	<p>Project objectives and the size of the site dictate the sensor technology and sensor platform that can be effectively deployed and evaluated for the specific site.</p>	- Size and shape - Depth - Arrangement of seed items - Spatial accuracy - Reacquisition
Munitions of interest expected at the site	<p>Based on historical research, site specific munitions should be used to ensure that geophysical system used can locate the items at varying and realistic depths and orientations.</p>	- Size and Shape - Depth and orientation, and - Composition
Depth of interest for each munitions items expected at the site	<p>Detection becomes more difficult as the depth below ground surface increases or the size of the munitions decreases. Therefore, to meet the project objectives the consultant must ensure that the sensor used can detect the smallest item at the specified depths.</p>	- Size of see items - Depth of emplacement
Composition of the munitions of interest	<p>Selection of geophysical sensors should be based on the composition of the suspected items, as each sensor system has its inherent strengths and weaknesses.</p>	- Composition of seed items
Quantity of munitions	<p>Sufficient number of seeded items should be included to ensure that project objectives are achieved. For large and complex sites, there may be a need to</p>	Number of seeded items

Design Criteria	Description/ Importance	SPO Parameters Influenced
	employ more than one SPO.	
Local geologic/ soil/ moisture conditions	Local geologic conditions vary considerably, however, in rare cases the geologic and soil conditions may make it difficult to emplace the seed items below ground surface to obtain threshold values	<ul style="list-style-type: none"> <li>- Seed item-sensor separation</li> <li>- Seed item placement</li> </ul>
Survey coverage and geometry: <ul style="list-style-type: none"> <li>- Full coverage</li> <li>- Transects</li> <li>- Meandering path</li> </ul>	SPO should be designed to evaluate the specific type of survey coverage planned for the site, and it should also evaluate the same sensor system geometry that will be deployed during the actual site survey.	<ul style="list-style-type: none"> <li>- Size of the SPO and geometry,</li> <li>- Seed item placement geometry</li> </ul>
Acceptable geophysical survey confidence and levels of uncertainty	The minimum number of seed items required is a function of the probability of detection and confidence level. However, it must be noted that the probability of detection and confidence levels are statistical measures and based on population level sample size.	<ul style="list-style-type: none"> <li>- Number of seed items</li> <li>- Size of seed items</li> <li>- Depth of placement</li> </ul>

**Table 3G1-1: Parameters Influencing SPO Design Criteria**

**APPENDIX 2 TO ANNEX G TO CHAPTER 3  
SAMPLE GEOPHYSICAL AUDIT FORM**

<b>Geophysical Audit Information</b>						
<b>General Information</b>						
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <b>Date of Audit:</b> _____   <b>Project Name:</b> _____   <b>Project Number:</b> _____   <b>Survey Location:</b> _____   <b>CA Auditor:</b> _____ </div> <div style="width: 45%;"> <b>Contracting Company:</b> _____   <b>Company Geophysicist:</b> _____   <b>Equipment Used:</b> _____ </div> </div>						
<b>Authorization</b>						
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <b>CA Representative:</b> _____   <b>Signature:</b> _____ </div> <div style="width: 45%;"> <b>Contractor Representative:</b> _____   <b>Signature:</b> _____ </div> </div>						
<b>General Geophysical Specifications</b>						
Subject	Reference	Question	YES	NO	N/A	Comments
Line Path	SOW Annex ? Para ??	Does the coverage of the area meet the requirements of the SOW/SOR excluding impassable areas?				
	SOW Annex ? Para ??	Is the distance between any two (2) survey lines greater then the sensor swath width?				

	SOW Annex ? Para ??	Do any line-breaks exist that are greater then the sensor swath width?				
GPS	SOW Annex ? Para ??	Were initial & daily static GPS tests provided? Has the contractor provided a reasonable equipment error range?				
		Did the results of the test(s) fall within established margin of error?				
System Test	SOW Annex ? Para ??	Are system test files provided for each day of surveying? Had the system norm been designated at the job beginning?				
		Do the results of the test meet the contracted requirements?				
Lag Test	SOW Annex ? Para ??	Was a lag test performed during the project?				
		Was variable lag visible in the data?				
		Did the lag correction applied to the data remove all lag effects within the data?				
Soft Prove Out	SOW Annex ? Para ??	Where the results of the SPO clearly provide in tabular and digital form as per SOW/SOR requirements?				
<b>Electromagnetic Specifications</b>						
<b>Subject</b>	<b>Reference</b>	<b>Question</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
Levelling	SOW Annex ? Para ??	Was all data levelled to a standard baseline (usually 0) correcting for temperature and equipment drift?				
Noise Levels	SOW Annex ? Para ??	Do the noise levels of the data meet established thresholds unless affected by cultural interference?				

Magnetic Specifications						
Subject	Reference	Question	YES	NO	N/A	Comments
Diurnal	SOW Annex ? Para ??	If applicable: Was a base station used to collect diurnal data? Was the data recorded acceptable?				
		Was the contractor successful in removing the effects of magnetic diurnal from the survey data?				
Noise Levels	SOW Annex ? Para ??	Did the noise levels of the magnetic data meet established thresholds? If not, were the affected areas re-surveyed?				
Dropouts	SOW Annex ? Para ??	Do un-interpolated, magnetic data dropouts exceed contract specifications?				
Geographical Information System (GIS) & Mapping						
Subject	Reference	Question	YES	NO	N/A	Comments
Maps	SOW Annex ? Para ??	Were appropriate map layers provided by the contractor defining impassable terrain, cultural influences, etc...?				
		Were the maps properly labelled with legends defining all layers and appropriate scales and colour ranges?				
		SOW Annex ? Para ??	Were polygon files provided that accurately defined the area to be surveyed?			
Units	SOW Annex ? Para ??	Was the data delivered in consistent metric units?				
Accuracy	SOW Annex ?	Did the spatial accuracy of the data provided meet				

	Para ??	contract specifications?				
<b>Data Deliverables</b>						
<b>Subject</b>	<b>Reference</b>	<b>Question</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
Files	SOW Deliverables Section and SOW Annex ?	Was a file provided that describes and identifies all data files associated with the project (Ex. Maps, calibration files, test files, SPO files, etc...)				
		Did headers of all ASCII files accurately define the content within the file?				
		Did all files conform with acceptable formats defined in the SOW/SOR Deliverables Section ?				
Target List		Were target list for each stage of clearance provided in a well-labelled and acceptable format?				



## **CHAPTER 4**

### **RANGE CLEARANCE/UXO ACTIVITIES QUALITY ASSURANCE (QA) GUIDELINES**

#### **SECTION 1**

#### **INTRODUCTION**

##### **401. GENERAL**

1. **General.** Range clearance/UXO activities are no different than other military tasks or contracted tasks/projects in that some degree of Quality Assurance (QA) is normally required. The level of QA employed for a range clearance/UXO activity is indicative of the degree of confidence required in the outcome of the range clearance/UXO activity, as well as the effectiveness and efficiency of those conducting the range clearance/UXO activity. This chapter provides guidelines for QA concepts and techniques for range/UXO clearance activities. Assistance in determining the best QA techniques for specific tasks/projects as well as the latest QA techniques applicable to range clearance/UXO activities can be obtained from the Directorate of Environmental Engineering Management (DEEM) 2 or the Directorate of Real Property Management (DRPM) 2 – DND UXO and Legacy Sites Program (UXO Legacy Sites Program).

2. **Organizations.** The range clearance/UXO activity QA organization may be based upon military or civilian team(s) tailored to the task. QA organizations should reflect the capabilities given in Chapter 2 for military clearance or Chapter 3 for contracted clearance. Military QA personnel should be drawn from personnel qualified as described in Annex A to Chapter 2. Properly qualified civilian personnel/teams may come from DND civilian personnel or be contracted through DCC, PWGSC or other Contracting Authority (CA).

#### **SECTION 2**

#### **QA CONCEPTS**

##### **402. GENERAL**

1. The QA concept must be determined during the planning/definition phase and be included in the project plan as well as the Statement of Work (SOW)/Statement of Requirement (SOR). The QA plan should specify who is conducting the QA, what is to be measured and how, standard(s) required and action(s) to be taken if the standards are not met. The amount of QA will depend on the level of assurance desired. However, the more stringent the QA, the more expensive in terms of cost, personnel, time and resources.

##### **403. MILITARY RANGE CLEARANCE/UXO ACTIVITY QA**

1. CF personnel will normally be used for QA on military range clearance/UXO operations. However, if required, external QA personnel/teams can be contracted from industry or drawn from appropriately qualified and experienced DND civilian personnel..

##### **404. CONTRACTED RANGE CLEARANCE/UXO ACTIVITY QA**

1. **General.** On contracted range clearance/UXO activities, QA is an obligatory contractual term and therefore, it is normally the responsibility of the Contracting Authority (CA) to ensure the QA level designated by DND/CF QA plan is attained. The QA Representative (QA Rep) reports directly to the CA and is the first point of contact for contractual quality issues. All aspects of the contractor's work will be scrutinized and any deviation from an acceptable

standard will be reported to the contractor by the QA Rep. A QA Rep to oversee the clearance contractor's QC and Work Plans may be engaged by DND through DND resources or contracted sources as follows:

- a. **Military Personnel for QA.** CF personnel may be used for QA on contracted range clearance/UXO operations only however, the amount of resources and length of time required during contracted range clearance will usually preclude the use of military personnel.
- b. **Contracted QA.** QA may be contracted separately from the main range clearance/UXO activity contract, in which case a separate site specific SOW/SOR and a separate contract Request for Proposal (RFP) process will be initiated.
- c. **Internal QA**
  - (1) QA may be conducted internally to the task/project management team if time, resources and expertise are available, or
  - (2) QA may be conducted internal to the CA, in which case a Service Level Agreement or similar document between DND/CF and the CA will be initiated.

### SECTION 3 QA TECHNIQUES

#### 405. GENERAL

1. There are various QA techniques recognized within the Quality Control (QC)/QA profession to confirm the degree of compliance and/or effectiveness of a given task/project. The versatility and effectiveness of statistical analysis software/technologies has improved QA techniques, and continues to do so. One or more of the techniques described below may be used.

#### 406. PHYSICALLY BASED QA CHECK OF RANGE CLEARANCE/UXO WORK TECHNIQUES

1. **General.** Physically based QA checks of range clearance/UXO work techniques involves replicating the range clearance/UXO activity as a physical check/confirmation that the work was conducted properly and to raise the level of confidence that the results desired will be attained. Physically based QA check techniques are normally associated with range/UXO surface/subsurface clearance work.
2. **100% QA Check.** A 100% QA check entails a complete visual surface clearance or visual and electronic subsurface clearance of the entire area. This type of QA is the most resource intensive and should be used only when the highest degree of clearance certainty is required.
3. **Percentage QA Check.** A percentage QA check entails a complete surface or subsurface clearance of a pre-determined percentage of the area previously cleared. For military clearances, 15% of the area previously cleared has been the norm. For contracted clearances, the amount selected should be based on a confidence level statistical selection process unique to the site. This type of QA can be resource intensive if a high percentage of the area is used (i.e. the higher the percentage, the larger the cost). However, it does permit a large degree of flexibility. The following methods (or variations) can be used:

- a. **Random QA Check.** Small areas are selected at random based on interpretation of and/or confidence in operation/work plan compliance by the clearance organization conducting the initial clearance. The selected areas are subject to a complete surface or subsurface clearance until the desired percentage of the total area is checked. Selecting areas randomly is normally the preferred method.
- b. **Pre-Set Areas QA Check.** A complete surface or subsurface clearance is conducted at pre-determined intervals (usually in terms of clearance grids/cells completed, distance or time) until the desired percentage of the total area is checked.

#### 407. STATISTICALLY BASED QA CHECK OF RANGE CLEARANCE/UXO WORK TECHNIQUES

1. **General.** Statistical analysis of results obtained from the range clearance/UXO activity can be used to calculate the degree of compliance and/or effectiveness of the range clearance/UXO activity. Statistically based QA check techniques can be used for both survey and clearance work. Some possible methodologies for clearance work, used singly or in concert with others are described below. Other methods may also be available.
2. **Seeding QA Check.** A pre-determined number of control objects (marked rods, canisters, etc) are seeded (emplaced) at selected locations within a number of clearance grids in the clearance area prior to conducting the clearance. Once found by the clearance personnel, the control objects are returned to QA personnel. The number of control objects found will give an indication as to the effectiveness and efficiency of the clearance operation.
3. **UXO Finds QA Check.** The amount of UXO found is compared to the number of UXO expected through statistical analysis to ascertain the clearance operation effectiveness. This technique is predicated on having a high degree of confidence in the accuracy of the information on the total amount of UXO in the area obtained through records, etc. This is normally the least precise technique and should only be used if a low degree of clearance certainty is acceptable. For contracted range/UXO clearance activities, this technique is very difficult to enforce and should be avoided.
4. **QC Plan Analysis QA Check.** Analysis of the rigour of compliance to and enforcement of the contractor's QC Plan can be used to ascertain the effectiveness of the range clearance/UXO organization and/or their compliance to the requirements of the DND/CF SOW/SOR as detailed in the accepted contractor's Work Plan. For contracted range clearances/UXO activities, it is mandatory that a designated QC person be identified. Having a recognized QC person as part of the on-site clearance organization can add to the degree of confidence in range clearance/UXO activity organization compliance.
5. **Electronic Sensing Data Analysis QA Check.** Analysis of electronic/GIS data from previous range/UXO clearances/surveys compared to data collected by the range clearance/UXO activity organization can be used to ascertain the effectiveness of the range clearance/UXO activity organization and/or their compliance to the requirements of the DND/CF SOW/SOR as detailed in the accepted contractor's Work Plan. When coupled with a comparison to the UXO/suspected UXO and scrap found, this can allow a high degree of certainty/confidence in the work performed.

## SECTION 4 QA CRITERIA

### 408. GENERAL

1. Defect criteria must be **site specific** and tailored to the requirements of the task/project and the QA method or combination of methods utilized. Example defect criteria for QA inspection results for techniques described in Section 3 are provided in paragraphs below for illustrative purposes only—.

### 409. PHYSICALLY BASED QA CHECK OF RANGE CLEARANCE/UXO WORK TECHNIQUES CRITERIA

1. **General.** Many different criteria can be used if the 100%, Percentage, Random or Pre-Set Areas QA checks are used. Two types, false negative and false positive criteria are provided below as examples. In each case on escalation from a lesser defect to a more serious should require implementation of a root cause analysis and corrective action undertaken.

2. **False Negative Criteria.** A false negative criterion is the most common defect criteria and is based on the failure to locate, from the electronic signal, an item(s) that is actually present. Examples of possible scales of defects using the false negative criteria are as follows:

- a. **Critical Defect.** Identification, as the result of inspection, of a UXO in a designated clearance grid could constitute a critical defect. Identification, as the result of inspection, of the same clearance grid being done three times due to a major defect could constitute a critical defect. Identification of three critical defects under this operation/contract could cause:
  - (1) **For Military Range/UXO Clearance Operation.** The Military Commander could replace the Sweep Team (if available) until the previous Sweep Team has successfully completed re-training to the accepted standard.
  - (2) **For Contracted Range Clearance/UXO Activity.** The DND PM could recommend repeating the range clearance/UXO work with replacement technicians or re-examine the contract and could recommend to the Contracting Authority (CA) that the contract be terminated.
- b. **Major Defect.** Identification, as the result of inspection, of three or more false negatives in a clearance grid could constitute a major defect. A false negative for a Major Defect is defined as a substantial munitions fragment greater than the pre-determined minimum size (normally 15 cm for military range/UXO clearance operations) in any direction that would have been expected to be found based on the electronic signal. Identification, as the result of inspection, of the same clearance grid being done three times due to minor defect could constitute a major defect.
- c. **Minor Defect.** Identification, as the result of inspection, of 15 or more false negatives in a clearance grid could constitute a minor defect. A false negative for a Minor Defect is defined as a small munitions fragment greater than the pre-determined characteristic (normally 5 cm<sup>2</sup> for military range/UXO clearance operations), but less than substantial munitions fragments (munitions fragment greater than the pre-determined minimum size (normally 15 cm for military range

clearance operations) in any direction) which would have been expected to be found based on the electronic signal.

3. **False Positive Criteria.** A false positive criterion, based on indicating, from the electronic signal, that an item(s) is present when there is none. This advent of a number of false positives may be indicative of faulty equipment or poor usage/techniques. Scales of defects similar to the false negative criteria may be developed and used in concert with the false negative criteria.

#### 410. STATISTICALLY BASED QA CHECK OF RANGE CLEARANCE/UXO WORK TECHNIQUES CRITERIA

1. **General.** The criteria below can be used if the statistically based QA checks are used. In each case on escalation from a lesser defect to a more serious should require implementation of a root cause analysis and corrective action undertaken

2. **Seeding QA Check**

- a. **Critical Defect.** Failure to locate and identify any of the seeded items in a clearance grid could constitute a critical defect. The occurrence of three minor defects (i.e. three attempts to locate and identify all seeded items in the seeded clearance grid) could also constitute a critical defect. Identification of a critical defect under this operation/contract could cause:
  - (1) **For Military Range/UXO Clearance Operation.** The Military Commander could replace the Sweep Team (if available) until the previous Sweep Team has successfully completed re-training to the accepted standard.
  - (2) **For Contracted Range Clearance/UXO Activity.** The DND PM could recommend repeating the range clearance/UXO work with replacement technicians or re-examine the contract and could recommend to the CA that the contract be terminated.
- b. **Major Defect.** Failure after two attempts (i.e. two minor defects) to locate and identify all of the seeded items in a seeded clearance grid could constitute a major defect. On identifying a major defect, a further review of the techniques and equipment in use should be conducted and the seeded clearance grid must be redone to the satisfaction of the QA inspector.
- c. **Minor Defect.** Failure to locate and identify at least 90% of the seeded items in a seeded clearance grid could constitute a minor defect. On identifying a minor defect, a root cause analysis should be performed to determine why items were missed and then the seeded clearance grid must be redone to the satisfaction of the QA inspector.

3. **UXO Finds QA Check**

- a. **Critical Defect.** Failure to locate and identify at least 50% of the predicted number of expected UXO in a clearance grid could constitute a critical defect. The occurrence of three major defects could also constitute a critical defect. Identification of three critical defects under this operation/contract could cause:
  - (1) **For Military Range/UXO Clearance Operation.** The Military Commander could replace the Sweep Team (if available) until the

previous Sweep Team has successfully completed re-training to the accepted standard.

- (2) **For Contracted Range Clearance/UXO Activity.** The DND PM could recommend repeating the range clearance/UXO work with replacement technicians or re-examine the contract and could recommend to the CA that the contract be terminated.

- b. **Major Defect.** Failure to locate and identify at least 75% of the predicted number of expected UXO in a clearance grid could constitute a major defect. On identifying a major defect, the clearance grid must be redone to the satisfaction of the QA inspector. The occurrence of three minor defects could also constitute a major defect.
- c. **Minor Defect.** Failure to locate and identify at least 90% of the predicted number of expected UXO in a clearance grid could constitute a minor defect. On identifying a minor defect, the clearance grid must be redone to the satisfaction of the QA inspector.

#### 4. **Contractor's QC Plan**

- a. **Critical Non-Conformance or Deviation.** General non-conformance to the QC plan or the identification of three major deviations related to the contractor's observance of their QC Plan would constitute a critical defect. Identification of a critical defect under this operation/contract could cause the DND PM to re-examine the contract and could form the basis for recommendations to the CA for contract termination.
- b. **Major Non-Conformance or Deviation.** Failure of the contractor to undertake remedial action to comply with and/or to enforce their QC Plan related to life threatening issues could constitute a major deviation and be recorded as such by the QA inspector. The identification of three minor deviations related to the contractor's observance of their QC Plan would constitute a major deviation.
- c. **Minor Non-Conformance or Deviation.** Failure of the contractor to undertake remedial action to comply with and/or to enforce their QC Plan related to non-life threatening issues could constitute a minor deviation and be recorded as such by the QA inspector. Safety infractions, especially those concerning UXO handling, search equipment calibration/operation or other safe practices breaches shall be included as part of the QC Plan.

#### 5. **Electronic Sensing Data Analysis QA Check**

- a. **Critical Defect.** Identification of three major defects related to the electronic sensing data analysis would constitute a critical defect. Identification of a critical defect under this operation/contract could cause the DND PM to re-examine the contract and could form the basis for recommendations to the CA for contract termination.
- b. **Major Defect.** Identification of three minor defects related to electronic sensing data analysis would constitute a critical defect.
- a. **Minor Defect.** Failure of the electronic sensing data analysis to show at least a 90% statistical assurance for the effectiveness of the clearance organization or compliance with the DND/CF SOW/SOR and accepted contractor's Work Plan in a clearance grid could constitute a minor defect. On identifying a minor defect, the clearance grid must be redone to the satisfaction of the QA inspector.

## **SECTION 5 QA REPORTING**

### **411. GENERAL**

1. The QA organization will report to the Military Commander (for military range clearance) or the Project Manager through the CA (for contracted range clearance/UXO activity). The reporting format will be prescribed in the Op O for military operations. For contracted range clearance/UXO activities, the format will be included in the DND/CF SOW/SOR or issued at the “kick-off” meeting prior to the commencement of work as part of the project QA plan.

INTERIM 12 Apr 2011





## GLOSSARY

1. This publication is primarily written using established military terminology. It is important that all personnel are familiar with and use recognized terminology to avoid confusion. As required, further terms and definitions or any changes must be included in the operations order for a military operation or as part of the Statement of Work/Statement of Requirement for contracted UXO activities.

- a. **Active Site.** Any property currently under DND administration and control. These are designated as Category A and B sites.
- b. **Blind.** See Unexploded Explosive Ordnance (UXO).
- c. **Blow-in Place (BIP).** See Destroy in situ.
- d. **Conceptual Site Model (CSM).** A layered compilation of geo-referenced information pertaining to a site (topographic, demographic, hydrologic, UXO, environmental, vegetation, infrastructure, etc) that provides an overview of the site.
- e. **Danger Area.** The area associated with a range from which unauthorized ships, personnel, equipment and aircraft are excluded for reasons of safety, either because of the actual firing of weapons or the presence in the ground of UXO. Others may refer to Danger Area as exclusion zone.
- f. **Destroy in situ (DIS).** Destroying/disposing of munitions with an explosive in the place that they are found. Others may refer to DIS as blown-in-place (BIP).
- g. **Discarded Military Munitions (DMM).** Defence explosive ordnance (EO) that has been lost, abandoned, buried or otherwise disposed of in an improper manner. Sometimes referred to as potentially hazardous EO. For UXO related work, UXO includes DMM.
- h. **Disposal.** The end-of-life tasks and actions for residual materials resulting from demilitarization operations. Disposal encompasses the process of redistributing, transferring, donating, selling, abandoning, or destroying military munitions. (AOP-38-4)
- i. **Dud.** See UXO.
- j. **Energetic Material.** Explosive and reactive material from EO.
- k. **Environmental Chief of Staff (ECS).** This term designates to any one of the three Chiefs Of Staff: Chief of Land Staff (CLS), the Chief of Maritime Staff (CMS) or the Chief of Air Staff (CAS). They all report to the Chief of the Defence Staff (CDS). (Defence Terminology Bank)
- l. **Explosive Ordnance (EO).** All munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges; demolition charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature. (AAP-6)
- m. **Explosive Ordnance Disposal (EOD).** The detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive

ordnance. It may also include explosive ordnance which has become hazardous by damage or deterioration. (AAP-6)

- n. **EO Exposure Pathway (EEP).** Any means by which humans may come in contact with EO or munitions debris.
- o. **Explosive Residue.** Energetic material from functioned or non-functioned EO that has accumulated in sufficient quantity to create an explosive risk. For UXO related work, UXO includes explosive residue.
- p. **Fragments.** Any metal portion of the ammunition or its package that is propelled from the site of an explosion. For range clearance/UXO activities purposes, ammunition fragments, while still requiring de-militarization, do not require further destruction techniques applied and may be described as a munitions type by function. They are recorded by weight as a type of Munitions Scrap (MS) in the Site UXO Model (SUM) to the CSM to provide information on the magnitude of resources for follow-on work.
- q. **False Negative.** A Type II statistical error that fails to observe a difference when in truth there is one thus indicating poor sensitivity and viewed as the error of excessive scepticism. An example of this would be if the locating sensor results show no target anomalies in a given area when in reality, there are target anomalies.
- r. **False Positive.** A Type I statistical error that observes a difference when in truth there is none thus indicating poor specificity and viewed as the error of excessive credulity. An example of this would be if the locating sensor results show target anomalies in a given area when in reality, there are none.
- s. **Free From Explosive (FFE).** An item containing no energetic material. The FFE designation must be accompanied by a DAER approved caveat delineating the levels of FFE certification (Safe to Handle, Safe to Transport, Safe for Final Disposal, etc.).
- t. **Impact Area.** An area having designated boundaries within which all ordnance is to make contact with the ground.
- u. **Legacy Site.** Property that DND occupied, used, owned, leased or was directly affected by DND activities but is no longer under DND administration and control. These are designated as Category C sites.
- v. **Level 1 (L1).** A senior official, either civilian or military, who has direct accountability to the Deputy Minister or the Chief of Defence Staff. (Defence Terminology Bank)
- w. **Munitions Scrap (MS).** All by-products resulting from the functioning of ammunition. This includes empty shell casings, projectiles, launchers, shrapnel, pieces of fuse, and all similar objects. Target vehicles, although of a non-munitions origin, shall be considered as munitions scrap because of the risk of hidden or residual munitions or items of an explosive nature contained within or near the target. For range clearance/UXO activities purposes, fragments and objects readily identifiable by nomenclature as EO (carrier shells, casings, etc) are reported and recorded as part of the SUM to the CSM to provide definable information for site characterization. Others may refer to MS as munitions debris (MD).
- x. **Non-Hazardous EO.** Expended (fired) or unexpended (unfired) EO items which do not present a serious threat to life or injury if activated. This includes all

expended small arms ammunition (bullets and casings), pyrotechnic clips and links that require clearance during surface and subsurface clearance. They are not considered indicative of impact areas when considering subsurface clearances.

- y. **Non-Munitions Scrap (NMS).** All scrap items that are not related to munitions. This covers metallic items (barbed wire, angle iron pickets, non-target vehicle pieces, soft drink cans, etc), wood (boards, crates, etc), glass, plastics and paper. Weights of NMS are recorded and form part of the SUM to the CSM to provide information for site characterization.
- z. **Ordnance.** Military material such as combat weapons of all kinds with ammunition and equipment required for their use. Ordnance includes all weapons components, ammunition, and all equipment needed to control, operate and support the weapons.
- aa. **Post-Firing Range Sweeps.** The surface clearance of a range undertaken after a unit has terminated exercise or firing activities. Details are contained in B-GL-381-003/TS-000 *Operational Training – Part 1 – Training Safety*.
- bb. **Range/UXO Clearance.** The process of detection, identification, exposing and safe reduction or removal of foreign objects, explosive or non-explosive, on or under a site affected by UXO.
- cc. **Range Clearance/UXO Activity.** Range clearance/UXO activities include UXO avoidance tasks, range/UXO surveys, range/UXO clearance tasks/projects/operations, and residual risk audits or assessments.
- dd. **Range/UXO Clearance Operation.** The planning, execution, quality assurance and reporting of the results of the clearance of UXO as part of annual/periodic maintenance or change of land use/return of land to original owner. The term, normally used in a military context, does not include post firing-range sweeps, UXO avoidance or range/UXO surveys.
- ee. **Range/UXO Survey.** Used to identify and determine outer limits and extent of UXO EO contamination on a range/site. The survey can employ manual/intrusive methods (i.e. range clearance procedures) or the use of electronic/remote survey techniques.
- ff. **Render Safe Procedures (RSP).** The application of special EOD methods and tools to provide the interruption or separation of essential components of UXO to prevent an unacceptable detonation. Not to be used during UXO activities/operations.
- gg. **Residual Risk Audit or Assessment (RRA).** The process of determining the remaining UXO risk to a site. Residual Risk Assessments are conducted on active sites as part of ongoing sustainable ranges and training areas activities. For legacy sites, Residual Risk Audits are a formal process by DRPM 2 – UXO Legacy Sites Program to verify whether the risk level at a previously cleared site remains valid.
- hh. **Risk Factor Levels.** The appropriate level of clearance required to make lands safe for military or civilian uses, and not pose a health and safety risk for the intended land use.
- ii. **Risk Zones.** Zones created to identify areas within a site to delineate specific areas of concern, or areas that contain similar UXO densities and risk levels.

- jj. **Scrap.** All items and residue remaining as a result of occupation or use. See munitions and non-munitions scrap for specific definitions for range clearance/UXO activities.
- kk. **Site UXO Model (SUM).** A methodology to capture UXO related data for the CSM, preferably using an electronic format in an approved DND GIS architecture.
- ll. **Special Status Site.** For UXO purposes, a Special Status Site is a site that DND/CF does not own or lease but where a UXO risk has occurred, from known or unknown reasons (current/routine training, operations, etc.) or unknown reasons (recent air crashes/shipwrecks, scrap dumps, etc.), and where DND has lead agency responsibility to rectify the UXO problem. A current accident site (maritime, ground or air related) or a commercial salvage yard where defence EO has created a UXO risk are examples. These are designated as Category D sites.
- mm. **Surface Clearance.** The clearance of surface UXO and visible scrap from the range (if required). A surface clearance is normally completed prior to a subsurface clearance to improve the detection of buried items and to provide additional data for subsurface clearance planning.
- nn. **Subsurface Clearance.** The clearance of sub-surface UXO to the depth required commensurate with the risk factor and intended use of the land.
- oo. **Unexploded Explosive Ordnance (UXO).** EO which has been primed, fused, armed or otherwise prepared for action and which has been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel or material, and remains unexploded either by malfunction or design or for any other causes (NATO AAP-6). For UXO related work, UXO includes DMM and explosive residue but excludes EOD/IED items and activities falling under CF EOD response activities and procedures. Others may refer to UXO as hazardous EO, a blind, a dud or Munitions and Explosives of Concern (MEC).
- pp. **UXO Avoidance.** Measures taken to detect and avoid UXO/suspected UXO. Does not include identification, exposing, handling or destruction of UXO or suspected UXO.

2. For clarity, some of the accepted DND/CF definitions above indicate some of the common non-DND/CF terms that may be used by others. A more comprehensive Glossary of range clearance/UXO activity terms, including geophysical terminology and the most recent DND/CF approved UXO terms, can be obtained from DRPP 5 – ADM(IE) RTA/UXO Coord (DWAN – [http://admie.ottawa-hull.mil.ca/dgme/RTA-Mgr/uxo\\_activities\\_e.html](http://admie.ottawa-hull.mil.ca/dgme/RTA-Mgr/uxo_activities_e.html)), DEEM 2 (DWAN – [http://admie.ottawa-hull.mil.ca/dgme/deem/uxo\\_e.asp](http://admie.ottawa-hull.mil.ca/dgme/deem/uxo_e.asp)). The use of non-DND/CF terminology is deemed appropriate only when it is necessary to facilitate the mutual understanding of a foreign agency or contractor with comparable DND/CF terms.

**ABBREVIATIONS**

1. This publication is primarily written using established military abbreviations. It is important that all personnel are familiar with and use recognized abbreviations to avoid confusion. As required, further terms and definitions or any changes must be included in the operations order for a military operation or as part of the Statement of Work/Statement of Requirement for contracted activities.

A&EI	Ammunition and Explosive Instruction
Ammo Tech	Ammunition Technician
ATO	Ammunition Technical Officer
BDU	Bomb Dispensing Unit
BTWC	Biological and Toxins Weapons Convention (CBRN related)
CA	Contracting Authority
CBRN	Chemical, Biological, Radiological and Nuclear
CF	Canadian Forces
CFAO	Canadian Forces Administrative Order
CFEOD	EOD Staff Organization (CLS/DGLCD/C-IED 2)
CF EOD	EOD in the CF
CFRIS	Canadian Forces Range Information System
CMD	Conventional Munitions Disposal
CAN	Canadian National Authority (CBRN related)
CNSSSF	Canadian National Single Small Scale Facility (CBRN related)
Comd	Commander
COS(IE)	Chief of Staff (Infrastructure and Environment)
CSA	Canadian Standards Association
CSM	Conceptual Site Model
CTAT	Controlled Technology Access and Transfer
CWC	Chemical Weapons Convention (CBRN related)
DAER	Directorate of Ammunition and Explosive Regulation
DAOD	Defence Administrative Orders and Directives
D Strat A	Directorate of Strategic Analysis

DCC	Defence Construction Canada
DEEM	Directorate of Environmental Engineering Management
DFAIT	Department of Foreign Affairs and International Trade
DIEIM	Directorate of Infrastructure and Environment Issues Management
DGME	Director General Military Engineering
DGRP	Director General Real Property
DRPM	Directorate of Real Property Management
DRPP	Directorate of Real Property Plans
DMM	Discarded Military Munitions
DND	Department of National Defence
DQO	Data Quality Objective
DTB	Defence Terminology Bank
EED	Electro-Explosive Device
ECS	Environmental Chief of Staff
EIED	Electrically Initiated Explosive Device
EEP	EO Encounter Pathway
EEZ	Exclusive Economic Zone
EM	Electro-Magnetic
EO	Explosive Ordnance
EOD	Explosive Ordnance Disposal
FFE	Free from Explosives
GIS	Geographic Information System
GPS	Global Positioning System
HE	High Explosives
HERO	Hazards from Electromagnetic Radiation to Ordnance
HPO	Hard Prove Out
IRTAM SC	Integrated Range and Training Area Management Sub Committee

ITAR	International Traffic in Arms Regulations
L1	Level 1
Ldr	Leader
MCE	Maximum Credible Event
MS	Munitions Scrap
NMS	Non-Munitions Scrap
NEQ	Net Explosive Quantity
NRCan	Natural Resources Canada
NSOD	Nuclear Safety Order and Directive (CBRN related)
OIG	Ordnance Identification Guide
OPCW	Organization for the Prohibition of Chemical Weapons (CBRN related)
PAG	Project Approval Guide
PD	Project Director
PDA	Personal Data Assistant
PM	Project Manager
PO	Project Officer
PWGSC	Public Works and Government Services Canada
OIG	Ordnance Identification Guide
QA	Quality Assurance
QC	Quality Control
QR&O	Queen's Regulations and Orders
RFP	Request for Proposal
RRA	Residual Risk Audit/Assessment
RSP	Render Safe Procedure
RSO	Range Safety Officer
RSOs	Range Standing Orders
RTA	Range and Training Area

RTA/UXO Coord	Range and Training Area/Unexploded Explosive Ordnance Coordinator
SAA	Small Arms Ammunition
SOP	Standard Operating Procedure
SOR	Statement of Requirement
SOW	Statement of Work
SPO	Soft Prove Out
SRCL	Security Requirements Checklist
SRTAM	Sustainable Range and Training Area Management
SRTAMP	Sustainable Range and Training Area Management Plan
SS(ID)	Synopsis Sheet (Identification)
SS(PPA)	Synopsis Sheet (Preliminary Project Approval)
SS(EPA)	Synopsis Sheet (Effective Project Approval)
STM	Safe to Move
SUM	Site UXO Model
TEWT	Tactical Exercise Without Troops
UXO	Unexploded Explosive Ordnance
UXOA	UXO Assistant
UXOFS	UXO Field Supervisor
UXOPL	UXO Project Leader
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
UXO TECH	UXO Technician
UXOTS	UXO Technician Supervisor
UXOS SC	UXO Sites Sub Committee (formerly UXO Sites Working Group)

2. A more comprehensive listing of abbreviations, including geophysical terminology and the most recent DND/CF approved UXO terms, can be obtained from DRPP 5 - ADM(IE) RTA/UXO Coord, DEEM 2 or DRPM 2 - DND UXO and Legacy Sites Program.