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**RETOURNER LES SOUMISSIONS À:**

Bid Receiving Public Works and Government  
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Pacific Region  
401 - 1230 Government Street  
Victoria, B.C.  
V8W 3X4  
Bid Fax: (250) 363-3344

**SOLICITATION AMENDMENT  
MODIFICATION DE L'INVITATION**

The referenced document is hereby revised; unless otherwise  
indicated, all other terms and conditions of the Solicitation  
remain the same.

Ce document est par la présente révisé; sauf indication contraire,  
les modalités de l'invitation demeurent les mêmes.

**Comments - Commentaires**

**Vendor/Firm Name and Address  
Raison sociale et adresse du  
fournisseur/de l'entrepreneur**

**Issuing Office - Bureau de distribution**  
Public Works and Government Services Canada - Pacific  
Region  
401 - 1230 Government Street  
Victoria, B. C.  
V8W 3X4

<b>Title - Sujet</b> Wildlife Control Services	
<b>Solicitation No. - N° de l'invitation</b> W0133-19H014/A	<b>Amendment No. - N° modif.</b> 001
<b>Client Reference No. - N° de référence du client</b> W0133-19H014	<b>Date</b> 2019-02-07
<b>GETS Reference No. - N° de référence de SEAG</b> PW-\$VIC-249-7680	
<b>File No. - N° de dossier</b> VIC-8-41145 (249)	<b>CCC No./N° CCC - FMS No./N° VME</b>
<b>Solicitation Closes - L'invitation prend fin</b> <b>at - à 02:00 PM</b> <b>on - le 2019-03-04</b>	
<b>Time Zone</b> Fuseau horaire Pacific Standard Time PST	
<b>F.O.B. - F.A.B.</b> <b>Plant-Usine:</b> <input type="checkbox"/> <b>Destination:</b> <input checked="" type="checkbox"/> <b>Other-Autre:</b> <input type="checkbox"/>	
<b>Address Enquiries to: - Adresser toutes questions à:</b> Cress, Christine	<b>Buyer Id - Id de l'acheteur</b> vic249
<b>Telephone No. - N° de téléphone</b> (250) 514-9294 ( )	<b>FAX No. - N° de FAX</b> ( ) -
<b>Destination - of Goods, Services, and Construction:</b> <b>Destination - des biens, services et construction:</b> DEPARTMENT OF NATIONAL DEFENCE 19 WING COMOX WING OPS, ATC BLDG 239 LAZO British Columbia V0R2K0 Canada	

**Instructions: See Herein**

**Instructions: Voir aux présentes**

<b>Delivery Required - Livraison exigée</b> See Herein	<b>Delivery Offered - Livraison proposée</b>
<b>Vendor/Firm Name and Address</b> <b>Raison sociale et adresse du fournisseur/de l'entrepreneur</b>	
<b>Telephone No. - N° de téléphone</b> <b>Facsimile No. - N° de télécopieur</b>	
<b>Name and title of person authorized to sign on behalf of Vendor/Firm</b> <b>(type or print)</b> <b>Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)</b>	
<b>Signature</b>	<b>Date</b>

This Amendment to the Solicitation is raised to address questions received from prospective Bidders and make changes to the solicitation document as follows:

QUESTION 1:

RE: 4.1.1.2 point-rated technical criteria, please define Coastal versus West Coast.

ANSWER:

Coastal: A coast other than the West Coast of Canada in proximity to a body of salt water.

West Coast: Coastline of British Columbia in proximity to the Pacific Ocean.

QUESTION 2:

Is it possible to receive any or all documents referenced under Annex A Section 1-3 in a), b), c), d) and g).

ANSWER:

Reference A: Attached.

Reference B: [http://corpsec.mil.ca/admfincs/subjects/cfao/034-46\\_e.asp](http://corpsec.mil.ca/admfincs/subjects/cfao/034-46_e.asp)

Reference C:

[http://winnipeg.mil.ca/cms/Libraries/SSO\\_ACR/Aerodrome\\_Wildlife\\_Control\\_Manual\\_2013update-final.sflb.ashx](http://winnipeg.mil.ca/cms/Libraries/SSO_ACR/Aerodrome_Wildlife_Control_Manual_2013update-final.sflb.ashx)

Reference D:

[http://rcaf.mil.ca/assets/RCAF\\_Intranet/docs/en/flight-safety/manuals/aga135001-aa001-change2-aug17-eng.pdf](http://rcaf.mil.ca/assets/RCAF_Intranet/docs/en/flight-safety/manuals/aga135001-aa001-change2-aug17-eng.pdf)

Reference G: Attached.

QUESTION 3:

Annex A section 1-22: response time of... "15 minutes at ALL OTHER TIMES is imperative", does this imply 24/7?

ANSWER:

Yes., 15 minimum response time 24/7.

QUESTION 4a:

Annex A section 1-30: are there particular methods required for the mammal monitoring?

ANSWER:

No particular methods specified.

QUESTION 4b:

Are these for small mammals (e.g. voles), large mammals (e.g. coyote), or both?

ANSWER:

Both. Refer to Section 1, Para 20 (Inventory of Wildlife).

QUESTION 4c:

What types of surveys are required and at what regularity?

ANSWER:

The specificity of type of survey and regularity is at Contractor's discretion as long as Appendices 1 through 3 to Annex A can be accurately filled out and submitted (i.e., A Daily Log, Monthly Summaries and Annual Reports submitted to the WATCO or designate).

QUESTION 4d:

Are surveys to be conducted on the airfield, base, and adjacent areas?

ANSWER:

Refer to Annex A, Section 1, Para 8, Scope of Locations. However, surveys will normally be focused on the airfield itself within the perimeter fence.

QUESTION 5a:

Annex A section 1-35: what is the size of the building?

ANSWER: Approximately 10 feet by 20 feet. Attached is a building blue print with dimensions for Building 292 Bird Man Building ("Birdman shack").

QUESTION 5b:

Though unfurnished, are costs like electricity, heat, telephone, and/or internet included as part of supplied building?

ANSWER:

Heat, hot water, electricity, and a phone line are included, but not internet.

QUESTION 6:

Annex A section 1-51: can you give an example of an inspection fee?

ANSWER:

Ex. Vehicle Inspection Fee

QUESTION 7:

RE: Annex A section 1-66, 67: reference document location needs to be corrected.

ANSWER:

Para 66, reference document is in Appendix 1 to Annex A.

Para 67, reference document is in Appendix 2 to Annex A.

QUESTION 8:

RE: Annex A section 2-12: How much time should be allocated for the ramp DDC and testing?

ANSWER:

A maximum of 2 calendar days (approximately 15 hours).

QUESTION 9:

RE: Annex A section 2-22: what other modes of transport are recommended for the area?

ANSWER:

As per Annex A, Section 3, Para 2, a 4 wheel drive vehicle capable of light off-road use is required. If this vehicle cannot access an area, the Contractor would be expected to visit areas on foot.

QUESTION 10:

Within this RFP under 4.1.1.1 Mandatory Technical Criteria, the word "year" is used in determining qualifications by both the bidder and senior Wildlife Control Officer. The requirement requires services during all four seasons of the year. Does the term "year" refer to a complete fiscal year or can it be used if a bidder or senior Wildlife Control officer has many years of seasonal work that can add up to the required 2 or 4 years of experience? It would seem that qualification would be needed over a single calendar year to have it count as a full year rather than adding several partial years to equal one year. May I get a definition of the term "year" for this RFP.

ANSWER: In the context of this RFP, the word "year" is defined as 12 consecutive months to ensure that the Bidder has demonstrated experience in all seasonal conditions. We have to consider both the weather and bird migration patterns.

QUESTION 11:

RE: 1.1.2: at what point in the process can the bidder submit documentation with 19 Wing as its sponsor for security clearances?

ANSWER: Normally only after evaluation is complete and a Bidder is recommended for contract award. Further, the Industrial Security Directorate will only accept requests for sponsorship from the Contracting Authority or other trusted source on behalf of recommended Bidder if they don't already have a valid clearance in accordance with the security requirements in the Solicitation. The Client department is responsible for establishing the level of security required only as per the Security Requirements Checklist (SRCL).

The following changes are made to the solicitation document:

Under Annex C – Insurance Requirements:

ADD THE FOLLOWING CLAUSE:

Bailee's Customer's Goods Insurance

The Contractor must obtain Bailee's Customer's Goods insurance while Government Property is under its care, custody or control for repair or servicing, and maintain it in force throughout the duration of the Contract, in an amount of not less than \$ \_\_\_\_\_ (to be determined). Government Property must be insured on a Replacement Cost (new) basis.

1. Administration of Claims: The Contractor must notify Canada promptly about any losses or damages to Government Property and monitor, investigate and document losses of or damage to ensure that claims are properly made and paid.

2. The Bailee's Customer's Goods must include the following:
  - a. Notice of Cancellation: The Contractor will provide the Contracting Authority thirty (30) days prior written notice of policy cancellation or any changes to the insurance policy.
  - b. Settlement of Claims: The insurance proceeds regarding any loss of or damage to Government Property must be payable to the appropriate party as directed by the Contracting Authority.
  - c. Waiver of Subrogation Rights: Contractor's Insurer to waive all rights of subrogation against Canada as represented by the Department of National Defence and Public Works and Government Services Canada for any and all loss of or damage to the property however caused.

Under PART 2:

ADD THE FOLLOWING PARAGRAPH:

2.6 Optional Site Visit (Bidder to pick 1 of 2 dates.)

It is recommended that the Bidder or a representative of the Bidder visit the work site. Arrangements have been made for site visits to be held at 19 Wing Comox, Lazo BC on dates:

February 13, 2019 or February 20, 2019. The site visit will begin at 09:00 PST on both dates.

The physical address for meeting place is at the "MP shack" located at:

12 Military Police Flight Comox  
Building 194 Heritage Blvd  
Lazo, BC V0R 2K0

(the very first building on the right once you pass the main gate.) Bidders will be escorted around the Base from there.

Bidders are requested to communicate with the Contracting Authority no later than 2 working days prior to site visit to confirm attendance on which date and provide the name(s) of the person(s) who will attend in order to coordinate the required security passes.

Bidders may be requested to sign an attendance sheet.

Bidders who do not attend or do not send a representative on either of these 2 dates will not be given an alternative appointment but they will not be precluded from submitting a bid.

Any clarifications or changes to the bid solicitation resulting from the site visit will be included as an amendment to the bid solicitation.

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.

19 Wing Comox

Airport Wildlife Management Plan

**FOREWORD**

**“An Airport Wildlife Management Plan (AWMP) ensures wildlife problems are dealt with in a systematic and coordinated manner. A well-developed AWMP minimizes wildlife strikes, improves flight safety and reduces aircraft damage costs. These plans must have clear goals and be supported by airport policy and senior airport managers.”**

**(TP13549 pg160)**

The 19 Wing Airport Wildlife Management Program has been created under the direction of 1 CAD Aerospace Readiness. This document is issued on the authority of the Wing Commander, 19 Wing Comox.

Suggestions for improvement or comments should be forwarded through normal channels to the WATCO, 19 Wing Comox.

S.P. Driscoll  
Major  
19 Wing Air Traffic Control Officer

Updated  
14 Oct 2018

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## Direction and Administration

### References:

- a. CFAO 34-46, *Pest Control*
- b. CFACM 2-813, *Operations Manual for Aerodrome Wildlife Control*
- c. A-GA-135-001/AA-001, *Flight Safety for the Royal Canadian Air Force*
- d. TP 11500, *Transport Canada – Wildlife Control Procedures Manual*
- e. TP 13549, *Transport Canada – Sharing the Skies*
- f. 19 Wing Comox Standing Orders

### Mission Statement

1. The mission of the 19 Wing Airport Wildlife Management Plan is to ensure aviation safety by reducing the potential risks to aircraft and aerodrome operations caused by bird and mammal activities on, and in the vicinity of, the 19 Wing Aerodrome.

### Wildlife Control Committee

2. The Wing Air Traffic Control Officer (WATCO) is responsible to the Wing Commander, for the administration of the Airport Wildlife Management Plan. The ATC Bird and Mammal Control Officer (BAMCO), in conjunction with members of the 19 Wing Wildlife Control Committee (WCC) is responsible to ensure the implementation of the AWMP. The 19 Wing Wildlife Control Committee is comprised of:
  - a. WATCO – Chair
  - b. Wing Flight Safety Representative;
  - c. Wing Transportation Officer or Representative;
  - d. Chief Controller, Aerodrome Control/Bird and Mammal Control Officer;
  - e. Wing RP Ops Representative;
  - f. Wing Environmental Officer;
  - g. Bird and Animal Control Contractor; and
  - i. Regional Wildlife Service Officer/ DFO Officer (as required).

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3. The duties and responsibilities for the individual members of the WCC are detailed in CFACM 2-813. The WCC will be convened twice annually to review the AWMP and the associated records pertaining to the implementation of the plan.

### **Control of Wildlife on the Aerodrome**

4. Day to day control of wildlife on the aerodrome is conducted by a contracted service provider. The contractor is primarily responsible for:

- a. Obtaining appropriate firearms certificates and permits;
- b. Species identification on all wildlife struck by aircraft;
- c. The control and disposition of wildlife on the aerodrome;
- d. Maintaining records of wildlife management;
- e. Keeping aerodrome users and ATC personnel apprised of the wildlife status; and
- f. Other requirements as stipulated in the service contract.

5. Responsibility for acquiring and retaining wildlife control permits rests with the WATCO.

### **Awareness Promotion**

6. The success of the wildlife management plan at 19 Wing is dependent upon the education of all users, and to the degree possible, the education of the neighbours of the aerodrome, to the potential hazards that exist. Wing Firefighters, Infield Maintenance Workers, Hydro, Air Traffic Control and Special Purpose Vehicle Operators must be aware of the need to report wildlife activity. Lands adjacent to 19 Wing also directly affect the success of the Wildlife Management Plan. Landowners therefore should be made aware, and consulted when their activity is deemed to impact the program. The expertise of local Wildlife Service Officers, Department of Fisheries and Oceans, or Agriculture Department representatives may be required when consulting with the public regarding private land use issues.

### **Operating Principles and Values**

7. The basis under which the Wildlife Management Plan operates are as follows:

- a. Aviation safety is our #1 priority;
- b. Program activities are based upon soundly researched information;
- c. Success is dependent upon teamwork among all agencies;

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- d. Fiscal realities must be considered in plan implementation; and
  - e. Central to our success is the respect for the natural environment and an understanding of the ability of birds and mammals to adapt to control techniques.
8. Through persistent and consistent effort, the risks associated with wildlife at the aerodrome can be managed, and minimized.

## Ecological Factors

### Identification of Ecological Factors

9. Ecological factors relating to bird and wildlife management at 19 Wing Comox have been addressed for some time. These were confirmed by an environmental study conducted in 1996 which identified areas for concern. As a result, they continue to be minimized. Ongoing awareness and study of these factors is essential to understand how environmental changes can add to or diminish the risks to airfield operations.

10. At the Comox Aerodrome the specific known environmental factors which directly affect operations are understood and addressed as part of the AWMP. These include:

- a. Proximity to the seashore – the physical location of the airport, on a bluff, adjacent to the Straits of Georgia;
- b. The existence of tall trees, broom, and snags located on airport property;
- c. Adjacent farmland, normally planted in corn and potatoes, which in the winter is flooded;
- d. A golf course, on airport property, which has ponds;
- e. A treed camp-ground, Tepee Park, located on airport property;
- f. Military married quarters housing;
- g. Ecological reserves located within 5km of the aerodrome – Lazo Marsh, and the Courtenay River Estuary;
- h. Pigeon Lake Landfill, located 10km southwest of the aerodrome; and
- i. The Pacific Flyway for migratory birds, which passes directly over the field.

### Inventory of Risk Species

11. Recorded bird-strike data and control logs have been analysed to determine the species which pose the greatest risk to the safety of aircraft.
- a. Gulls and shorebirds – specifically Glaucous-Winged, Herring, Mew Gulls and Killdeers/Plovers which vacate the shoreline for the airfield during periods of high wind/wave activity and after rain showers to feed on worms on the runway. Gulls rarely congregate in flocks larger than 50 in number, but several flocks may be on the airfield simultaneously;
  - b. Eagles – Bald Eagles, a protected species, frequently nest in the tall trees and snags located on the golf course adjacent to the aerodrome. The risk is highest when the young first learn to fly and are unaware of the airfield activity and at a very young stage when the adults transit frequently from the nesting area to the shoreline in search of food. Resident adult eagles rarely interfere with flight operations outside of this period. Itinerant Bald Eagles frequent the landfill at Pigeon Lake;
  - c. Ducks and Geese – many varieties, including Brants and Mallards frequent the area during migration periods and often loaf at the golf course ponds located within 1000 feet of the primary taxiway at the airport. Additionally, migratory birds rest upon the field enroute and are attracted to the ecological reserves located near the aerodrome;
  - d. Deer – many deer are permanent residents of the golf course and campground and on occasion have breached the perimeter fence. These breaches are infrequent, but are potentially disastrous from an aviation perspective;
  - e. Rabbits – are not a native species, but are household pets released into the wild. They are predominantly in the vicinity of Tepee Park campground, but have been noted in areas further afield;
  - f. Crows – crows are often around the field and are attracted by Military Housing (PMQ's) located south-west of the aerodrome;
  - g. Trumpeter Swans – winter in the Comox Valley and frequent the flooded fields located adjacent to the airport. These fields are flooded in winter in support of a Wildlife Federation and Ducks Unlimited project to provide habitat for these birds. The period of risk for this species is in the morning and evening as they transit from feeding areas near the airport to roosting areas in the Courtenay Estuary. They rarely land on the airfield, but their flight path often takes them overhead in transit, particularly in the approach area of runway 18/36; and
  - h. Great Blue Heron – protected species, historically nesting in trees northeast of field in vicinity of Cape Lazo.

## Risk Analysis

### **Aircraft Activity**

12. Aircraft operations at 19 Wing vary widely from periods of intense fighter activity to the daily commercial flights that service the Comox Valley Airport Commission (CVAC) terminal. Day and night operations at the airport are the norm, however, hazards have proven to be greatest during daylight hours. Search and Rescue operations are conducted in all weather conditions using fixed wing and rotary wing assets. Other flight operations involve multi-engine turbo-prop aircraft and jet engine fighter/trainers. Passenger loads to the CVAC have grown exponentially. The civilian terminal is now serviced daily by multiple B737-800 series aircraft with a passenger load of 120 as well as smaller commuter aircraft carrying 15 or more passengers. The potential risks associated with bird and wildlife strikes continue to grow with passenger numbers.

- a. Recent Aircraft Traffic Statistics for 19 Wing – Appendix B;
- b. Passenger Traffic Statistics for CVAC – Appendix C;
- c. Bird strike Summaries for 19 Wing – Appendix D.

## Mitigation Plan

### Habitat Management

13. Specific habitat management actions are taken to reduce the threat from wildlife hazards on the aerodrome. This activity includes:
  - a. Keeping grass lengths to those unattractive to problem species. It has been found that most species on the Comox airfield are deterred by a long grass environment. During the cutting season – April to October – grass lengths are allowed to grow to be at least 30 cm in length. During winter dormancy grass cutting is not required. Areas such as glider landing area, DZ Infield South are continuously cut by Heavy Equipment Section as they are employed for operations throughout the summer. Areas around the airfield markings and lights will be cut by RP Ops. Occasionally, an unserviceability of equipment will prevent grass cutting requirements from being achieved. During these periods, a prioritized cutting program will be implemented to address the area’s most critical to flight safety. Map – Annex D.
  - b. Grading and levelling of airfield surfaces is an ongoing process to remove low areas that are attractant to birds. It is very expensive and is undertaken in small projects. In addition to removing habitat, it also increases mower life due to a reduction in wear from operations on rough surfaces. This is an ongoing program.
  - c. Removal of brush on airfield property. Oriental Broom is an introduced plant species on Vancouver Island and it is prolific. Seed pods, and dense underbrush associated with broom are an attractant to birds and mammals alike. Ongoing eradication of broom is essential in order to deny habitat to pests. Mowing removes most broom, but occasionally it must be manually controlled in areas inaccessible to mowers. This is reviewed with airfield maintenance and addressed by work-order as required.
  - d. Garbage problems associated with Military Housing have been addressed with the introduction of a Wing Standing Order (WSO 2-27) mandating the requirement for all garbage to be stored in sealed containers and banning the use of plastic bags, which are easily compromised by Corvus species (crows etc.).

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- e. Nixalite application is complete on the aerodrome for all signage that has been historically used as perching areas for birds. Both stainless steel and plastic (PVC) Nixalite are in use at Comox. It is a very successful deterrent to perching. Sign maintenance and hydro personnel must be cautioned when working in its vicinity.
- f. Construction and building surveillance by Wildlife Control Contractors and through the encouraged input of individuals on the Wing allows the Wing Wildlife Committee to assess and recommend structural changes to existing buildings to reduce or eliminate bird habitat.
- g. Habitat Management outside of the Wing perimeter is managed in cooperation with local Wildlife, Fisheries and Environmental Officials. Contact information is included as Annex E.

### **Control Techniques**

14. Consistent and continuous control methods are necessary if control techniques are to be successful. 19 Wing Wildlife Control Contractors provide continuous daylight services, with patrols staggered and not exceeding more than two hours between them. All scheduled Wing flying activity is also covered under the contract terms. Historically, risks during evening operations are minimal.

15. Methods used to control and harass wildlife activity on the airfield and in those areas adjacent to the field for which we have jurisdiction are:

- a. Chasing
- b. Scare shells
- c. Bangers
- d. Screamers
- e. Starter Pistol
- f. Audio Tapes
- g. Live shells
- h. Trapping

16. No single method of control is entirely successful and only a combination of these methods provides adequate deterrent. Deer have been kept under control through tall fencing around the entire airfield. On the rare occasion when deer do access the aerodrome, they are successfully herded through a gate and off the field. The rabbit population on the field is a recent problem. Since 1998 an increase in their numbers has been noted and a trapping and removal program initiated. Their proximity to campers raises issues of control methods and public perception. Shooting could have a negative public relations impact and is being avoided. Trapping has been effective to date at

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controlling populations, but the situation is under continuous monitor by Wildlife Control Personnel. Annex F refers to the Wildlife Control Requirements.

17. The use of dogs and or birds of prey in the control of wildlife must be approved under the following conditions:

- a. the animals to be used must be properly trained;
- b. they must not be released to work when there is a risk of noise interference from aircraft that could prevent them from hearing commands or in the vicinity of glider operations where large numbers of people could result in distraction;
- c. permission to release must be requested via radio from the Control Tower and will be granted/denied at the discretion of the DATCO.
- d. the use of animals in the process of wildlife control remains the sole responsibility of the contractor since it is not contained in the specifications for the contract. It is deemed experimental and permission to use animals in the performance of these duties may be withdrawn at the discretion of the WATCO.

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APPENDIX B

**Aircraft Movement Totals for 19 Wing**

<b>Year</b>	<b>Movements</b>
2008	65,988
2009	68,721
2010	58,617
2011	56,869
2012	55,821
2013	52,801
2014	54,379
2015	56,661
2016	52,156
2017	44,395

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APPENDIX C

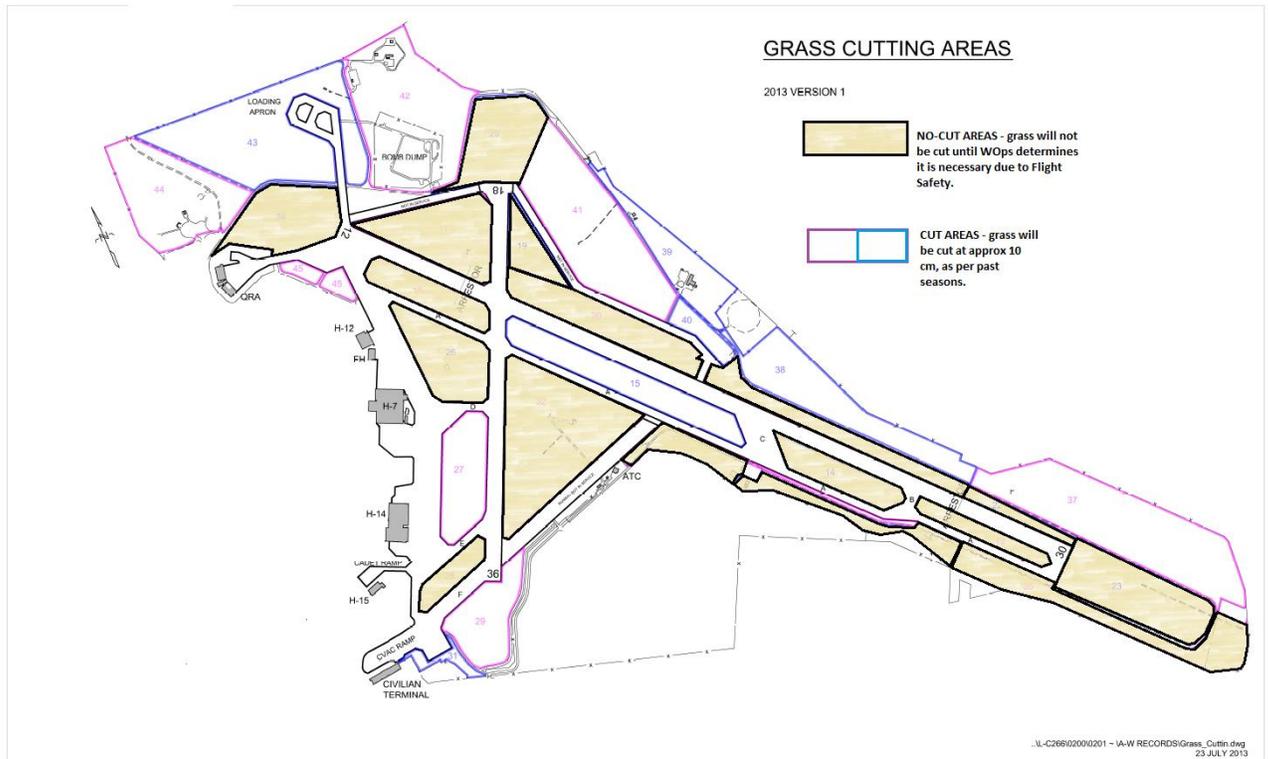
**PASSENGER TRAFFIC LEVELS COMOX VALLEY AIRPORT COMMISSION**  
**(CVAC)**

Year	Passengers
2008	304069
2009	289978
2010	296567
2011	308937
2012	327827
2013	313186
2014	318830
2015	351530
2016	368733
2017	369169

**BIRD STRIKE REPORT SUMMARIES**

<b>Year</b>	<b>MIGRATORY KILLS</b>	<b>BIRD STRIKES</b>
2014-2015	23 Gulls, 4 Dunlins, 25 Pigeons, 2 Ducks, 51 Killdeer	6 Strikes. 1 Great horned owl, 1 Peregrine Falcon, 1 starling, 4 gulls.
2015-2016	56 Gulls, 7 Dunlins, 10 Pigeons	4 Strikes. 2 Dunlins, 1 Mallard Duck, 1 mew Gull, 5 herring gulls.
2016-2017	35 Gulls, 6 Killdeer, 29 Pigeons	4 Strikes. 1 Dunlin, 3 Herring Gulls.
2017-2018	12 Gulls, 9 Killdeer	5 Strikes. 4 Gulls, 1 Killdeer, 2 Starlings, 1 Merlin Falcon

**COMOX GRASS CUTTING PRIORITIES**



**WILDLIFE MANAGEMENT CONTACT LIST**

19 Wing Air Traffic Control Officer.....	339-8211 ext. 8209
19 Wing Flight Safety Officer .....	339-8211 ext. 8227
19 Wing Real Property Ops OC .....	339-8211 ext. 8258
19 Wing Transportation Officer .....	339-8211 ext. 7902
19 Wing Environmental Officer .....	339-8211 ext. 8187
19 Wing Pre-Med Tech .....	339-8211 ext. 6658
Wildlife Control Contractor (Thru BAMCO) .....	339-8211 ext. 8848
Fisheries and Oceans Canada (DFO) .....	339-2031
Agriculture Information .....	334-1239
Environment and Conservation .....	334-3281

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APPENDIX G

**DEPT. OF NATIONAL DEFENCE  
CANADIAN FORCES BASE COMOX  
LAZO, BC**

**SPECIFICATIONS  
FOR  
WILDLIFE CONTROL SERVICES**

**L-C266-0207/1**

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APPENDIX G

[SEE CONTRACT FOR SPECIFICATIONS FOR WILDLIFE CONTROL]

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 APPENDIX H

Daily Log – Wildlife Control Activities

CONTROL TECHNIQUES	Swans	Gulls	Shore Birds	Pigeons	Starlings	Ducks	Geese	Deer	Dogs	Racoons
Shotgun										
Shell Cracker										
Distress Cry Tape										
Trapping										
Models (dead & plastic)										
Chase Trucks										
Patrol Round										
Lights & Sirens										
Gas Cannon										
Number Shot										
Number Trapped										

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**WILDLIFE CONTROL ACTIVITIES**

**Canadian Forces Base Comox – Airport  
Monthly Summary**

From : \_\_\_\_\_ To: \_\_\_\_\_ 20 \_\_\_\_

Contractor's Name: \_\_\_\_\_

Wildlife Control Officer(s) on Duty:

- |          |          |
|----------|----------|
| 1. _____ | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ | 6. _____ |

Control Techniques used (in order of frequency):

- |          |          |
|----------|----------|
| 1. _____ | 5. _____ |
| 2. _____ | 6. _____ |
| 3. _____ | 7. _____ |
| 4. _____ | 8. _____ |

Wildlife on Airport Requiring Control (in order of frequency):

BIRDS: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,

MAMMALS \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,

19 Wing Comox  
Airport Wildlife  
Management Plan  
APPENDIX I

Wildlife Removed (list species and number)

BIRDS	NUMBER
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Areas where control required most – (explain and relate to species)

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Recommended changes to Airport or Tenant facilities – (explain and relate to species)

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Recommended changes to Airport or Tenant facilities – (explain and relate to species)

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Comments:

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## ANNUAL WILDLIFE CONTROL REPORT

Location 19 WING COMOX

Date \_\_\_\_\_

### A. Wildlife Activity and Control Techniques

Types of species observed:	Number of birds/mammals trapped:
Concentrations of species observed:	Numbers of birds/mammals killed:
Seasonal trends:	Bird nesting frequency.
Diurnal trends:	Bird nesting sites:
Migratory trends:	Attractants to aerodrome:
Number of strikes on aerodrome:	Problems with wildlife in hangars:
Number of bird remains forwarded to The Smithsonian Institute for identification:	Bird loafing areas:
Dispersal techniques:	Other:

**B. Pest Activity and Control Techniques**

Species observed (i.e., insects, shadflies, grasshoppers, voles, mice, worms, etc.):	Concentration of species observed:
Seasonal pest trends:	What attracts pests to vicinity of aerodrome:
Pest dispersal techniques:	Other:

**C. Equipment**

Effectiveness of unit wildlife control equipment:	Other:
---	--------

**D. Environmental and Structural Concerns**

Water pooling or drainage:	Landfill management:
Grass height policy:	Dumping activity:
Fencing problems:	Impact of off-base land use issues:

19 Wing Comox  
 Airport Wildlife  
 Management Plan  
 APPENDIX I

Aerodrome spray program:	Habitat management strategies:
Screening of vents and ducts:	Agricultural outlease program:
Hangar door seal integrity:	Other:

**E. Program Management**

Impact of wildlife activity on flying operations	
Effectiveness of base wildlife control program	
Program initiatives	
Suitability of Base Resources to manage wildlife control program	
Contractor performance assessment	



National Défense  
Defence nationale

C-09-153-001/TS-000

## AMMUNITION AND EXPLOSIVES

### SAFETY MANUAL

### VOLUME 1

# STORAGE AND TRANSPORTATION



#### NOTICE

This documentation has been reviewed by the technical authority and does not contain controlled goods. Disclosure notices and handling instructions originally received with the document shall continue to apply.

#### AVIS

Cette documentation a été révisée par l'autorité technique et ne contient pas des marchandises contrôlées. Les avis de divulgation et les instructions de manutention reçues originalement doivent continuer de s'appliquer.

Issued on Authority of the Chief of the Defence Staff

OPI DAER

2005-03-01

CHG 2 - 2013-08-31

Canada

**LIST OF EFFECTIVE PAGES**

Insert latest changed pages; dispose of superseded pages in accordance with applicable orders.

**NOTE**

The portion of the text affected by the latest change is indicated by a black vertical line in the margin of the page. Changes to illustrations are indicated by miniature pointing hands or black vertical lines.

Dates of issue for original and changed pages are:

Original 0	2005-03-01	Ch.	4
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Ch. 2	2013-08-31	Ch.	6
Ch. 3		Ch.	7

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**Contact Officer - DAER 2**  
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## FOREWORD

1. C-09-153-001/TS-000, Ammunition and Explosives Safety Manual, Volume 1, Storage and Transportation, is issued on authority of the Chief of the Defence Staff.
2. This publication supersedes C-09-153-001/TS-000 dated 2005-12-05.
3. C-09-153-001/TS-000 is effective on receipt. It has been updated to include applicable NATO safety principles for ammunition and explosives.
4. Suggestions for changes shall be forwarded through normal channels to National Defence Headquarters, Attention: DAER 2.

### NOTE

This publication has been revised to remove material that has been either cancelled or superseded by volumes in the new C-09-005-series Ammunition and Explosives Safety Manual. Deleted sections have been indicated. Organization names have been updated and grammatical corrections made, where applicable, without sidebar indications.

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## PART 1

### INTRODUCTION

#### PURPOSE

1. The operation of Canadian Forces Ammunition Depots, ammunition facilities, and temporary ammunition and explosives storage sites shall be regulated in accordance with this publication with respect to the care, handling, storing, and shipping of ammunition and explosives in order to minimize the inherent hazards.
2. DAER shall be informed of any circumstances which conflict with these regulations. When there is doubt as to the exact meaning of any part of this publication, or if it seems that an amendment is necessary, a request for a definition or for a change should be forwarded through normal channels to NDHQ, Attention: DAER 2.

#### SCOPE

3. These regulations are the minimum requirements compatible with safeguarding personnel and property.
4. NDHQ is the only authority which may permit temporary conditions not in compliance with these regulations for a specific period of time.
5. Personnel are to interpret these regulations intelligently, bearing in mind these regulations, although comprehensive and exacting, cannot be expected to provide for every contingency or emergency that may arise or to replace sound judgement, common sense, and efficient supervision.

#### INTERPRETATION

6. Mandatory clauses are those containing the word shall or must. These clauses must be observed at all times, unless otherwise authorized by NDHQ.
7. Advisory clauses are those containing the word should. These clauses shall be followed except when such a course is impractical for operational reasons.
8. Permissive clauses are those containing the word may. These clauses shall be within the discretionary powers of the appointment or authority specified in the regulations.
9. In instances where the interpretation of these regulations suggests various alternative methods of application, the method which most closely meets the highest interest of safety shall be adopted.

#### AMMUNITION AND EXPLOSIVES SAFETY MANUAL

10. This Ammunition and Explosives Safety Manual consists of the following volumes:
  - a. C-09-153-001/TS-000, Ammunition and Explosives Safety Manual, Volume 1, Storage and Transportation; and
  - b. C-09-153-003/TS-000, Ammunition and Explosives Safety Manual, Volume 3 Naval Vessels.

#### NOTE

This manual is being replaced by the C-09-005 series Ammunition and Explosives Safety Manual. Consult the DAER DIN site for published volumes in the new manual.  
([http://admmat.mil.ca/cosmat/daer/en/daer\\_controlled\\_documents\\_e.asp](http://admmat.mil.ca/cosmat/daer/en/daer_controlled_documents_e.asp))

**DND EXPLOSIVES SAFETY PROGRAM**

11. DND Explosives Safety Program publications consist of the following volumes:
  - a. A-GG-040-006/AG-001, DND Explosives Safety Program; and
  - b. A-GG-040-006/AG-002, DND Ammunition or Explosives Accident/ Incident/ Defect/ Malfunction Reporting.

**APPLICABLE ORDERS AND PUBLICATIONS**

12. Annex A lists applicable orders and publications pertaining to the policy and safety principles for ammunition and explosives.

**GLOSSARY**

13. To avoid conflict with general usage, certain terms in this publication, which have particular meaning, are explained in the Glossary in the back matter of this publication. These terms and others appearing in specific sections are applicable to this publication unless it is clearly indicated by the context that a common dictionary meaning is intended.

**PART 2**  
**CONSTRUCTION AND MAINTENANCE**

**SECTION 1**

**CONSTRUCTION AND SITING**

**INTRODUCTION**

1. The regulations contained in this section shall be followed in the construction of new ammunition depots and ammunition facilities. It is not intended that extensive alterations be made to existing depots and facilities to make them conform. However, if repairs are being made to buildings and it is practical and economical to bring the buildings up to a standard, the necessary alterations should be made. In no case will the alterations be made without complying with paragraph 16.

**SITING**

2. The choice of a site for ammunition depots and ammunition facilities, whether permanent or temporary, is subject to varying circumstances and considerations. Every effort shall be made to select a location which meets the conditions set out in this publication.

**EXTENT OF THE SITE**

3. The extent of the site will be governed by the number of magazines and workshops needed, their explosive capacities, and the Quantity-Distances required. If possible, a site large enough to permit future expansion should be selected.

4. Siting of ammunition depots and facilities shall be done in consultation with NDHQ/ADM(IE) and DAER. It is the responsibility, however, of all personnel proposing siting of other facilities in proximity of ammunition depots and ammunition facilities to ensure that Quantity-Distances as specified in C-09-005-002/TS-000 are not compromised. This applies to navigational aids, transmitting devices, POL storage facilities, hangars, workshops, offices, dwellings, airfield runways, landing pads, roads and recreational facilities including picnic areas, golf courses, etc. All proposed new construction adjacent to the explosives area shall be referred to NDHQ/ADM(IE) and DAER prior to approval of siting (see C-09-005-002/TS-000 Part 3 Section 7 for the requirements for Protective Zones).

5. DELETED

**OUTSIDE HAZARDS**

6. Ammunition depots and ammunition facilities shall not be located close to potential sources of danger from without (see C-09-005-002/TS-000, Part 3 Section 3). Therefore, their locality shall be:

- a. remote from factories engaged in the manufacture of ammunition and explosives;
- b. clear of electric power lines;
- c. free from electric generating stations and high powered radio stations;
- d. free from volatile carbon fuel storage installations and pipelines; and
- e. remote from airfields.

## GENERAL LAYOUT

7. An ammunition depot consists of three principal areas:
  - a. an explosives area which shall be enclosed by a fence and may contain magazines, workshops, and laboratories;
  - b. a destruction area which should be enclosed by a fence; and
  - c. an administration area which need not be enclosed by a fence and may contain offices, barracks, engineering workshops, and garages.
  
8. An ammunition facility may consist of:
  - a. magazines; and
  - b. other facilities such as:
    - (1) workshops;
    - (2) laboratories;
    - (3) hardstands;
    - (4) rocket assembly and fuzing buildings;
    - (5) bomb assembly and fuzing buildings;
    - (6) torpedo assembly and fuzing buildings;
    - (7) torpedo fuelling and torpedo fuel storage facilities;
    - (8) storage for related non-explosive components; and
    - (9) salvage processing buildings.

## SPACING OF BUILDINGS

9. All magazines, workshops, and laboratories shall be sited in relation to other magazines, workshops, and laboratories and to buildings not containing ammunition or explosives, whether public or private, in accordance with the Quantity-Distances prescribed in C-09-005-002/TS-000. Certain buildings may be sited within explosives areas, with DAER approval, without prejudice to explosives storage limits of other buildings. These are:

- a. buildings for storage of inert ammunition, inert components, aids to production, ammunition scrap and munitions scrap;
- b. small branch offices and storehouses;
- c. washrooms;
- d. sheds for fire and first aid appliances;
- e. small buildings or receptacles for retention of paints, oils and lubricants; and
- f. garages and buildings housing materiel handling equipment and their charging facilities.

## COMMUNICATIONS

10. The explosives area may be divided into two or more sectors, each with an office connected by telephone to the administrative area. Each of these offices may in turn be connected by telephone to magazines, workshops and laboratories.

## ROADS

11. Roads with all weather surfaces shall connect all buildings within the ammunition facility. Suitable turning circles and passing lanes shall be provided as necessary.

## FENCES

12. Ammunition depots and ammunition facilities shall be enclosed by restricted area perimeter fencing in accordance with National Defence Security Instructions.

## FIRE PROTECTION

13. Fire protection shall be in accordance with C-08-005-120/AG-000, Realty Asset Management Manual, Chapter 10, Fire Protection and Emergency Services, and in accordance with Part 5 of C-09-005-002/TS-000.

14. All fire protection systems, active and passive, shall be reviewed and approved by NDHQ/CFFM.

## AMENITIES

15. Lockers and toilet facilities should be provided in the explosives area.

## APPROVAL FOR CONSTRUCTION OR ALTERATIONS TO BUILDINGS

16. NDHQ approval shall be obtained prior to authorizing any project which includes the construction or alteration to any new or existing explosives areas including magazines, explosives workshops, laboratories, assembly buildings, and destruction areas. In requesting this approval, the following shall be submitted through the Command Headquarters to NDHQ/DAER:

- a. sketches of proposed magazines, workshops, and destruction areas;
- b. a site plan of the area showing the following:
  - (1) the vulnerable construction building zone as per C-09-005-002/TS-000 Part 3 Section 7;
  - (2) any structure or facility within the area of the plan with brief description of its use; a built up area may be represented by a solid block instead of by individual buildings;
  - (3) the ownership of all developed and undeveloped land within the area of the plan; the DND property boundary shall be indicated clearly when displayed within the area of the plan; if this boundary lies outside the area of the plan, a note shall state so, giving its nearest distance and direction from outlying magazines; and
  - (4) in a built up area, the ownership may be shown only in general terms.

**Paragraphs 17 to 19 inclusive are deleted by this change.**

## AMMUNITION PIERS AND WHARFS

20. The responsibility for the siting, design and construction of new ammunition piers and wharfs lies with NDHQ/ADM(IE). The considerations of the following subparagraphs are provided as specific requirements for ammunition piers and wharfs:

- a. A pier or a wharf should be constructed of reinforced concrete piles and deck, or of solid fill with the necessary fender systems.
- b. A pier or a wharf should be limited to two berths for ships or berthing space for four barges. To prevent simultaneous detonation, vessels should be separated one from the other by the distance required for the largest NEQ to be contained in one of the vessels as detailed in C-09-153-003/TS-000, Ammunition and Explosives Safety Manual, Volume 3 Naval Vessels.
- c. Not more than three ammunition piers or wharfs should be constructed at one installation, and such piers or wharfs should be separated by distances listed in Quantity-Distance Tables (see C-09-005-002/TS-000). The separation distances between piers or wharfs should be measured from the nearest point of the vessel at one pier to the nearest point of the vessel under consideration at the other pier. The applicable separation distance between piers or wharfs will depend upon the total NEQ in each vessel.
- d. The distance from one pier or wharf to areas and structures outside and inside the CFAD shall be based on the planned explosives concentration at the pier or wharf and should comply with the required Quantity Distances in C-09-005-002/TS-000.
- e. For ease of operation and for safety purposes, both ends of the wharf should be connected to the shore whenever practicable.
- f. The pier or wharf may be built of wood piles and stringers but the deck should be of reinforced concrete or wood covered with concrete.
- g. Piers and wharfs which have combustible piling or deck should be provided with transverse fire stops.
- h. No sheds for cargo storage or warehousing purposes will be constructed on ammunition piers or wharfs.
- j. Proximity to water of sufficient depth to permit the sinking of a vessel in case of an emergency.
- k. Ammunition piers and wharfs should be sited in sheltered waters and screened by intervening land masses from the open sea.
- m. Additional berthing space, beyond that required for ships and barges, should be provided for tugs, fireboats and other craft incidental to the operation of the ammunition pier or wharf. This additional berthing for fireboats should be at or very near the ammunition pier or wharf.
- n. The design drawings and other information showing the proposed location and construction details of the new ammunition pier or wharf shall be submitted by J4 Ammo to DAER, through the proper C Navy channels, for review and comments with regard to safety.

- p. It is recognized that ammunition piers and wharfs now in use do not meet all requirements stated above because of the type of construction or their physical location. It is not intended that extensive alterations be made to the existing ammunition piers and wharfs. However, when repairs are required and it is practical and economical to bring a pier or a wharf up to a standard, the necessary alterations should be made.
- q. The existing ammunition piers and wharfs shall not be used for any storage of ammunition, explosives or combustible materiel.

**EXPLOSIVES ANCHORAGE**

20. Explosives anchorage may be provided for loading and unloading vessels and for anchoring vessels carrying a cargo of ammunition and explosives. The application of Quantity Distances to explosives anchorage shall be in accordance with C-09-005-002/TS-000.

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## SECTION 2

### GENERAL SPECIFICATIONS FOR CONSTRUCTION OF MAGAZINES, WORKSHOPS AND LABORATORIES

#### INTRODUCTION

1. These general specifications apply to the construction, alteration, and conversion of magazines, workshops and laboratories.

#### PRINCIPLES

2. Magazines, workshops and laboratories shall be constructed in accordance with the latest engineering practices and in conformity with the general specifications stated in these regulations. The main principles to be observed in the construction of buildings are:

- a. reduction of explosion and fire risks to a minimum. This necessitates the elimination, as far as possible, of flammable materials from the structure;
- b. protection of the contents from weather and moisture;
- c. maintenance of even temperatures;
- d. provision of adequate entrances and exits; and
- e. provision of efficient working conditions.

#### SPECIAL PURPOSE MAGAZINES

3. Small special purpose magazines may be authorized by NDHQ/DAER for specific purposes, e.g. for isolation of deteriorated, condemned or unserviceable ammunition and explosives.

**Paragraphs 4 to 12 inclusive are deleted by this change.**

#### MATERIALS

13. The construction of magazines, workshops, and laboratories should be of the most economical materials consistent with stability and climatic conditions. Concrete is the most suitable; however, other materials may be used provided they are proved suitable and are not subject to heavy weathering. Wood and flammable materials generally should be avoided.

14. Exposed metals inside magazines, workshops and laboratories shall be treated in a manner calculated to prevent condensation and subsequent dripping of water. Exposed iron, steel, aluminium or aluminium alloy parts which are liable to come into contact with explosives shall be either lagged with granulated cork or covered with three coats of fire resistant paint or treated in some other way to effect the same condition.

#### FOUNDATIONS

15. The foundation should be of concrete. It shall be extended to a sufficient distance around the building to provide adequate drainage of surface water away from the building. In areas of heavy rainfall or where there is a local tendency to flooding, efficient surface drainage shall be installed.

## FLOORS

16. The floors in magazines, laboratories and explosives workshops should be of well finished concrete free from cracks and crevices. Cracks which impede the safe movement of ammunition and explosives shall be repaired.

17. Floors in explosives workshops and laboratories shall, in addition, be surfaced with a composition which is both spark proof and capable of dissipating static electricity. Such floors shall meet the Canadian Government Specifications Board standard for Flooring Conductive and Spark Resistant described in CGSB-81 GP-1M for Class I, Type A, Grade ASW.

18. All floors of magazines shall be constructed to support a minimum weight of 5 000 kg/m<sup>2</sup>. All corners should be rounded to facilitate cleaning.

## WALLS

19. Inside walls shall have a smooth finish and be free from cracks and crevices. Walls may be painted, glazed or treated as required.

20. A wall designed to prevent simultaneous detonation of quantities of ammunition or explosives on opposite sides of it is known as a substantial dividing wall. For the purpose of this publication, a substantial dividing wall shall be a reinforced concrete wall not less than 30 cm thick. It shall be secured to prevent overturning and shall be keyed to the cross walls. Both wall faces shall be reinforced with not less than 15 M (Metric Bar) (or #4 in existing facilities) bars located not less than 50 mm from the face, spaced not more than 30 cm horizontally and vertically. Bars on one face shall be staggered with regard to bars on the opposite face; the vertical bars shall be lapped with the foundation reinforcing and all reinforcing is to be continuous through all joints. The concrete shall have a minimum design compressive strength of 20 MPa (Mega Pascals) (or 2 500 psi in existing facilities).

21. For the purposes of this publication, a heavy walled building shall be a building of non-combustible construction, used for explosives storage, with walls of 70 cm concrete, brick or equivalent, (45 cm reinforced concrete) which may or may not have a protective roof of 15 cm reinforced concrete with suitable support. The door must be barricaded if it faces a potential explosion site (PES).

## ROOFS

22. The roof shall be of non-combustible material and give protection against penetration by debris, comparatively low velocity fragments, and lobbed ammunition. A protective roof shall consist of 15 cm of reinforced concrete or its equivalent. It should not collapse if the walls are damaged except in the case of earth covered structures.

## ENTRANCES

23. The number of doors in a magazine, workshop or laboratory should be adequate to satisfy requirements for the movement of personnel, materiel and handling equipment.

24. Sliding or cantilever doors should be provided. When sliding doors cannot be provided, hinged doors must open outwards. Exposed hinge pins and hinge bolts shall be suitably secured against removal.

25. Doors shall be tight fitting and their fire rating (National Building Code Of Canada (Appendix D)) shall match the fire rating of the remainder of the structure. If fire resistant non-ferrous material is used in upgrading a fire rating, priority for coverage shall be given to the outside surface.

**LOCKS**

26. All pedestrian doors shall be fitted with built-in locks having a quick release on the inside. Padlocks used on loading doors shall meet a minimum security rating of S283. It is preferable that a master lock system be used so that all locks in an explosives area may be operated with a minimum number of keys. National Defence Security Policy (NDSP) should be consulted.

**WINDOWS**

27. Magazines shall not be constructed with windows since this will defeat the purpose of the protective wall. Facilities such as workshops or laboratories may require windows for ventilation. Such windows should be installed in locations which present the least hazard. The glass shall be either heat-resistant, mirrored or frosted wire glass to prevent direct sunlight affecting ammunition within the building. All windows shall be weatherproof, open outwards and be secure against forced entry. Heavy walled workshops with windows shall be protected with barricades.

**VENTILATION**

28. Ventilators should be installed in walls or roofs to provide effective ventilation. They shall be baffled to prevent ingress of foreign material, birds, rodents, etc, and be secure against forced entry.

**STATIC ELECTRICITY**

29. Adequate precautions, such as the bonding and grounding of all conducting materials, shall be taken to prevent the accumulation of static electricity. CFTO C-98-016-MIS/MJ-002, Maintenance and Testing of Grounding Systems Quick Reaction Alert (QRA) and Special Ammunition Storage (SAS) Sites details the testing periodicity and recording requirements.

**FIRE DOORS**

30. Corridors which connect magazines or workshops shall be provided with suitable fire doors between the workshops or magazines. These fire doors shall be installed in accordance with National Building Code of Canada (NBCC).

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## SECTION 3

### ELECTRICAL, HEATING AND MAINTENANCE SPECIFICATIONS

#### APPLICATION

1. These regulations apply to the electrical and heating installations for magazines, workshops, laboratories and other facilities where ammunition or explosives are stored or serviced.

#### GENERAL

2. Special consideration shall be given to the design, construction, and maintenance of the electrical and heating systems in magazines, workshops and laboratories to avoid unnecessary risks.

#### CANADIAN ELECTRICAL CODE

3. These regulations shall be read in conjunction with the Canadian Electrical Code (CEC), Parts 1 and 2, which is the governing authority for electrical requirements in Canada. However broad-ranging, the CEC was designed to govern Electrical standards in Industrial applications and were not developed with the unique storage and maintenance requirements of CF Ammunition facilities in mind. Notwithstanding reference in the Code to aluminum wiring, copper conductors only shall be used for electrical wiring in magazines, workshops and laboratories.

#### ELECTRICAL REQUIREMENTS

4. Electrical equipment approved by the Canadian Standards Association (CSA) for use in hazardous locations is acceptable for installation in buildings containing ammunition or explosives. Where an explosive atmosphere in sufficient quantity exists as detailed in the Electrical Code, Hazardous Locations, electrical equipment shall be approved for the explosive properties of the specific gas, vapour or dust present. In addition, equipment shall have no exposed surface temperature (referred to as Temperature Code) in excess of 80 per cent of the ignition temperature in degrees Celsius of the specific gas, vapour or dust capable of surrounding the equipment. Ignition temperatures for military explosives are contained in R-74-007-009/TA-000, Military Explosives. If a specific ignition temperature is not known, direction should be obtained from NDHQ/DAER.

5. In planning the installation of electrical equipment for hazardous locations it is often possible to locate much of the equipment in less hazardous or in non-hazardous areas to reduce the quantity of special equipment required and to decrease the hazard. This should be considered in the layout of all electrical installations within hazardous locations. However, electrical equipment shall only be used when pneumatic or hydraulic power equipment is not available.

6. There are two acceptable methods used to protect electrical equipment within a hazardous location. The first is protection by enclosure and the second is protection by design.

#### PROTECTION BY ENCLOSURE

7. Section 18 of the Canadian Electrical Code (CEC) classifies hazardous locations according to the nature and the degree of the particular hazard present. This is accomplished by assigning Classes and Divisions to hazardous locations.

#### CLASS I LOCATIONS

8. Class I hazardous locations are areas in which flammable gases or vapours are or may be present in the atmosphere in quantities sufficient to produce explosive or ignitable mixtures. Class I Division 1 pertains to locations where hazardous gases or vapours exist continuously, intermittently, or periodically under normal working conditions or at any time due to the faulty operation of equipment such

as pumps or valves. In Division 2 locations, the liquids, gases or vapours are fully contained in vessels such as tanks, pipes, valves, etc, so they would only escape under an abnormal condition such as puncture or equipment malfunction. Groups A, B, C and D are sub-categories of Class I locations and are dependent of the specific chemical present:

- a. **Group A:** - atmospheres containing acetylene;
- b. **Group B:** - atmospheres containing butadiene, ethylene oxide, hydrogen, propylene oxide or other gases or vapours of equivalent hazard;
- c. **Group C:** - atmospheres containing acetaldehyde, cyclopropane, diethyl ether, ethylene, unsymmetrical dimethyl hydrazine (UDMH) or other gases or vapours of equivalent hazard; and
- d. **Group D:** - atmospheres containing acetone, acrylonitrile, alcohol, ammonia, benzene, benzol, butane, ethylene dichloride, gasoline, hexane, isoprene, lacquer solvent vapours, naphtha, natural gas, propane, propylene, styrene, vinyl acetate, vinyl chloride, xylenes or other gases or vapours of equivalent hazard.

9. Rooms or buildings containing vapours from which explosives may condense shall conform to a Class I Division 1 standard. The Temperature Code (TC) will not exceed 80 per cent of the ignition temperature of the vapour capable of surrounding the equipment. Class I Division 2 locations do not require any specific Temperature Code rating other than what is implied by the Group designation:

- a. **Groups A and B:** 280 degrees C;
- b. **Group C:** 160 degrees C; and
- c. **Group D:** 215 degrees C.

**CLASS II LOCATIONS**

10. Class II locations are areas in which combustible or electrically conductive dusts are present. Class II Division 1 pertains to hazardous locations where dusts may be in the air continuously, intermittently, or even periodically under normal operating conditions in quantities large enough to produce explosive or ignitable mixtures. Furthermore, such locations shall meet the specifications for Group E (atmospheres containing highly conductive dusts) and Group F (atmospheres containing dusts which are slightly conductive).

11. For Class II Division 1 Groups E and F locations the Temperature Code shall be less than 80 per cent of the ignition temperature of the propellant, pyrotechnic or explosive dust capable of surrounding the electrical equipment.

12. Class II Division 2 pertains to hazardous locations in which combustible dusts are not normally in the air, but in which deposits on, in or near electrical equipment may be ignited by arcs or sparks or which may interfere with the safe dissipation of heat. Due to the low probability of explosives, pyrotechnic or propellant dust surrounding the equipment, the Temperature Code is not required to be 80 per cent of the ignition temperature. However, the following Temperature Codes are required:

	<b>Equipment</b>	<b>Temperature Rating</b>	<b>Equipment Code</b>
a.	Equipment subject to overload	120 degrees C	T4A
b.	Equipment not subject to overload	165 degrees C	T3B

- |    |                            |               |    |
|----|----------------------------|---------------|----|
| c. | Motors, overload protected | 200 degrees C | T3 |
| d. | Lighting Fixtures          | 200 degrees C | T3 |

### **CLASS I AND CLASS II COMBINED LOCATIONS**

13. Areas in which there exists a combined hazard from both a vapour mixture and explosive dust require a combined rating of Class I and Class II. Examples of such areas are:

- a. paint facilities for ammunition components. Such locations require a Class I Division 1 for the hazards associated with the paint/solvent vapours and a Class II Division 2 due to the presence of the explosive items; and
- b. explosives workshops, ammunition assembly buildings, explosive laboratories and magazines in which Compatibility Group J ammunition is handled. For example, a magazine storing a Harpoon missile would require a Class I Division 2 Group D rating for the hazard associated with the JP10 fuel and a Class II Division 2 for the hazard associated with the warhead.

### **PROTECTION BY DESIGN**

14. Electrical equipment approved as intrinsically safe by CSA is approved for installation in hazardous locations. Intrinsic Safety is protection by design rather than protection by enclosure. This is accomplished by limiting the thermal and electrical energy given off by an electrical circuit to below the minimum ignition level of whatever dust, gas or vapour is present in the surrounding environment. This protective technique lends itself to low voltage devices such as communication and signalling equipment, motion sensors and monitoring and remote control devices.

### **ADDITIONAL REQUIREMENTS**

15. In addition to the preceding regulations, the following requirements shall be met when installing electrical equipment in hazardous locations:

- a. Lighting fixtures installed in hazardous locations shall be protected from physical damage by a suitable guard.
- b. Electrical equipment which may be exposed to water during operations shall also be rated for that environment (e.g. watertight, weatherproof or drip tight).
- c. Electrical installations for the entire structure, including non-ammunition holding areas such as offices and washrooms, shall conform to the same standards as the rest of the structure except when the non-ammunition areas are separated by close fitting, self closing approved fire doors for Class I Division 2 and Class II locations. A vapour proof barrier is required for Class I Division 1 locations.
- d. Light fixtures and electrical equipment installed on the exterior of a building containing explosives need not be approved for a hazardous location as long as the positioning and ventilation are such that there is no possibility of vapour or dust coming in contact with the fixtures or equipment.
- e. Electrical equipment exposed to Otto Fuel II vapours does not require a rating for hazardous locations.

16. It is recognised that present facilities do not meet all requirements stated in paragraphs 4 to 15 due to the differing standards used at the time of construction. It is not intended that extensive alterations

be made to existing facilities. However, when repairs are required and it is practical and economical to upgrade a facility to the required standard, the necessary alterations shall be made.

17. When planning for new magazines and workshops, consideration should be given to possible future requirements concerning the category of electrical installations in order to provide flexibility to meet both existing and possible future needs.

#### **SITING OF ELECTRICAL INSTALLATIONS**

18. Electrical installations shall be sited as follows:

- a. Permanent generating stations shall not be located within an enclosed explosives area.
- b. Mobile generators shall be located not less than 45 m from any building containing ammunition or explosives.
- c. Fire alarm points and emergency call boxes should be located behind a protective concrete wall or earth barricade and at a distance not less than 15 m from buildings containing ammunition or explosives.
- d. Low voltage switching stations, junction boxes and cable pits containing major electrical terminals shall be located behind a protective concrete wall or earth barricade and be at least 15 m from buildings containing ammunition or explosives.
- e. Overhead lines supplying electricity and serving telephones, fire alarm points and call boxes shall not be carried nearer than 15 m to buildings containing ammunition or explosives. The remaining distance shall be completed by underground cable.
- f. Lighting standards and poles carrying power, lighting, public address or telephone lines shall not be sited where they, or the wires they support, can fall on a building containing ammunition or explosives and in any event, due to lightning hazard, shall not be closer than 15 m from the building.

#### **ELECTRICAL POWER SUPPLY IN EXPLOSIVES AREA**

19. Electrical power supply lines within an explosives area shall be installed underground, but in difficult terrain, may be carried overhead with NDHQ siting approval. Underground cables, for maintenance reasons, shall not be laid below buildings. When the supply line is overhead, poles or other forms of support shall not be fixed to buildings containing ammunition or explosives.

#### **CONTROL OF ELECTRICAL POWER**

20. The primary electrical supply to an entire explosives area shall be so arranged that it can be cut off by switches located in the guardhouse or at a point outside the explosives area near the main gate.

21. The supply of electricity to a building containing ammunition or explosives shall be controlled by a master switch located outside the explosives storage space of the building. Indicator lamps should be fitted near the switch. When intrusion alarms are installed, their control boxes shall be installed within the building.

#### **CONDUITS**

22. Electrical wiring within a building containing ammunition or explosives shall be approved mineral insulated cable, other than light weight type, or be enclosed entirely in heavy gauge, screwed, rigid conduit. All conduits shall be screwed tightly into fittings in accordance with the appropriate hazardous

location category of the Canadian Electrical Code. Conduit fittings shall be fixed securely and should be placed high enough on the walls to eliminate the risk of accidental damage.

#### **ELECTRICAL OUTLETS AND SWITCHES**

23. Electrical outlets and wall switches may be installed where required in accordance with the standards specified in paragraphs 4 to 17.

#### **COMMUNICATION AND ALARM SYSTEMS**

24. Bells, buzzers, telephones, intrusion alarms, loudspeakers, intercoms and other similar equipment shall meet the electrical installation category of the building in which they are located, as specified in paragraphs 4 to 17.

#### **GROUNDING**

25. All metallic enclosures for electric wires and fittings shall be effectively bonded throughout and grounded. CFTO C-98-016-MIS/MJ-002, Maintenance and Testing of Grounding Systems QRA and SAS Sites, details testing periodicity and recording requirements.

**Paragraphs 26 to 28 inclusive are deleted by this change.**

#### **ELECTRICAL INSTALLATIONS ON AMMUNITION PIERS AND WHARFS**

29. All lighting fixtures as well as all other electrical installations and equipment used on ammunition piers and wharfs shall comply with the requirements for damp or wet locations as prescribed by the Canadian Electrical Code. When it has been determined that explosives dust, gases or vapour may be present on a pier or a wharf, or in ship's hold or magazine, all lighting fixtures and electrical equipment shall comply with the hazardous location requirements as defined in the Canadian Electrical Code. All lighting fixtures and equipment on ammunition piers and wharfs shall be properly grounded. The lighting fixtures should be arranged so that there is no glare or blind spots.

#### **HEATING SYSTEMS**

30. The following heating systems may be used in magazines, workshops and laboratories:
- a. hot water;
  - b. low pressure steam not exceeding 1.05 kg/ cm<sup>2</sup>; or
  - c. thermally designed electric heaters conforming to the standards described in paragraphs 4 to 17.

31. Where steam or hot water systems are installed, the temperature of the steam pipes or radiator panels shall not exceed 109 degrees C. Pipes should be painted but not otherwise coated nor boxed in wood. Pipes shall be clear of the walls and not less than 15 cm from any woodwork.

32. Explosives workshops, laboratories, transit buildings and similar buildings where personnel are employed on a regular basis shall be heated during the cold season to provide comfortable working conditions. New construction of magazines, workshops and laboratories shall have heating systems installed so that they may be activated when required.

## REPAIR TO BUILDINGS

33. Building repair and maintenance shall be carried out to individual building design standards.
34. Deficiencies to buildings within explosives areas which affect the safety of personnel or serviceability of ammunition and explosives shall receive immediate attention.
35. Repairs or alterations to such buildings shall be carried out under the following conditions:
  - a. All ammunition and explosives shall be removed from magazines, workshops and laboratories when repairs which require use of heat and spark producing equipment are being conducted inside magazines, workshops or laboratories.
  - b. The base/unit commander's or superintendent's approval shall be obtained for the use of heat and spark producing equipment for the external repairs of any buildings containing ammunition or explosives. Prior to the start of the operation, advice shall be sought from the fire chief.
  - c. Repairs, such as replacing window panes and repairing door and window fittings, may be undertaken without removing the ammunition and explosives. However, the ammunition and explosives should be removed from the immediate area in which repairs are to be effected and all other work within the building or compartment shall cease for the duration of the repair. Litter, such as wood shavings, nails, or like materials, shall not be allowed to accumulate, and the floors shall be swept frequently.
  - d. Floors shall be washed and cleaned to ensure they are free from explosives before being repaired
  - e. Following any maintenance or repair of buildings in which ammunition or explosives are stored, the buildings and surrounding areas shall be inspected to ensure no fire hazards exist and that the buildings and areas have been cleared of extraneous matter.
36. Before undertaking any repairs to the electrical circuit of a magazine, workshop, or laboratory the circuit shall be opened at the master switch for the building. In cases where testing of live circuits is mandatory, power may be left on. Repairs to electrical wiring, wiring additions or changes must conform to original installation standards or more stringent standards as required.

**Figures 2-3-1 through 2-3-4 are deleted by this change.**

## SECTION 4

### STATIC ELECTRICITY AND GROUNDING

#### GENERAL

1. The generation of static electricity is not a hazard in itself. The hazard arises when an accumulated electrical charge is subsequently discharged as a spark. This spark is a potential ignition source for flammable or explosive materials and electro-explosive devices (EEDs). To prevent the accumulation and discharge of static electricity, grounding is often used to dissipate the charges as they form.

**Paragraphs 2 to 8 inclusive are deleted by this change.**

#### DISSIPATION OF STATIC ELECTRICITY

9. While there are several methods for eliminating or reducing the hazard from static electricity, the fundamental method employed is to provide electrically continuous paths to ground to allow the charges to dissipate as fast as they are generated. This may be accomplished by bonding (connecting) two or more conductive bodies together and connecting them to a common ground conductor. Conductive bodies insulated from ground by non-conductors may collect dangerous charges of static electricity. This hazard can be reduced by replacing the insulating parts with conductive parts which can be bonded and grounded or by providing an electrical path over the non-conductor to ground. For example, grounding exterior parts of containers does not necessarily eliminate all of the danger from static electricity; in order to be completely effective, grounding must include the contents.

10. Humidification for preventing static electricity accumulations and subsequent discharges is usually effective if the relative humidity is above 60 per cent. However, certain materials such as metallic powders, pyrotechnic mixtures and some explosives cannot be exposed to air with 60 per cent relative humidity because of either the possibility of spontaneous ignition or deterioration.

#### GROUNDING REQUIREMENTS

11. There are five types of grounding systems permitted to be used at the CFADs and ammunition facilities. They are:

- a. power ground system;
- b. instrumentation ground system;
- c. lightning protection ground system;
- d. static ground system; and
- e. ordnance ground system.

12. The purpose of the power ground system is to assure that hazardous potentials do not develop on electrical equipment. It prevents arcing between separate items of electrical equipment due to voltage arising from electrical faults, prevents electric shock hazards to personnel and protects the equipment from over-voltage. The basic requirements for power grounding systems are contained in the Canadian Electrical Code.

13. The purpose of the instrumentation ground system is to provide error free operation of sensitive electronics instrumentation. These systems are designed to minimize introduction of spurious signals

(noise) into data. The noise is frequently generated by the electrical distribution systems, lighting, motors, and even adjacent instrumentation. The equipment most affected is that designed to process small signals. Normally power is supplied to these systems through isolation transformers. They are commonly grounded at a single common point on the ground girdle (counterpoise) to eliminate ground loops because common mode voltages may be generated in such loops.

14. The purpose of the lightning protection ground system is to maintain the entire ammunition storage or processing facility at one potential to minimize the chance of arcing between metal objects in the facility and to provide a low impedance path to ground for lightning strikes. The resistance of the lightning ground system to earth shall be less than 10 ohms and the resistance of any metallic component to the lightning ground system shall be less than 1 ohm. For detailed information on lightning protection and grounding installations, see C-98-016-001/DD-001, Lightning Protection for Explosives Buildings - Electrical Design.

15. The purpose of the static ground system is to eliminate electric discharges due to static electric charge build-up. The system conducts the charge to ground as rapidly as it is generated. Examples of segments of the static ground system are conductive floors, conductive table tops and ground grab bars. The static ground system shall be connected to the ground girdle (counterpoise), and it shall not be connected directly to gas, steam or air lines, dry sprinkler system piping or lightning down conductors.

16. The purpose of the ordnance ground system is to ensure that electric currents do not flow between ordnance components when they come in contact or are mated. These currents can be produced by common mode voltages induced in ground loops, electrostatic discharge of one component into another, potential differences created in the facilities ground system due to direct lightning strikes or near misses and electrical system faults. The ordnance ground system is electrically separated from all other ground systems (and objects connected to them) and shall be connected to the ground girdle (counterpoise) at a single point. When ordnance grounds are installed, it is permissible to establish work zones in a structure such that weapon components within that zone can be connected to ordnance busses which share only a common single point connection at the ground girdle (counterpoise). In the example shown in Figure 2-4-1, all ordnance in the room A can only be connected to busses which share a common single point ground girdle (counterpoise) connection. The same applies to rooms B and C. The zones need not be divided by walls provided positive measures are taken to assure components will not come into contact or be mated when connected to busses which do not have the same common single point ground connection.

17. Exceptions. During certain ordnance tests it is necessary to connect the ordnance item to electrical test sets which are externally powered. In these cases it is permissible to disconnect the ordnance from the ordnance ground system during these tests provided the ordnance is equipped with a mechanical out of line safing device and the EEDs in the circuit being tested are out of line or the EEDs are not brought into line except in a test cell after all personnel have been withdrawn.

18. Marking. The ordnance ground busses, static ground busses, electrical ground busses, and instrumentation ground busses shall be clearly marked in a manner which will preclude misidentification of each grounding system.

19. Precautions. The following precautions shall be observed when grounding of equipment is used in explosives operations:

- a. Intermittent grounds may increase the static hazard by failing to provide a controlled discharge path to ground.
- b. Permanent equipment in contact with conductive floors or table tops are not considered to be adequately grounded. Such equipment should be permanently connected by a suitable metallic conductor to a permitted ground. However, contact grounds shall be considered adequate for portable equipment, such as chairs and carts, providing the resistance to ground for the contact ground is not greater than 250 000 ohms.

**SPECIFIC REQUIREMENTS**

20. Ground grab bars should be installed just outside the entrance doors to processing buildings or other buildings or structures in which special hazards exist. A ground grab bar consists of a length of non-corroding conductive pipe fitted in brackets and connected to ground. All persons entering structures equipped with ground grab bars shall momentarily grasp the bar to dissipate any possible accumulation of static electricity. These bars shall not be painted.

**NOTE**

Ground grab bars do not prevent the re-accumulation of static after release of the bar. To prevent re-accumulation, conductive footwear or grounding straps shall be used.

21. Conductive belting shall be used in locations where static is a hazard. Such belting shall have a resistance not to exceed 1,000,000 ohms as measured between two electrodes placed 91.4 cm apart on one side of the belt. The resistance of the conductive belting to ground shall also be less than 1,000,000 ohms. Static combs shall not be used to drain off static electricity generated by the belting or pulleys used in locations where hazardous concentrations of explosive dusts or flammable vapours are present.

22. Grounding (bonding) straps should be used in locations where static is a hazard. Electrical continuity may be broken by oil on bearings, connections with gaskets, layers of dust or poorly conductive paint or rust at any contact points. In order to obtain a continuous circuit, bonding straps may be used to bridge such locations. Only braided straps shall be used for electrostatic bonding of equipment which vibrates.

23. Conductive floors may be made of lead, conductive rubber or plastic, conductive masonry material or conductive composition material. Floors shall comply with the following requirements:

- a. The surface of the floor must be free from cracks and reasonably smooth. If washing of floors is necessary, the material as installed must be capable of withstanding repeated washing with hot water. If conductive floors are to be waxed, a conductive wax which provides the same conductive characteristics shall be used.
- b. The material must not produce sparks when stroked briskly and firmly with a hardened steel file.
- c. The material must not slough off, wrinkle or buckle under normal conditions of use.
- d. The average resistance of the conductive floor shall be 1,000,000 ohms or less as measured between two electrodes placed 457mm apart. The average resistance of the conductive floor to building ground shall also be 1,000,000 ohms or less.
- e. The resistance of the floor shall be more than 5 000 ohms in areas with 110-volt service and 10 000 ohms in areas with 220-volt service, as measured between a permanent ground connection and an electrode placed at any point on the floor, and also as measured between two electrodes placed 91.4 cm apart at any points on the floor. This minimum is specified as an additional protection against electrical shock.
- f. Where conductive floors and conductive footwear are required, table tops on which exposed explosives or electro-explosive devices are handled or where explosive dust is encountered shall be covered with properly grounded, conductive, spark-proof material.

24. Conductive floors shall be used in areas where personnel work with or are exposed to contact with materials known to be static sensitive. Conductive footwear or other devices providing similar protection shall be worn in areas where conductive floors are mandatory except electricians required to

make electrical repairs shall not wear conductive shoes. Spark proof footwear should be worn in conjunction with steel reinforced concrete floors. Where the need for conductive floors is localized, they need not be installed throughout the building. In ammunition processing facilities, conductive floors and grounding are not necessary if documented tests have demonstrated the insensitivity of a weapon's electro-explosive devices, explosives and propellants to electrostatic discharges from personnel. In those cases in which the weapons configuration precludes the possibility of an electrostatic discharge to a sensitive component or its firing leads, conductive floors and grounding are not required.

#### **CONDUCTIVE APPAREL AND DEVICES**

25. Conductive cover footwear (see C-09-005-002/TS-000 Part 5, Section 9) or other devices providing similar protection shall be worn by personnel regularly working in areas where conductive floors are mandatory and when required by the SOPs. Personnel from other areas and visitors who enter processing areas where explosives are exposed shall wear conductive footwear or other approved grounding devices.

26. All legstats (see C-09-005-002/TS-000 Part 5, Section 9) should be provided with at least 40 000 ohm but no more than a 250 000 ohm resistors between the conductive rubber and the leg garter in order to protect personnel from any potential electrical shock hazards. Two legstats (one on each leg) shall be worn.

27. Static grounding of operators is mandatory during operations involving the handling of exposed explosives, electro-explosive devices and sensitive materials such as finely divided powdered metals and solvents and pyrotechnic mixtures. Grounding plates and grounding straps with breakaway devices shall be used in addition to conductive floors and conductive footwear if necessary to obtain adequate grounding.

#### **MACHINERY AND EQUIPMENT**

28. Grounding with less than 25 ohms resistance shall be used on mixers for pyrotechnic, propellant and explosive compositions, screening and sifting devices, assembly and disassembly machines, conveyors, elevators, defuzing machines, work tables, presses, hoppers and all associated equipment involved in loading or processing explosives and explosive materials. In non-hazardous locations, non-electrical equipment need not be grounded unless the grounding is part of the lightning protective system.

29. DELETED

#### **GROUNDING OF WEAPONS DURING ASSEMBLY, DISASSEMBLY AND CHECKOUT**

30. During assembly or disassembly each individual section of a weapon shall be continuously grounded. In addition, personnel performing assembly or disassembly operations must be grounded by a way of conductive footwear on conductive floors or other grounding or bonding methods if the possibility exists that exposed explosives, flammable gases or liquids, or exposed electro-explosive devices or exposed electro-explosive device contacts will be present. Inert components of weapons require grounding only prior to mating with explosive components under the following conditions:

- a. During all phases of checkout, the weapon or separate section shall be grounded. Personnel utilizing electrical test equipment shall not be grounded at any time when possibility of an electric shock hazard exists. However they should bring themselves to the same electric potential as the weapon by touching the weapon skin with a bare hand prior to touching any contacts that may serve as a path to conduct electrostatic charge to any electro-explosive devices. Caution must be exercised to ensure that the ordnance ground is not connected to electric ground inside the building. To preclude a difference of

potential between grounds, the ordnance and electric ground must be tied together outside the building via the ground girdle (counterpoise).

- b. In all cases precautions should be taken to avoid ground loops such as those that could be used by utilizing both an overhead ground cable and a conductive strap or weight dragging on the conductive floor when working on a weapon.
- c. The size of the grounding cable for electrostatic protection must be sufficient to prevent breaking of the wire for the worst case conditions under which it will be used.
- d. During aircraft loading or downloading evolutions involving explosive items, the aircraft shall be grounded. An aircraft ground is any ground in which the resistance between the aircraft structure and ground is 10 000 ohms or less.

### **INSPECTIONS AND TESTING OF CONDUCTIVE FLOORING**

31. Conductive flooring shall be tested for continuity and electrical resistance upon installation and annually thereafter. The readings shall be recorded in a log and a copy kept at the depot or ammunition facility. Testing procedures are detailed in CGSB-81-GP-1M, Canadian Government Specifications Board Standard for Flooring Conductive and Spark Resistant and C-98-016-MIS/MJ-002 - Maintenance and testing of grounding systems QRA and SAS sites.

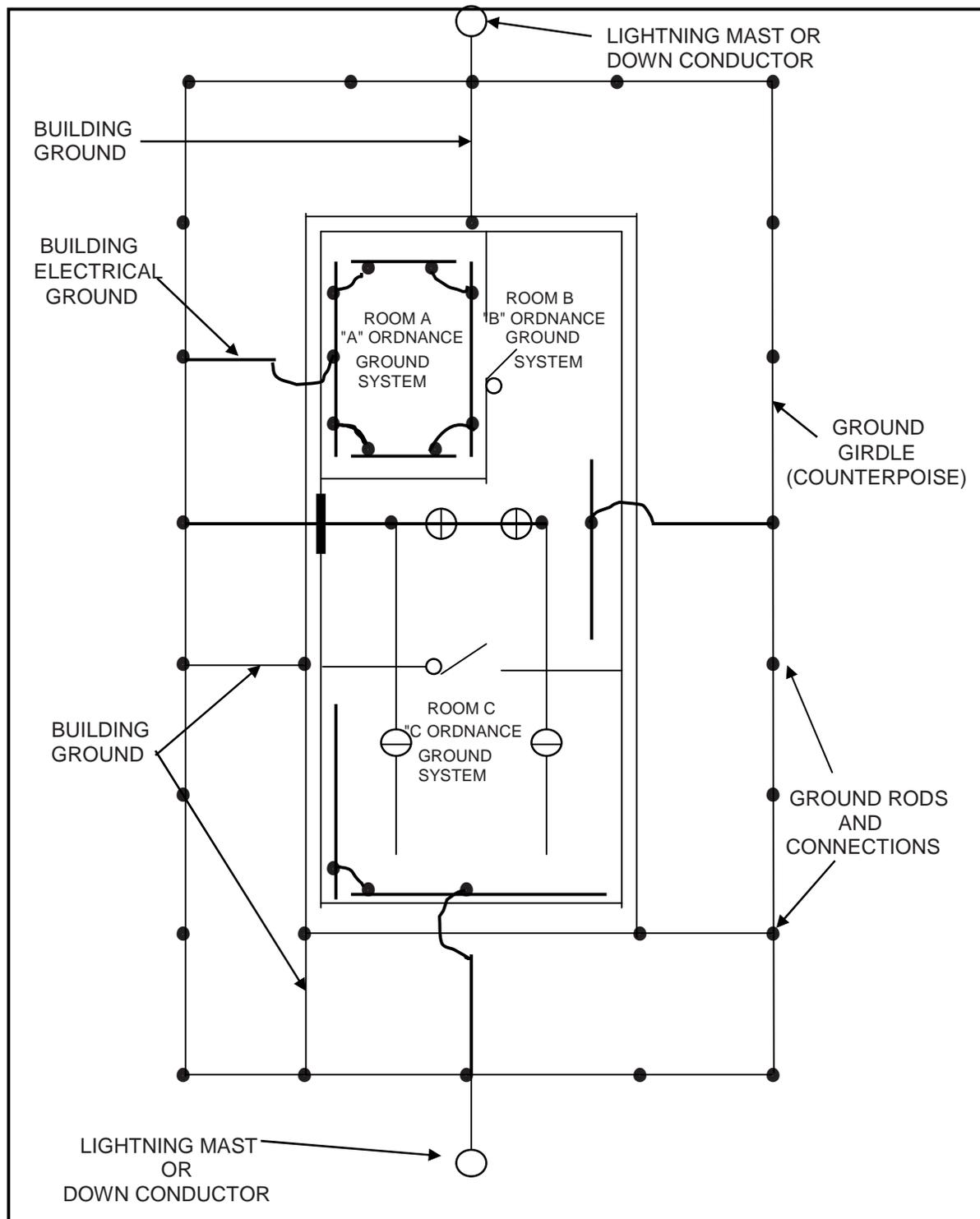


Figure 2-4-1 - Grounding System for Typical Explosives Processing Building

## SECTION 5 BARRICADES

**Paragraphs 1 to 4 inclusive are deleted by this change.**

### GEOMETRY OF EARTH BARRICADES

5. Proper barricade geometry is necessary to reduce the risk that high velocity projections may escape above or around the ends of the barricade and so produce an explosion in an adjacent site. Since such projections do not move along perfectly linear trajectories, reasonable margins in barricade height and length must be provided beyond the minimum dimensions which block lines of sight.

6. The required height of the barricade is determined as follows:

- a. For line AB on level terrain, point A is chosen as a reference on either of two stacks (see Figure 2-5-1). If the stacks have different heights, point A is on the lower stack. Point A is at the top of that face of the chosen stack which is remote from the other stack. If the stacks are covered by protective roofs, point A may be at the top of that face of the chosen stack which is nearer to the other stack. Point B is on the top face of the other stack.
- b. For line AB on sloping terrain, point A is on the stack whose top face is at the lower elevation (see Figure 2-5-1). Point A is at the top of that face of the chosen stack which is remote from the other stack. If the stacks are covered by protective roofs, point A may be at the top of that face of the chosen stack which is nearer to the other stack. Point B is on the top face of the other stack.
- c. Line AB must pass through at least 2.4 m of barricade material or undisturbed natural earth between the two stacks, whether or not they are adjacent.
- d. For line AC (2 degree rule) proceed as follows:
  - (1) Point A is chosen in accordance with subparagraphs a or b preceding.
  - (2) On level or sloping terrain, a second line AC is drawn at an angle of 2 degrees above line AB (see Figure 2-5-1).
  - (3) When stacks are separated by less than 300 m, line AC must pass through at least 1.0 m of barricade material or undisturbed natural earth.
  - (4) The 2 degree rule applies only where the distance between stacks is less than 300 m and the ground does not slope excessively. Where greater distances or marked slope is involved, advice shall be sought from NDHQ/DAER.
  - (5) In the existing facilities where the 2 degree rule cannot be applied without major reconstruction of barricades, advice shall be sought from NDHQ/DAER.

7. The required length of the barricade is determined by extending the barricade, exclusive of the end slope, to 1.0 m beyond lines between the extremes of the two stacks of ammunition under consideration. These lines must pass through at least 2.4 m of barricade material or undisturbed earth (see Figure 2-5-1).

8. The distance from a stack to the foot of a barricade is a compromise. Each case is considered individually to achieve the optimum solution, taking account of the following factors:

- a. A barricade close to a stack results in smaller dimensions for the barricade to intercept high velocity projections through a given solid angle. However, on sloping terrain the minimum separation may not result in the smallest barricade.
- b. A barricade further away from the stack results in easier access for maintenance and for vehicles, and the possibility to site the barricade outside the predicted crater when the Potential Explosion Site contains ammunition and explosives which have mass explosion hazard (Hazard Division 1.1). The barricade shall be sited so that the crater does not undermine it more than one third of its thickness at ground level.
- c. The minimum distance from a stack or a building containing ammunition or explosives to the foot of the barricade shall be 2.4 m.
- d. A good working estimate of the crater radius can be calculated from the formula:

$$R_c = \frac{1}{2} Q^{1/3}$$

Where  $R_c$  = crater radius (m) and  $Q$  = Net Explosives Quantity (kg). This radius is measured from the centre of the explosives. In certain soil conditions (saturated soil or clay), the crater may be larger than calculated from the preceding formula. In such conditions, considerations should be given to increasing the distance between magazines.

#### **MATERIAL FOR EARTH BARRICADES**

9. The earth for barricades should be as prescribed following. When non-reinforced concrete or solid brick is used in conjunction with earth, either of these materials may be taken as equivalent to four times its thickness of earth with regard to their ability to stop fragments. The concrete or brick may be used to support the earth or it may be those parts of the roof and walls of the building which intercept the high velocity projections.

10. Two precautions are necessary in the construction of earth barricades. One relates to the potential hazards to ammunition and personnel at Exposed Sites should the material be dispersed by an accidental explosion. The other relates to the precautions necessary to ensure the structural integrity of the earth barricades.

11. Because it is possible that the barricade material could be dispersed by an explosion, precautions shall be taken to reduce the hazards caused by large stones capable of causing initiation by impact upon ammunition or explosives in adjacent storage sites. The selection of material and its use shall be governed by the following, which represent a reasonable compromise between undue hazards and excessive costs of construction:

- a. Do not deliberately use rubble from demolished buildings.
- b. Ensure that stones larger than 0.3 m in girth (about the size of a man's clenched fist) are removed during construction. Other harmful matter shall also be removed.
- c. In climates where the ground becomes severely frozen, consideration should be given to the provision of an impermeable cover over the material or drainage to keep out excessive moisture.

12. The second precaution mentioned in paragraph 10, relating to structural integrity, applies in all cases. For this purpose, material should be reasonably cohesive and free from excessive amounts of

trash and detrimental organic matter. Compaction and surface preparation should be provided as necessary to maintain structural integrity and avoid erosion. Where it is impossible to use a cohesive material, for example at a site in a sandy area, the earth-works should be finished with either a layer of cohesive soil or an artificial skin. On the other hand, solid wet clay should be avoided during construction since it is too cohesive and would result in an excessive debris hazard.

### **WALLS AS BARRICADES**

13. External Walls of Buildings. A building without windows but with reinforced concrete walls of 45 cm thickness, 70 cm of solid brick or 70 cm of non-reinforced concrete is acceptable as a barricaded building for stopping fragments from an explosion in an adjacent building or stack. These buildings are defined as heavy walled buildings. A 25 cm solid brick wall protected by a 45 cm solid brick wall barricade is preferable to a single wall of about 70 cm of solid brick.

14. Substantial Dividing Walls within Buildings (see definition in Glossary). Walls of not less than 30 cm of reinforced concrete, extending from floor to ceiling, can often be used to divide a building into individual cubicles. The function of each dividing wall is to prevent, or at least to substantially delay, transmission of an explosion between ammunition or explosives on opposite sides of the wall. Ammunition and explosives in Hazard Division 1.1 shall be stored not less than 1 m from the substantial dividing wall. The main advantage of this is that Quantity Distances can then be based on the Net Explosives Quantity in one cubicle instead of on the total amount in the building. A second advantage is that an accidental explosion is less likely to render unserviceable all the stocks in the building. A multi-compartmented magazine, however, does not meet the above requirements of a multicubicle magazine and can not take advantage of the reduced Quantity Distances.

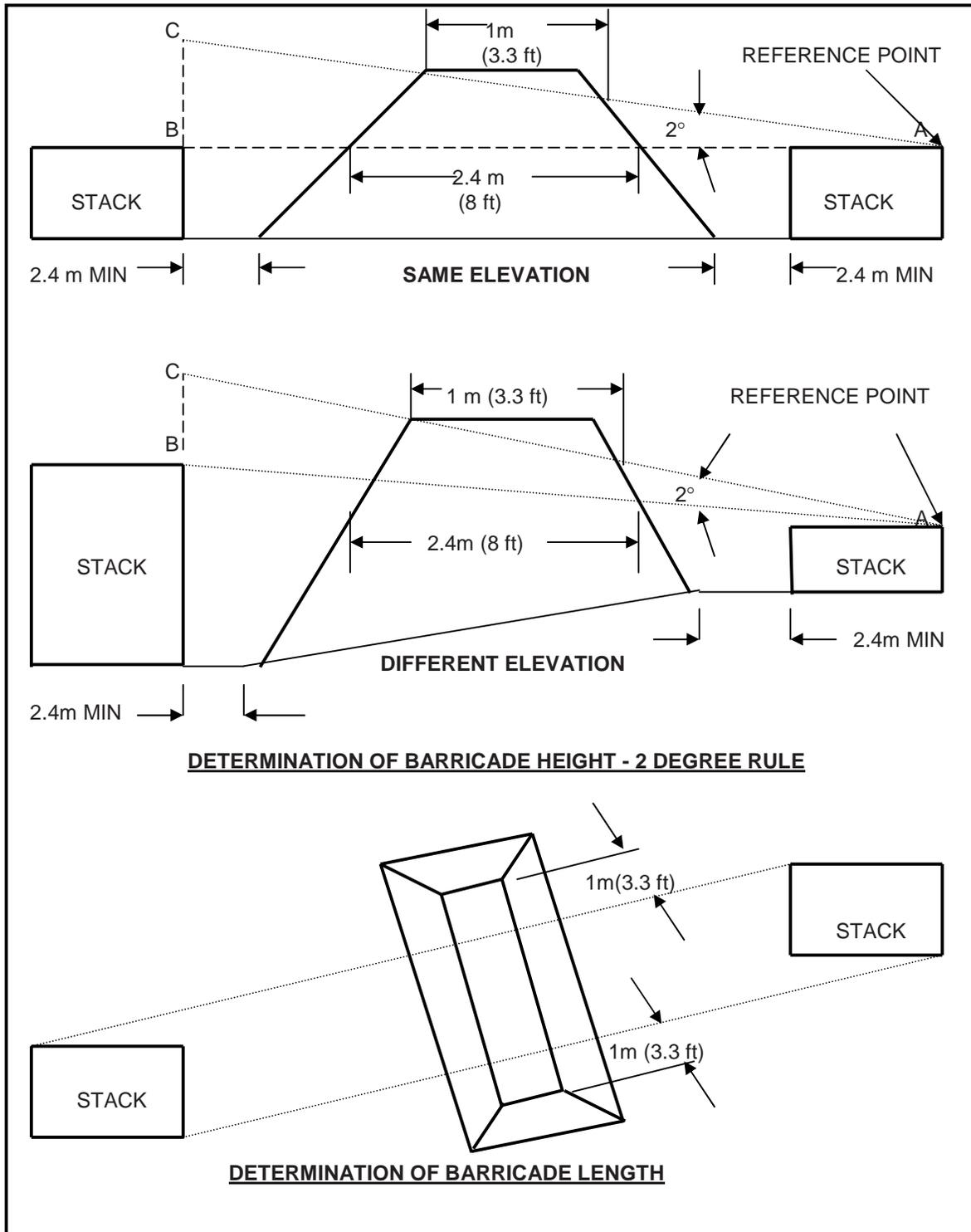


Figure 2-5-1 - Determination of Barricade Height and Length

**BARRICADE MATERIAL EQUIVALENCY FACTORS**

15. The following earth equivalents are provided to assist in determining the contribution of the vertical facing material to the overall effectiveness of a vertical face barricade in stopping high velocity, low angle fragments and debris:

- a. brick - 4 times;
- b. un-reinforced concrete - 4 times;
- c. reinforced concrete - 6 times; and
- d. steel - 24 times.

The barricade width may be reduced accordingly but the equivalent mass at the level of the top of the stack or eaves shall not be reduced below that of 2.4 m of earth.

**OTHER TYPES OF BARRICADES**

16. Barricades may take any of the following forms provided that all parameters (e.g. height, length and thickness) of paragraphs 6 and 7 are met, and that the equivalent thickness of barricade material used is as detailed in paragraph 15:

- a. Double Slope Barricade. An earth mound with both faces sloped at the natural angle of repose (see Figure 2-5-2).
- b. Single Slope Vertical Face (or Partial Vertical Face) Barricade. An earth mound with the outer face sloped at the natural angle and a vertical inner face suitably supported. Alternatively, the inner face may be partly vertical and partly sloped (see Figure 2-5-3).
- c. Steep Double Slope Barricade (see Figure 2-5-4).
- d. Wall Barricade. A brick or concrete wall (see Figure 2-5-5).
- e. Bunker Building or Igloo (see Figure 2-5-6).
- f. Building Below Natural Ground Level (see Figure 2-5-7).
- g. Metal-Bin Barricade (Binwall) (see Figure 2-5-8).
- h. A natural feature of the land formation.

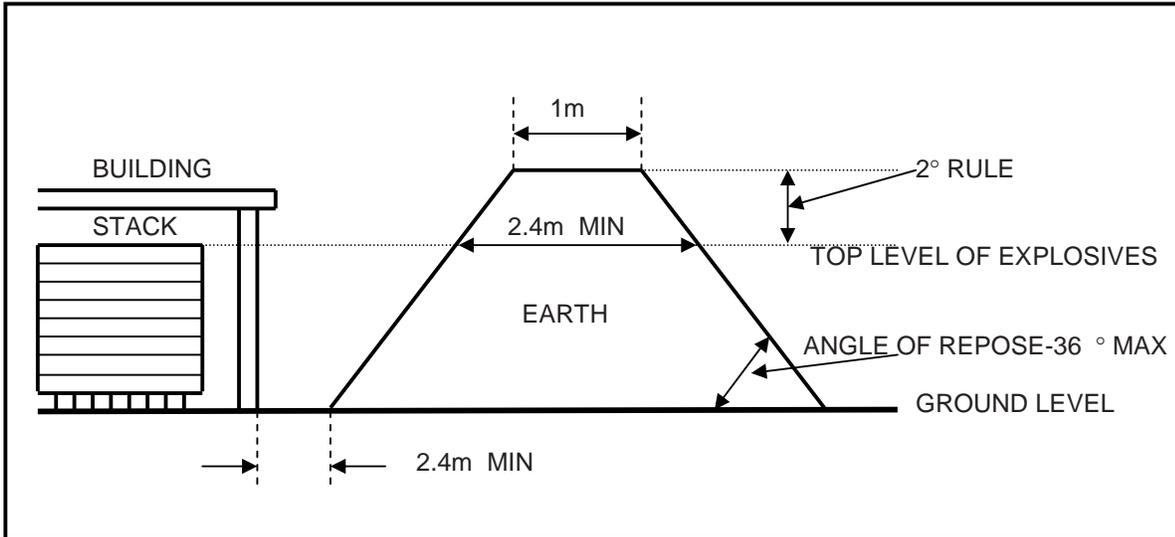


Figure 2-5-2 - Double Slope Barricade

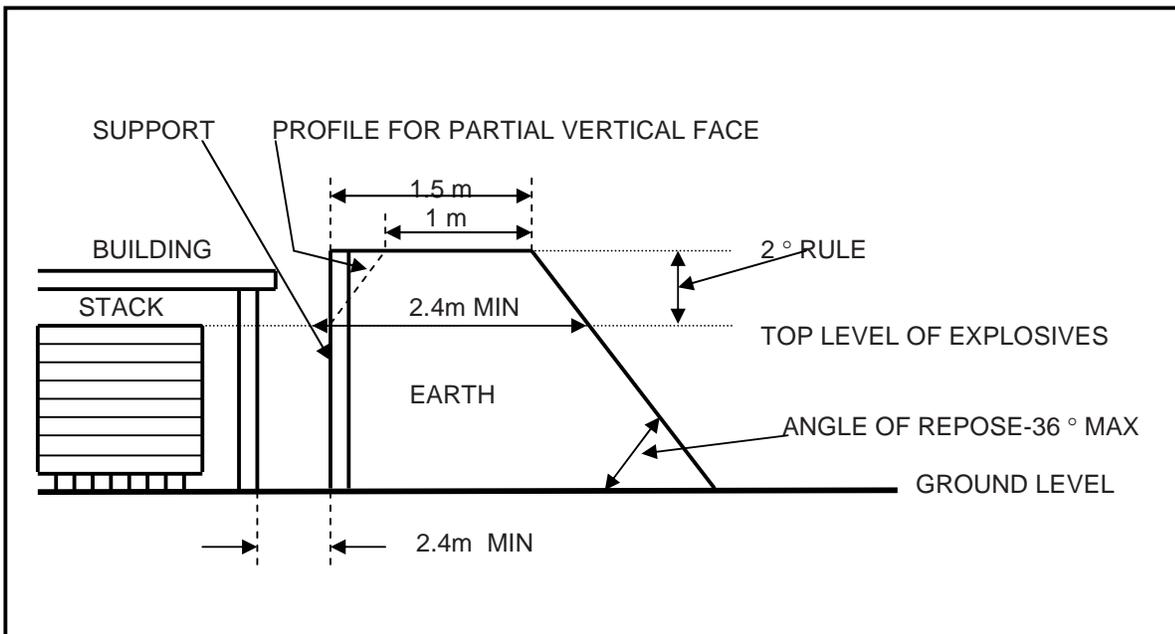


Figure 2-5-3 - Single Slope Vertical Face (or Partial Vertical Face) Barricade

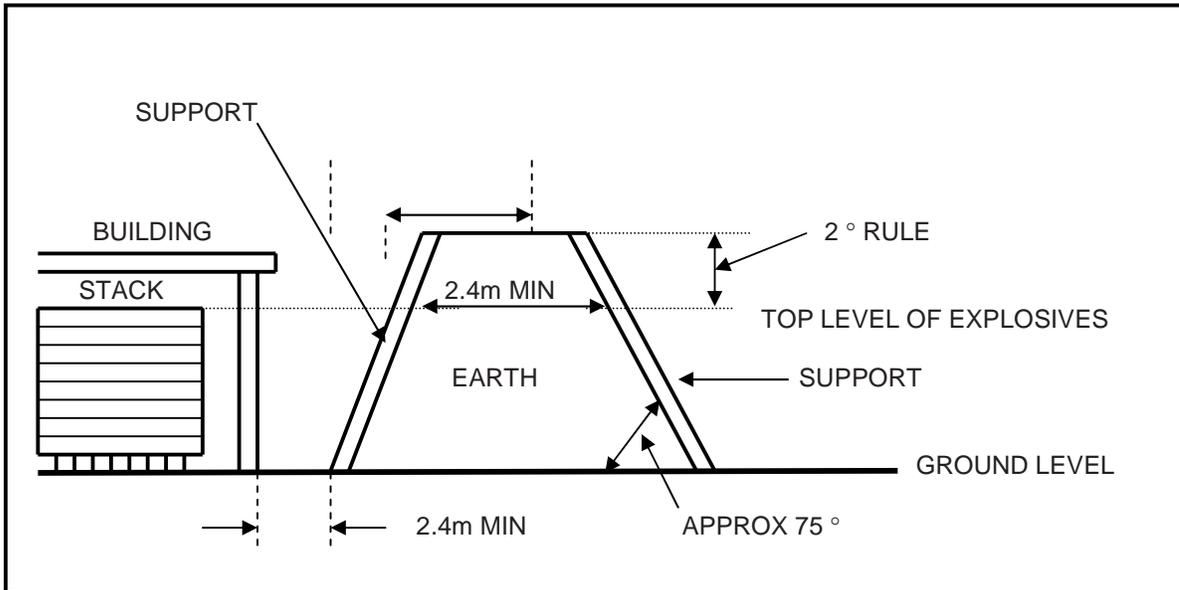


Figure 2-5-4 - Steep Double Slope Barricade

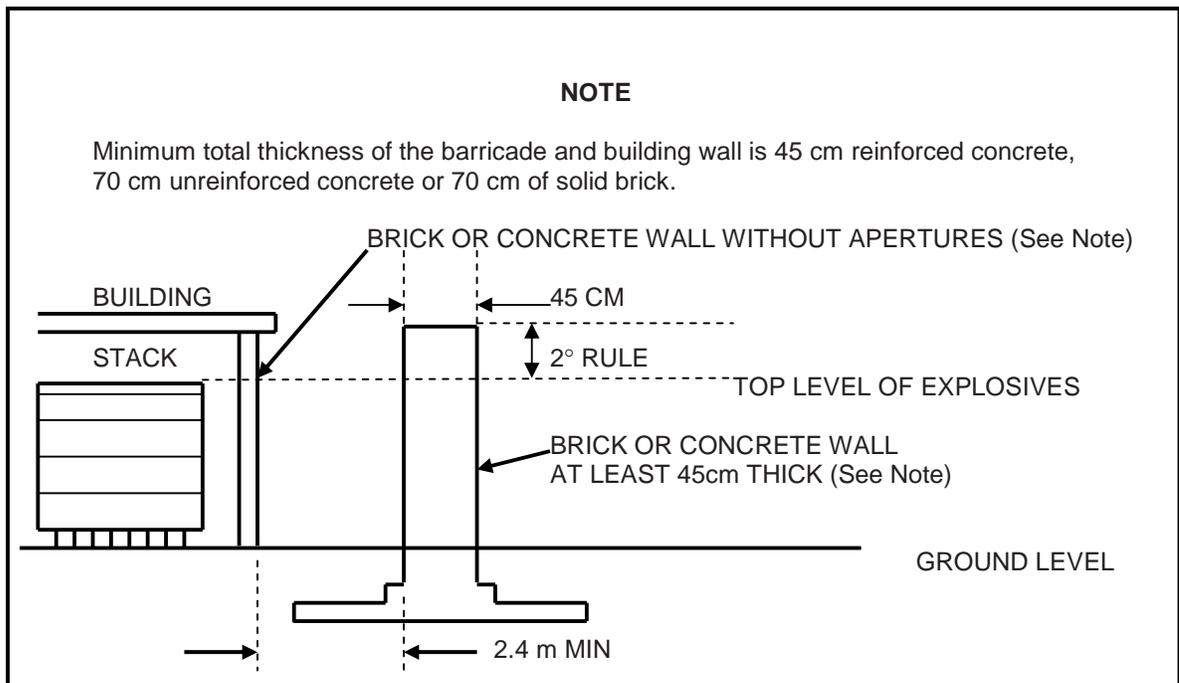


Figure 2-5-5 - Wall Barricade

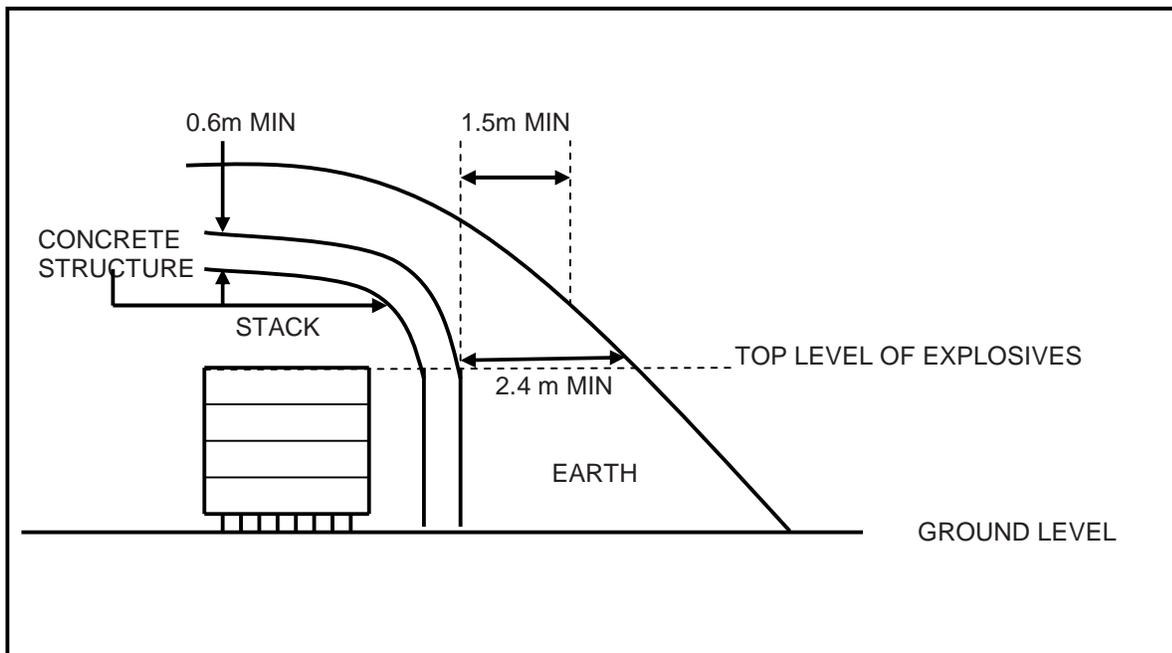


Figure 2-5-6 - Bunker Building or Igloo

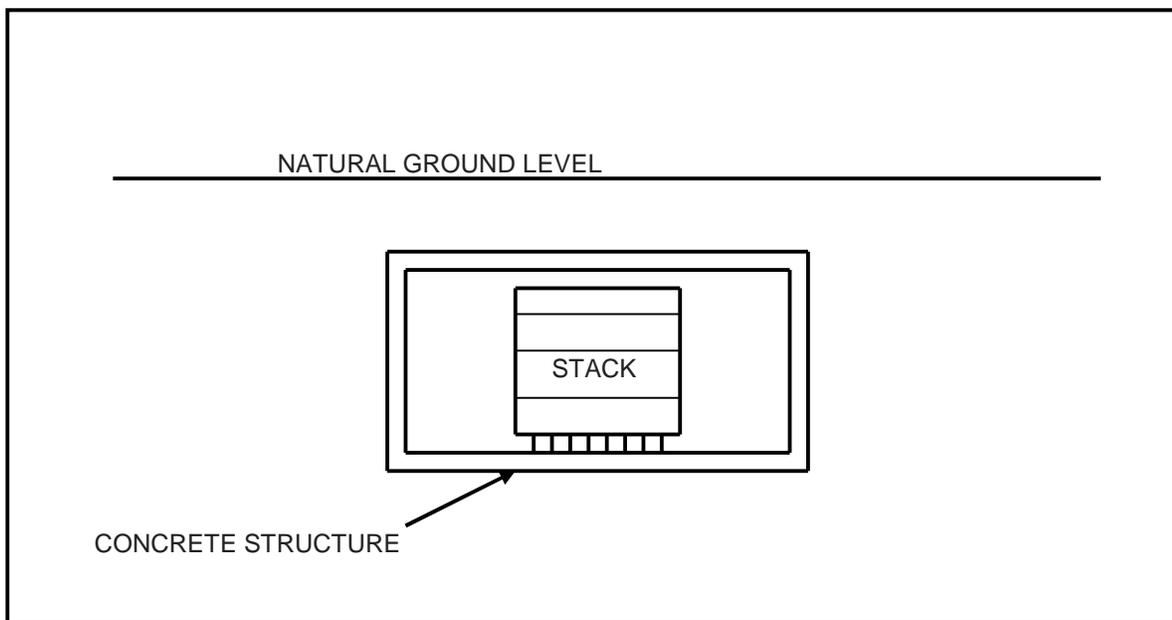


Figure 2-5-7 - Building Below Natural Ground Level

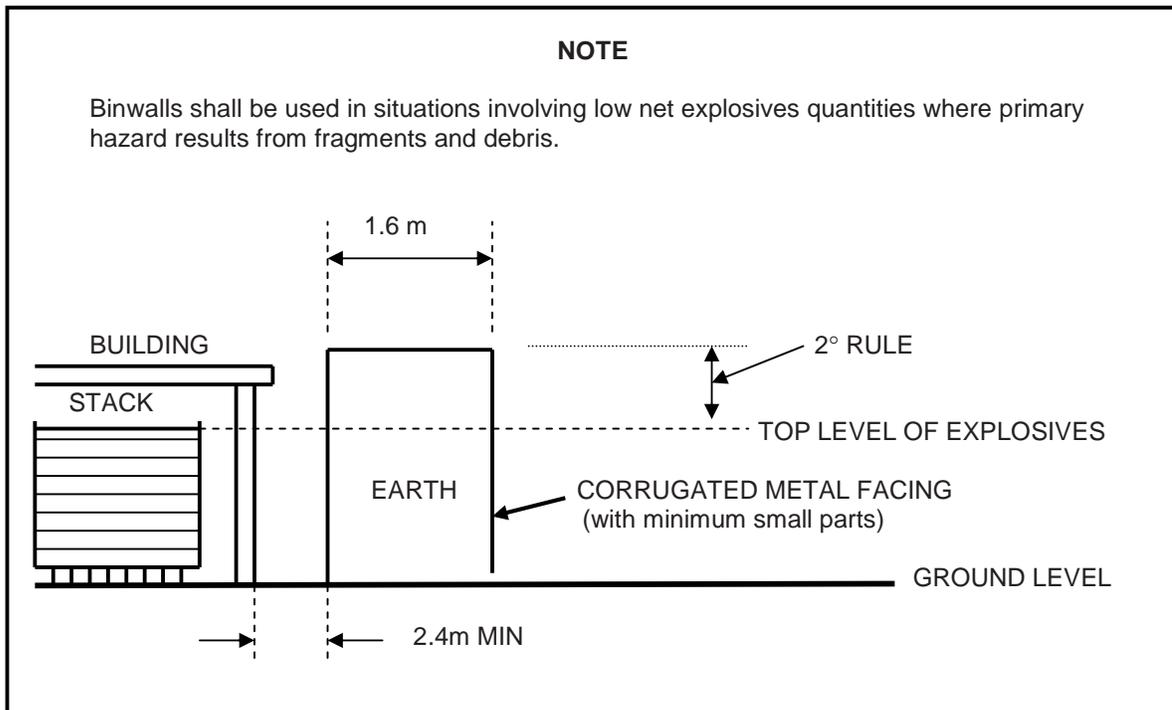


Figure 2-5-8 - Metal Bin Barricade (Binwall)

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**PART 3**  
**SECURITY**

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**PART 4**

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**PART 5**  
**AMMUNITION AND EXPLOSIVES OPERATIONS**  
**SECTION 1**  
**GENERAL SAFETY PRECAUTIONS**

**Paragraphs 1 to 45 inclusive are deleted by this change.**

**Figure 5-1-1 is deleted by this change.**

**PROTECTIVE PACKAGING**

46. Small arms ammunition, pyrotechnics and any other type of ammunition and explosives which are normally packed in cardboard containers or thin plywood crates, shall be repacked by the CFADs, into metal-lined wooden boxes, metal containers or service approved plastic containers prior to being issued to the CF ships. The chosen containers should conform to the designated stowage spaces and securing devices provided in the ships.

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## SECTION 5

### DESTRUCTION OF AMMUNITION AND EXPLOSIVES

#### INTRODUCTION

1. This section contains instructions pertaining to destruction areas. These instructions establish measures and procedures for minimizing the risk in destroying unwanted ammunition and explosives. All destruction operations shall be carried out in accordance with C-09-008-001/FP-000, Destruction of Surplus, Obsolete and Deteriorated Ammunition or, upon publication, C-09-005-004/TS-000. A destruction area normally contains a control point (CP), a stores awaiting destruction (SAD) point, and one or more destruction points (DP).

#### DESTRUCTION AREA AUTHORIZATION

2. Ammunition and explosives shall be destroyed, by detonation or burning, only in authorized locations.

3. Documentation procedures are detailed in paragraphs 16 and 17.

4. For establishments unable to provide the minimum Quantity Distances required by paragraph 6, disposal areas may be authorized, by DAER, subject to restrictions concerning the quantity of ammunition and explosives and the use of procedures and techniques that will limit projections, thermal radiation and blast overpressures to an acceptable level. Documentation procedures are detailed in paragraphs 16 and 18.

5. Burying ammunition or explosives is prohibited. Dumping ammunition or explosives in waste places, pits, wells, marshes, streams, waterways, oceans or any other area not specifically authorized by NDHQ/ DAER is also prohibited.

#### EXTERIOR QUANTITY DISTANCES FOR DESTRUCTION AREAS

6. Destruction areas shall be located with a minimum Quantity Distance of 730 m between the actual destruction point and surrounding magazines, explosives workshops and laboratories, inhabited buildings, places of assembly, highways and railroads.

#### SELECTION OF DESTRUCTION AREAS

7. The ideal destruction area is one with deep soil, free from loose rocks, where trenches and pits can be dug easily and in which the risk of fire is negligible. In the selection of a permanent destruction area, the land should be above rather than below the surrounding area, naturally drained. The destruction area shall be as far as possible from:

- a. magazines and other buildings in the explosives area;
- b. administration buildings;
- c. public or inhabited buildings;
- d. overhead and underground cables;
- e. land drainage systems, water mains, sewers and underground pipelines;
- f. railway and highway cuttings, tunnels and embankments where earth shocks might undermine or cause debris to fall on the tracks or roads; and

g. airfields.

7A. Destruction areas should be sited taking into account not only the effects of blast and fragmentation but also the effects of noise, smoke and vibration on the surrounding exposed sites. While any open area is considered suitable for a DA, each DP should normally have a safety distance of 730 m and must have a minimum distance of 100 m to any exposed site such as roads (except those closed during destruction operations), railroads, overhead power lines, buildings (including ammunition storage facilities), and airfields. There must be no underground utilities within the DA except those that may be required at the CP. The ground should be free of rocks that could be propelled by an explosion and of vegetation that could represent a fire or debris hazard, as well as having good drainage.

7B. The CP must be located not less than 90 m from any DP and from the SAD point.

7C. Destruction points must be located a minimum of 100 m from any exposed site and a minimum of 90 m from the SAD point and CP. For DAs with more than one DP, there should be 60 m between DPs, and there must be no less than 35 m. When there is less than 60 m, the approving authority must ensure that clear guidance on concurrent use, charge preparation, and firings is given on the DA authorization.

7D. A stores awaiting destruction point is a specific location within the DA where stores awaiting destruction and explosives required to effect that destruction are held. The SAD point must not be less than 90 m from the CP and from any DP. The SAD point must also be a minimum of 100 m from any exposed site external to the destruction area.

#### **EXPLOSIVES LIMITS FOR DESTRUCTION AREAS**

8. Explosives limits for destruction areas will vary because of local conditions. In establishing limits for items of Hazard Divisions 1.1, 1.2, 1.3 and 1.4 involved in individual destruction operations, the maximum quantity to be destroyed at any time shall be determined carefully by a qualified ammunition technical officer who shall start with a limited quantity and gradually increase that quantity until the maximum is reached which can be destroyed without undue risk to life and property, and without undue disturbance to the surrounding population.

8A. Within a DA, the required safety distance will depend on the type and quantity of A&E being destroyed, the method of destruction and the degree of protection provided for the personnel conducting the destruction. The maximum NEQ that may be detonated at a DP is dependant on the available distance to the closest exposed site from that DP. For the destruction of pyrotechnics, the maximum NEQ of the demolition stores used must be based upon a safety distance of 40 m/kg on stone-free ground or 60 m/kg on stony ground; with a minimum distance of 100 m. When conducting disposal operations using open detonation, the fragmentation hazard will usually require a greater distance than the blast radius. For the destruction of single rounds of land ammunition natures, the minimum safety distance from the DP to any exposed site must be the positive safety distance found in C-09-008-002/FP-000. Safety distance criteria for the destruction of air and sea element ammunition not listed must be sought from DAEME. For the destruction of multiple rounds, the required safety distances for each single round must be increased by a factor of 1.5.

8B. Reduced safety distances may be used for A&E up to 2.3 kg of high explosives where approved mitigation measures are employed (such as burying with earth cover in a destruction point or sandbagging) to attenuate blast and to reduce the distance travelled by primary fragments. In such cases, the safety distance for non-essential personnel must be used as the minimum distance from the DP to any exposed site.

8C. Destruction areas may be licensed only for those natures and NEQ for which the available safety distances are adequate. A site that cannot achieve the minimum safety distance of 100 m from any destruction point to the closest exposed site must not be licensed as a permanent destruction area.

8D. When not limited either by distance to an exposed site or by other directives, the maximum NEQ authorized for any single destruction point must be 300 kg.

9. When determining these limits, consideration shall be given to:

- a. the maximum radius of fragment and debris hazards;
- b. the maximum radius of blast effects;
- c. shock transmission through the particular ground strata (e.g. high water tables or rock formations);
- d. the effects of overcast weather conditions; and
- e. the effects of wind.

#### **DESTRUCTION AREA MAINTENANCE**

10. Fire breaks shall be maintained around and within destruction areas as required.

11. All trees, dry grass and undergrowth within a radius of 60 m from the destruction point shall be removed.

12. Fences should be erected as required by local conditions and the perimeter of the destruction area shall have no trespassing signs posted.

#### **LOCATION OF BURNING SLABS AND INCINERATORS**

13. Burning slabs and incinerators should be located in destruction areas. Destruction points authorized for burning operations should have a concrete pad (or other hard surface) on which burning trays may be used. The provision of the concrete pad will assist with clean-up operations following destruction by burning.

14. The quantities of ammunition and explosives to be destroyed by burning and the safety distances required shall be determined in accordance with C-09-008-001/FP-000, Destruction of Surplus, Obsolete and Deteriorated Ammunition.

#### **SPLINTER-PROOF SHELTERS**

15. In permanent destruction areas where ammunition is being destroyed by detonation, a splinter-proof shelter must be provided as a control point and to provide protection for personnel.

#### **DESTRUCTION AREA AUTHORIZATION FORM DND 1009**

16. Form DND 1009, Explosives Destruction Area Authorization, shall be the sole authority for destruction areas. The authorization of destruction areas with the required minimum safety distances is the responsibility of the Canadian Army Doctrine and Training Centre Headquarters (CATDC HQ) though the L1 Ammunition Technical Authority. A Destruction Area Authorization is valid for a period of five years from the date of issue or until the circumstances that permitted the authorization of the destruction area changed, whichever comes first. A current site plan of the destruction area showing its location on the base and the distances to magazines, dwellings, radar/radio antennae, traffic routes, destruction area control point shelter and material awaiting disposal shelters must be included.

17. After final authorization is completed at CADTC (see paragraph 18), one copy shall be retained by CADTC. One copy with supporting documentation shall be forwarded to NDHQ/DAER for information.

The original shall be returned to the originating unit where it shall be held on file. One copy shall be attached to the destruction area Standing Orders.

18. Where less than the 730 m required by paragraph 6 is available, NDHQ/DAER authorization is required. CADTC shall forward the DND 1009 form and the supporting documentation to NDHQ/DAER. The submission will be approved or rejected, and it shall be returned to CADTC for the return to the originating unit. DAER shall retain one copy for information.

19. The DND 1009 form does not negate the requirement for the submission of forms required by B-GL-381-001/TS-000, Operational Training, Volume 1 – Training Safety, and C-07-010-011/TP-000, Canadian Forces Air Weapons Ranges, when the destruction area is sited on land or air weapon ranges.

#### **COMPLETION OF FORM DND 1009**

20. Form DND 1009 has been incorporated into the CFRIS program and shall be completed as follows:

- a. Block 1. Indicate the name of the Base or CFAD that will normally perform destruction operations at the destruction area.
- b. Block 2. Location of destruction area.
- c. Block 3. Insert the serial number for the authorization form as follows:
  - (1) UIC of Base or CFAD operating the destruction area;
  - (2) followed by the alpha characters DA; and
  - (3) the last two digits of the current year.
- d. Block 4. Insert the common name assigned to the range.
- e. Block 5. Site plan number and date.
- f. Block 6. Destruction area particulars:
  - (1) List of exposed sites (all of these sites whether on DND property or civilian property need to be shown on site plan);
  - (2) Construction details and location of CP and SAD point;
  - (3) Number of Destruction points; and
  - (4) Any other pertinent details which affects the destruction operations which may be conducted.
- g. Block 7. Block 7 through 10. Based on the number of destruction points, insert the maximum authorized NEQ, the authorized method of destruction, and the exposed site that is closest to that DP and the distance in meters from the exposed site to the DP. Where more than one destruction point has the same limitations and governing exposed site, they may be listed on the same line.

#### **NOTE**

The burning limit for HE must not exceed the NEQ limits for detonation.

- h. DELETED
- j. DELETED
- k. DELETED
- m. Block 11. Based upon available safety distances identify those ammunition natures that may be destroyed at the destruction area. Natures may be authorized in generic terms such as all thin skinned pyrotechnics; all land ammunition natures with positive safety distances less than 300 m. Restrictions on what ammunition natures may be destroyed must also be indicated, such as “no fragmentation grenades.”
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**PART 6**

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**PART 7**

**FIRE PROTECTION AND FIRE FIGHTING IN EXPLOSIVES AREAS**

**SECTION 1**

**FIRE PRECAUTIONS**

**Paragraphs 1 to 29 inclusive are deleted by this change.**

**WATER SUPPLY**

30. Provision shall be made for an adequate water supply to be available throughout the explosives area at all times. The number, size and siting of the static water tanks, and the number of hydrants and volume of water to be provided will be determined by NDHQ/DRPM.

**Paragraphs 31 and 32 are deleted by this change.**

**FIRE ALARM SYSTEM**

33. An efficient fire alarm system shall be installed and maintained. It is to be audible throughout the whole explosives area. Fire alarm points shall be plainly visible in daylight and in the dark. They shall be positioned at strategic points that are readily accessible at all times.

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## ANNEX A

## APPLICABLE ORDERS AND PUBLICATIONS

Order/Publication Number	Title
QR&O, VOL 1, 30.04	Fire Protection Services, Practice Fire Drills
QR&O, VOL 2, 103.59	Negligent Handling of Dangerous Substances
QR&O, VOL 4, 3.2	Defence Controlled Access Regulations
DAOD 2008-3	Issue and Crisis Management
CFAO 20-21	Service Airlift – Materiel (Annex A, Appendix 2, Space Request – Dangerous Cargo)
DAOD 4007-0	Fire Protection Services
CFAO 34-23	Occupational Health
CFAO 34-34	CANCELLED (see CFHS Instruction 4000-21)
DAOD 3026-0	Radio Frequency Safety
DAOD 3026-1	Radio Frequency Safety Programme
DAOD 8000-0	Explosive Ordnance Disposal
DAOD 3002-6	Display Fireworks
DAOD 3002-5	Use of Firearms, Ammunitions and Explosives
DAOD 4003-1	Hazardous Materials Management
DAOD 3002-3	Ammunition and Explosives Safety Program
DAOD 3002-4	Ammunition or Explosives Accident, Incident, Defect or Malfunction Reporting
A-GG-040-006/AG-001	DND Explosives Safety Program
A-GG-040-006/AG-002	DND Ammunition or Explosives Accident/ Incident/ Defect/ Malfunction Reporting
	International Air Transport Association Regulations (IATA)
	International Maritime Dangerous Goods Code (IMDG Code)
	United Nations Recommendations on the Transport of Dangerous Goods(Orange Book)
	Transportation of Dangerous Goods Regulations

Order/Publication Number	Title
A-LM-007-014/AG-001	Canadian Forces Supply Manual
A-LM-008-044/VS-001	United States Bureau of Explosives Pamphlet, No. 6, Illustrating Approved Methods for Loading and Bracing Carload and Less than Carload Shipments of Explosives and Other Hazardous Materials
A-LM-008-045/VS-001	United States Bureau of Explosives Pamphlet, No. 6A, Illustrating Approved Methods for Loading and Bracing Carload Shipments of Military Ammunition and Explosives
A-LM-008-046/NS-001	United States Bureau of Explosives Pamphlet, No. 6C, Approved Methods for Loading and Restraining Shipments of Hazardous Materials for Trailer/Container on Flat Car (TOFC-COFC) Movements Including Less than Trailer/Container Loads and Mixed Loads
A-LM-117-001/FP-001	Transportation of Dangerous Materials by CF Aircraft
A-LM-158-004/AG-001	Transportation Manual, Volume 4, Movement of Materiel
A-LM-187-002/JS-001	Packaging and Preservation, Volume 2, Detailed Procedures
	National Defence Security Instructions (NDSI)
	National Defence Security Policy (NDSP)
B-GA-297-001/TS-000	Safety Orders for CF Air Weapons Systems
B-GL-381-001/TS-000	Operational Training, Training Safety
B-GL-381-003/TS-003	Operational Training, Range and UXO Clearance Handbook
C-02-040-003/TP-000	Handling of Depleted Uranium Ammunition
C-02-040-007/TS-001	General Safety Precautions
C-02-040-009/AG-001	DND General Safety Standards (DND P 41)
C-02-040-010/MB-003	Driver's Manual for Dangerous Goods
	International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air
C-07-010-011/TP-000	Canadian Forces Air Weapons Ranges
C-08-005-120/AG-000	Realty Asset Management Manual, Chapter 10, Fire Protection and Emergency Services
C-09-008-001/FP-000	Destruction of Surplus, Obsolete and Deteriorated Ammunition

Order/Publication Number	Title
C-09-008-002/FP-000	Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas
C-09-011-001/AB-000	Blasters Handbook (CIL)
C-09-011-002/AG-000	RESCINDED
C-09-015-001/AG-000	Ammunition Data Card CF 1040
C-09-153-003/TS-000	Ammunition and Explosives Safety Manual, Volume 3 Naval Vessels
C-09-216-001/TX-000	Ammunition Restrictions-Stock Classes 1300 to 1410
D-09-002-004/SG-000	Identification of Ammunition and Ammunition Packaging
C-74-300-B01/AG-000	Ammunition Maintenance Procedures and Guidelines
C-74-300-B02/NJ-000	Ammunition and Explosives Manual, Inspection of Ammunition
C-74-300-D01/TA-000	Ammunition Logistical Data
C-77-008-001/MS-000	RESCINDED
C-97-005-001/AM-000	Servicing of Portable Ground Fire-Fighting Equipment
C-98-002-003/MS-003	RESCINDED
C-98-016-001/DD-001	Lightning Protection Requirements for Department of National Defence Critical Buildings
C-98-016-MIS/MJ-002	Maintenance and Testing of Grounding Systems QRA and SAS Sites
D-09-002-002/SG-000	Canadian Forces Standard – Ammunition Lotting Procedure
D-09-002-003/SG-000	Specification for Palletization of Ammunition
R-74-007-009/TA-000	Military Explosives
AASTP1(AC/258-D/258)	Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives (issue is controlled and restricted by NDHQ/DAER)
AASTP 2	Manual of NATO Safety Principles for the Transport of Military Ammunition and Explosives (Issue is controlled and restricted by NDHQ/DAER)
C.22.1	Canadian Standards Association (CSA) Standard for Electrical Code(Parts 1 and 2)

Order/Publication Number	Title
CFR 49	U.S. Code of Federal Regulations (Transportation), Parts 100 to 177
CGSB-43.150-97	Performance Packagings for the Transportation of Dangerous Goods
CGSB-43.151-97	Packaging of Explosives, Class 1, for Transportation
CGSB-81-GP-1M	Flooring Conductive and Spark Resistant
NFPA 78-1986	Safety Code for the Protection of Life and Property Against Lightning
NRCC No. 15557	National Research Council of Canada-Fire Performance Ratings
STANAG 2158	CANCELLED
STANAG 2322	CANCELLED
STANAG 2828	Military Pallets, Packages and Containers
STANAG 2890	CANCELLED
STANAG 3854	Policies and Procedures Governing the Air Transportation of Dangerous Cargo
STANAG 4123	Determination of the Classification of Military Ammunition and Explosives
AECTP-500	Electromagnetic Environmental Effects Tests and Verification Ammunition and Explosives Instructions

## GLOSSARY

Certain terms used in this publication have particular meanings more specific or inclusive within the scope of A&E than their common dictionary interpretations. The order of precedence for terminology sources is as follows, except when specifically defined within this volume:

- a. The Defence Terminology Bank(<http://terminology.mil.ca/term-eng.asp>).
- b. Approved subject matter or specialized glossaries and reference books.
- c. The Translation Bureau terminology and on-line databank Termium Plus® (<http://btb.termiumplus.gc.ca/tpv2alpha/alpha-eng.html?lang=eng>).
- d. The latest editions of the Canadian Oxford Dictionary for English and Le Petit Robert for French.

For the purpose of this publication, the following terms and definitions apply:

DELETED

**administration area** /zone administrative

An area where administrative support functions for a fixed ammunition facility or a base explosives area are being carried out. Personnel working in the administrative area are not usually directly involved with any ammunition function. The QD used is inhabited building distance.

DELETED

**ammunition** /munition

1. A device charged with explosives, propellants, pyrotechnics, initiating composition or nuclear, biological or chemical material for use in connection with defence or offence, including demolitions. Certain ammunition can be used for training, ceremonial or non-operational purposes.
2. In this Manual the term is restricted to conventional ammunition and the conventional explosive components of nuclear ammunition or ammunition containing toxic chemical agents. This Manual does not deal with nuclear or toxic hazards or their classification.

### NOTE

The term "ammunition" in its restricted meaning is used throughout this publication in the same sense as "explosive article" is used in the United Nations Recommendations on the Transport of Dangerous Goods, Orange Book and in the International Maritime Dangerous Goods (IMDG) Code to mean an article containing one or more explosive substances.

DELETED

**ammunition salvage** /matériel récupéré

Scrap resulting from range practices or from ammunition workshop procedures. It will consist of readily identifiable ammunition components, such as fired cartridge cases, small arms brass, etc.

**approved package** /emballage réglementaire

The container in which ammunition and explosives are packed as detailed by the design authority, Substitute packages for less than original quantities should be equally as strong as the original package.

**approved seal** /sceau approuvé

A seal Metallic C1 or seal Cloth Linen, bearing an approved station monogram which is used as a quality assurance device. It is not a security appliance.

| DELETED

**armoured fighting vehicle** /véhicule blindé de combat

A vehicle which is armoured and not intended for logistic transport of ammunition. The ammunition carried by this type of vehicle is for use in its own weapon(s).

**assembly** /montage

The fitting together of the necessary components or separate parts to make up an item of ammunition.

| DELETED

**barrier** /barrière

A red coloured board or marker used to indicate the division between "clean" and other areas.

| DELETED

**branch office** /bureau

An office in the explosives area used by personnel whose continued presence in the explosives area is essential to its operation. This office is not used as a rest area or for general administrative functions. An example is an office provided for an assembly building or explosives workshop supervisor located close to the operation.

| DELETED

**cartridge** /cartouche

A round of ammunition wherein the propellant and primer are contained in a casing and in which propellant, primer and projectile (where present) are assembled, stored, shipped and issued as a complete unit.

| DELETED

**curtain wall building** /bâtiment à murs rideaux

A building of skeleton frame construction with exterior walls that carry no load other than their own weight. These non-load bearing walls are inherently weak to the lateral forces associated with blast loads and when so stressed may shatter or be displaced as units, endangering exposed personnel both inside and outside the building (see *vulnerable construction*).

| DELETED

**data card** /fiche de munitions

An identification card which is prepared for each lot of ammunition or explosives and used by the CF to record and identify technical data and lot history. Space is also provided for recording of inspections, proofs, restrictions, issues, receipts, stock balances, packaging data and storage locations.

DELETED

**explosive** /explosif

A substance manufactured with a view to producing a practical effect by explosion or pyrotechnic effect. An explosive atmosphere of gas, vapour or dust is not considered to be an explosive.

**NOTE**

The term "explosive" is used throughout this publication in the same sense as "explosive substance" is used in the United Nations Recommendations on the Transport of Dangerous Goods, Orange Book, and in the International Maritime Dangerous Goods (IMDG) Code to mean in its broadest sense all explosive and pyrotechnic substances. The term may be made more restrictive by qualifying it with such terms as "primary".

DELETED

**fixed ammunition facility** / installation fixe de munitions

An establishment, other than an ammunition depot, that is constructed for permanent storage of ammunition and explosives. Some fixed ammunition facilities may also have the capability to carry out detailed inspections and repair of ammunition in support of official tasking.

DELETED

**hardstand** /aire de stationnement

A flat area (usually paved or a cement slab) located in an explosives area and used for outside, temporary storage of ammunition or explosives.

DELETED

**inhabited building** /habitation

Building or structure occupied in whole or in part by people, either within and outside DND establishments. These include, but are not limited to, offices, schools, churches, residences and quarters, service clubs, aircraft passenger terminals, stores, shops, factories, hospitals, theatres, messes, post offices and indoor recreational facilities.

DELETED

**isolation magazine** /magasin d'isolement

A magazine used for the temporary storage of ammunition and explosives which, for safety reasons, must not be stored in ordinary magazines.

DELETED

**magazine** /magasin

Any building or structure used exclusively for the storage of ammunition and explosives.

DELETED

**multi-compartmented magazine** /magasin à compartiments multiples

A magazine comprised of a number of compartments. The external walls, doors and internal dividing walls shall have a fire rating of at least 2 hours. A separate entrance shall be provided to each compartment. Subject to available QD and physical capacity, the NEQ for the entire magazine shall not exceed 2 500 kg except for HD 1.4 which may be stored to the physical capacity of the magazine.

**multi-cubicle ready-use magazine** /magasin à cellules de disponibilité immédiate

A magazine comprised of a number of cubicles with the dividing walls constructed to a Substantial Dividing Wall specification (see *substantial dividing wall*). The capability of these walls to prevent simultaneous detonation of mass detonating explosives in adjacent cubicles is based on a limit of 190 kg NEQ of Hazard Division 1.1 explosives located 1 m from the substantial dividing walls.

**munitions scrap** /rebut de munitions

Scrap recovered from ranges as a result of range practices. It will usually consist of shell/mortar fragments, spent projectiles, burnt out pyrotechnics, rocket hardware and other similar items which result from consumed ammunition and the remains of hard targets.

DELETED

**non-combustible construction** / construction incombustible

A stone, brick, concrete or metallic structure free from fixtures or fittings which could ignite under the intense heat produced by a propellant fire or by a mass explosion in immediately adjacent buildings.

DELETED

**prohibited articles** /articles interdits

Matches, lighters and other spark or flame producing devices, dangerous goods, all flammable materials or any other items specifically prohibited from the explosives areas by this publication or any other CF regulations.

DELETED

**qualified person** /personne compétente

A person who has received military occupation training which incorporates the principles of explosives safety and transportation (see C-09-005-001/TS-000).

DELETED

**spark proof** /anti-étincelles

The term used to describe equipment which is so designed to ensure no flames or sparks will escape to the surrounding atmosphere from within its case or enclosure. Also referred to as spark enclosed.

**stacks** /ilots

Safe, orderly groupings of ammunition, explosives and related component parts in storage.

DELETED

**substantial dividing wall** /mur de refend plein

A wall designed to prevent simultaneous detonation of quantities of ammunition or explosives on opposite sides of the wall. For the purpose of this publication, a substantial dividing wall shall be a reinforced concrete wall not less than 30 cm thick. It shall be secured to prevent overturning and shall be keyed to the cross walls. Both wall faces shall be reinforced with not less than 15 M (Metric Bar) (or #4 in existing facilities) bars located not less than 50 mm from the face, spaced not more than 30 cm horizontally and vertically. Bars on one face shall be staggered with regard to bars on the opposite face; the vertical bars shall be lapped with the foundation reinforcing and all reinforcing is to be continuous through all joints. The concrete shall have a minimum design compressive strength of 20 MPa (mega Pascals) (or 2 500 psi in existing facilities).

DELETED

**traffic route** /artère de circulation

A road used for general traffic; a railway outside the explosives area which is used for public passenger traffic; a waterway, such as a river having tidal water and canal, used by passenger vessels; and other waterways where special consideration is warranted.

**transit building** /bâtiment de transit

A magazine used to prepare and process receipts and issues of ammunition and explosives.

DELETED

**vulnerable construction** / construction vulnérable

Buildings of vulnerable construction are of three main types as follows:

- a. Type 1. A building of Curtain Wall Construction which has four storeys or more and is constructed with external non-load bearing panels on a separate sub-frame which is supported off the structural frame or floors for the full height of the building. Where these cladding panels are large (greater than 1 500 mm square) and constructed of glass or similar light weight frangible material, which is liable to shatter producing dangerous fragments or be displaced under the effect of lateral explosive blast loads greater than the designed wind forces, the curtain walling would be considered a hazard to personnel both inside and outside the building because of flying fragments or falling panels.
- b. Type 2. A building of Largely Glass Construction that has four storeys or more and has more than 50 per cent of its wall area glazed.
- c. Type 3. The third type of Vulnerable Construction is impracticable to define precisely. This covers any large building which employs non-load-bearing cladding panels, eg, glass covered market gardens or warehouse type retail stores. The explosion effects on such buildings depends on many factors, including:
  - (1) the weight per unit area and frangibility of the cladding material;
  - (2) the detailed design of the frame structure including stiffening partitions;
  - (3) the use to which the building is dedicated; and

- (4) the local population inside and outside the building.

**NOTE**

Definition of this type of construction cannot be more precise because of the variation in types of modern structures and the complexity of the interaction of the factors given. There is no real alternative to individual assessment of any large building within two times Inhabited Building Distance which is not of traditional house construction.

**waiver** /dispense

Written authorization to deviate from prescribed ammunition and explosives safety regulations or other mandatory specifications, because of the operational necessity or operation impracticability. A waiver is usually granted for a specific period and under prescribed safety provisions.

**water activated material** /matériau réactif à l'eau

Material which reacts violently upon mixture with water.

**water reactive material (solid)** / matériau réactif à l'eau (solide)

Any solid substance (including sludge and paste) which, by interaction with water, is likely to become spontaneously flammable or which will give off flammable or toxic gases in dangerous quantities.

**with a propelling charge** /avec charge propulsive

The propelling charge is assembled to the projectile or packed with the projectile in the same package or pelletized with the projectile on the same pallet.

**LIST OF ABBREVIATIONS**

DELETED		
<b>ADM(IE)</b>	Assistant Deputy Minister (Infrastructure and environment)	
DELETED		
<b>ATO</b>	ammunition technical officer	
DELETED		
<b>BL</b>	breech loading	
<b>C</b>	Celsius	
DELETED		
<b>CF</b>	Canadian Forces	
<b>CFAD</b>	Canadian Forces Ammunition Depot	
<b>CFAO</b>	Canadian Forces Administrative Orders	
DELETED		
<b>CFR</b>	Code of Federal Regulations	
DELETED		
<b>CFTO</b>	Canadian Forces Technical Order	
<b>CGSB</b>	Canadian General Specifications Board	
DELETED		
<b>cm</b>	centimetre	
<b>C Navy</b>	Chief of the Naval Staff	
DELETED		
<b>CSA</b>	Canadian Standards Association	
DELETED		
<b>DND</b>	Department of National Defence	
DELETED		
<b>HD</b>	Hazard Division	
<b>HE</b>	high explosive	
DELETED		
<b>IATA</b>	International Air Transport Association	

**ICAO** International Civil Aviation Organization

| DELETED

**IMDG** International Maritime Dangerous Goods Code

| DELETED

**NATO** North Atlantic Treaty Organization

**NBCC** National Building Code of Canada

**NDHQ** National Defence Headquarters

| DELETED

**NEQ** Net Explosives Quantity

| DELETED

**PES** Potential Explosion Site

| DELETED

**POL** petroleum, oil and lubricants

| DELETED

**QD** Quantity Distance

| DELETED

**QR&O** Queens Regulations and Orders for the Canadian Forces

| DELETED

**SAS** special ammunition storage

**SOP** standing operating procedure

| DELETED

**TOFC** trailer on flat car

| DELETED