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# DIRECTOR AMMUNITION AND EXPLOSIVES REGULATION

## Annual Report

Thirteenth Report to the Deputy Minister and the Chief of the Defence Staff

A Review from

1 April 2020 to 31 March 2021



Canada

## Cover Photo

*A pilot inspects his Cf-188 Hornet fighter jet in preparation for the next mission at Camp Patrice Vincent, Kuwait during Operation IMPACT on January 17, 2015.*

*Leading Seaman Jennifer Buckle, a member of the boarding party from Her Majesty's Canadian Ship WINNIPEG fires a 9mm pistol on the flight deck of the ship as part of an exercise during POSEIDON CUTLASS, March 15, 2017.*

*Canadian Armed Forces members with NATO's enhanced Forward Presence Battlegroup Latvia defend their position during a simulated early morning battle on August 23, 2017, as a part of the Certification Exercise being held at Camp Adazi, Latvia during Operation REASSURANCE.*

*Corporal Brendan McDevitt (left) and Master-Corporal Steven Drinkwalter prepare to load a CH124 Sea King helicopter with two MK46 torpedoes during hot torpedo load training on the flight deck of Her Majesty's Canadian Ship REGINA on May 22, 2014 in support of NATO Reassurance Measures in the Mediterranean Sea.*

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**Thirteenth Report to the Deputy Minister and the Chief of the Defence Staff**  
**A Review from 1 April 2020 to 31 March 2021**



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# EXECUTIVE SUMMARY

## INTRODUCTION

The Director Ammunition and Explosives Regulation's annual report to the Deputy Minister and Chief of the Defence Staff provides an independent assessment of the state of ammunition and explosives safety within the Department of National Defence and Canadian Armed Forces. This is accomplished through the execution of an Ammunition Program-based compliance assurance program and a careful review and consideration of organizational practices around the Ammunition and Explosives Safety Program.

The report is divided into six parts:

- a. Executive summary;
- b. Section 1 – Prologue;
- c. Section 2 – Policy review;
- d. Section 3 – Ammunition Program compliance oversight;
- e. Section 4 – Ammunition and Explosives Safety Program; and
- f. Section 5 – Report conclusion.

The executive summary provides an overview of key observations made during the course of the reporting year and ends with the assessed overall state of ammunition and explosives safety within the department. While the report highlights areas for improvement within assessed elements of the Ammunition Program, it is important to recognize that Groups and Commands have already initiated efforts in some areas to address observations where improvement is required.

## KEY OBSERVATIONS – DEPARTMENTAL STRENGTHS

The following observations highlight areas where the department has been successful in strengthening its Ammunition and Explosives Safety Program.

### Demilitarization and disposal

Collectively, the department successfully reduced its stockpile by 1 566K kilograms through sale, demilitarization and destruction operations. As a result and for FY 2020/21, DND's stockpile<sup>1</sup> awaiting disposal was established at approximately 7 500K kilograms.

<sup>1</sup> Includes ammunition and explosives that is surplus, obsolete, deteriorated and time-expired, as well as munition scrap and spent brass/steel cartridge cases.



## Ammunition and explosives warehousing and management

This year witnessed an overall improvement in the quality of ammunition and explosives inventory warehousing and management oversight within the Canadian Special Operations Forces Command and the Canadian Joint Operations Command. Ammunition and explosives safety inspection results were assessed as acceptable, with exceptional improvement within the Canadian Joint Operations Command.

### Infrastructure siting

An increased understanding of and adherence to policies surrounding the siting of ammunition facilities was observed during the reporting period. Enhanced lines of communication between the ammunition and real property communities have led to a better understanding of requirements, greater coordination and informed decision making. As a result, planning for new infrastructure will allow licensing of ammunition and explosives-related facilities to meet operational requirements without resorting to risk-based licences.

### Civilian Ammunition Technicians

The status of full-time Civilian Ammunition Technicians is improving. This is attributed to the introduction of standardized training material delivered through a decentralized on-line methodology. It is projected that 29 direct entry Civilian Ammunition Technicians 2 level technicians will graduate by 2022 and 14 new Civilian Ammunition Technicians 3 and 4 level technicians will be generated using the new training system.

## KEY OBSERVATIONS – OPPORTUNITIES FOR IMPROVEMENT

The following observations highlight departmental opportunities for improvement requiring increased Group and Command oversight.

### Departmental policies

**A repeat observation**, C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas*, details the authorized methods for explosive ordnance disposal on land and is currently outdated and requires a comprehensive review. This represents a potential safety risk to Canadian Armed Forces personnel conducting explosive ordnance disposal operations, there is a requirement for the Canadian Army to initiate a review of the policy document.

## Ammunition and explosives safety inspection – aggregated results

The aggregate self-assessed ammunition and explosives safety inspection results for Groups/Commands was assessed as **improvement required**. Specific areas of attention were centred on a failed safety inspection within Canadian Special Operations Forces Command and the Canadian Army's inability to inspect ten (10) of its eleven (11) second line facilities.

### Ammunition and explosives safety information management system

**A repeat observation**, this year witnessed an overall lack of understanding, an underutilization and an absence of enforcement for the implementation of the ammunition and explosives safety information management system as the department's system of record. Where safety inspections were not executed and/or results not recorded, there is a concern that safety-critical risks are left unaddressed and could adversely impact personnel safety and operations. Though there is a requirement for increased vigilance and oversight at all levels, this is particularly important at the Group/Command level to ensure prompt tracking and completion of explosives safety-related management action plans.

### Occurrence reporting

**A repeat observation applicable to all Groups/Commands**, once an investigation report was released by a unit, Groups/Commands averaged 126 days to review and close cases in the ammunition and explosives safety information management system. Of the 117 cases initiated during the reporting period, only 32 were closed as of 31 March 2021, leaving 85 active cases pending Group/Command review and action, the majority of which fall under the Canadian Army. While there has been some effort towards closing reports, there remain 171 active reports awaiting Group/Command action since the implementation of the ammunition and explosives safety information management system in April 2017.

**A repeat observation applicable to all Groups/Commands with a downward trend**, where preventive measures were being recorded within the ammunition and explosives safety information management system, 46% of the preventive measures were not actively tracked and/or updated by responsible Groups/Commands. Failure to action preventive measures or update the ammunition and explosives safety information management system and maintain an accurate system of record could lead to increased safety risks and potential departmental liabilities.



**A repeat observation applicable to all Groups/Commands with a downward trend**, whereas investigations of ammunition and explosives occurrences were explicit in defining “what” had occurred, only 21% of the reports addressed the “why” and the “how” of occurrences, adversely affecting the department’s ability to identify root causes and appropriate preventive measures. A review of individual ammunition and explosives practitioner training programs indicates that instruction covering event analysis, identification of causal factors and understanding systemic causes of failure in complex systems is inadequate or missing. The absence of comprehensive ammunition and explosives training aimed at standardizing investigations and identifying root causes and effective preventive measures across the department represents a real concern and contributes to the department’s challenge in preventing a recurrence or mitigating consequence(s).

#### **OVERALL ASSESSMENT OF THE STATE OF AMMUNITION AND EXPLOSIVES SAFETY WITHIN THE DEPARTMENT OF NATIONAL DEFENCE AND CANADIAN ARMED FORCES**

**Overall, the state of ammunition and explosives safety within the Department of National Defence and Canadian Armed Forces has been assessed as improvement required.**

The department’s ability to maintain a healthy ammunition and explosives safety program hinges on its ability to effectively address and oversee the challenges that have been identified in this report. Many of the observations in this report have appeared in previous reports and have not been adequately addressed. Barring the implementation and effective oversight<sup>2</sup> of management action plans, the department’s Ammunition and Explosives Safety Program will continue to be adversely affected, impacting safety and operational capability.

Observations related to infrastructure, practitioner competency<sup>3</sup> and occurrence reporting are strategic in nature, affect more than one Level 1 organization and require a concerted effort and whole-of-Ammunition Program approach to resolve. The absence of management action plans to address safety critical observations raised within the annual reports represents a significant challenge for the Department of National Defence and Canadian Armed Forces.



<sup>2</sup> Whereas the Ammunition Program Oversight Committee can act as an enabler, it has no authority over responsible Groups and Commands.

<sup>3</sup> Competency is defined as the state of being suitably qualified and experienced.





*Major Carra Greenhorn (left), a social worker deployed aboard HMCS FREDERICTON helps with the unloading of a Bofors 57mm canon as part of its post fire maintenance during Operation REASSURANCE, May 19, 2020.*

# PROLOGUE

This report provides a “health check” on the state of ammunition and explosives safety and risk management for the Department of National Defence and Canadian Armed Forces.

Ammunition and explosives activities under the direction or control of the Minister of National Defence are exempt from the provisions of the *Explosives Act*. Notwithstanding, the Department of National Defence and Canadian Armed Forces have an obligation to oversee the spectrum of their ammunition and explosives related activities to ensure safety through the effective control, management and use of this strategic commodity during its life cycle.

As the Department of National Defence and Canadian Armed Forces functional authority for ammunition and explosives regulation and safety, the Director Ammunition and Explosives Regulation has adopted the following departmental regulatory oversight strategy, which sets the stage for the report:

- a. safety through the provision of policies, orders and directives;
- b. safety through the execution of an Ammunition Program-based, risk-informed compliance assurance program; and
- c. safety through the oversight and management of the ammunition and explosives safety program.

A foundational tenet of the report is that transparency, dialogue and collaboration will strengthen the regulatory framework. Accordingly, the enclosed report was coordinated and discussed with all Level 1 organizations, at the technical staff and senior leadership levels, during the reporting year and prior to finalization.







*Members from 3<sup>rd</sup> Battalion, The Royal Canadian Regiment and members from 2 Combat Engineer Regiment work together to breach a simulated building during a training exercise in the Garrison Petawawa training area, 22 October 2020.*



# POLICY

## INTRODUCTION

Except as provided by the *Explosives Regulations, 2013*, the *Explosives Act* does not apply to explosives under the direction or control of the Minister of National Defence (MND). Within the Department of National Defence (DND) and the Canadian Armed Forces (CAF), the Director Ammunition and Explosives Regulation (DAER) is the functional authority for ammunition and explosives (A&E) regulation and safety. DAER meets its mandate in part through the collaborative development and promulgation of A&E safety policies, orders, directives and other instruments related to the safe acquisition, storage, transportation, inspection, maintenance, authorized modification, issue, use and disposal of A&E under the direction or control of the MND, including A&E used for research and development.

While technical authorities are distributed across several Groups and Commands, DAER is responsible for overseeing the development of departmental A&E safety policies to ensure they remain relevant and current. This is achieved through a three-year policy review cycle and collaborative engagement with departmental technical authorities.

This section of the annual report discusses significant amendments and findings as they relate to departmental A&E safety policies. Current status, supporting documents and general policy information can be found on the [Director Ammunition and Explosives Regulation \(mil.ca\)](https://mil.ca) intranet site.

## AMMUNITION AND EXPLOSIVES SAFETY MANUALS

C-09-008-002/FP-000, *Ammunition and Explosives Procedural Manual – Destruction of Dud and Misfired Ammunition on CF Ranges and Training Areas*. **This is a repeat observation.** This publication details the authorized methods for explosive ordnance disposal (EOD) on land and is currently issued under the authority of DAER. The Defence Administrative Order and Directive (DAOD) 1000-8, *Policy Framework for Safety and Security Management* identifies the Chief of the Army Staff as having functional authority over EOD including issuing orders and directives. Throughout the reporting period and despite renewed discussions during the Demolition and Explosives Training working group held in January 2021, the Canadian Army (CA) has yet to accept responsibility, accountability and authority for the policy due to reported resource limitations within the Joint Counter Explosives Threat Task Force. Delays in transferring, reviewing and updating the publication continue to represent a potential safety risk to CAF personnel conducting EOD operations.





A-GG-040-006/AG-001, *Ammunition and Explosives Safety Program*. This policy document supplements and amplifies DAOD 3002-3, *Ammunition and Explosives Safety Program* by providing policy, direction, and guidance for DND employees and CAF members on the content and implementation of an ammunition and explosives safety program (AESP). During the reporting period the policy was subject to an extensive review and significant amendments. Of note, the revision addressed a long-standing management action plan identified during the 2005 Chief Review Services evaluation by establishing the DND/CAF A&E safety recognition program. Established to foster A&E safety within the DND and the CAF, the recognition program acknowledges A&E safety excellence in our civilian employees and military members who demonstrate resourcefulness and inspire positive actions that promote A&E safety.

D-09-002-010/SG-000, *Standard – Assessment of the Safety and Suitability for Service of Ammunition and Explosives*.<sup>4</sup> Efforts to transfer ownership of this procedural manual from DAER to the A&E Technical Authority –the Director Ammunition and Explosives Management and Engineering (DAEME) within the Assistant Deputy Minister Materiel (ADM(Mat)), were initiated during the reporting period through a joint working group. This initiative is expected to continue throughout the upcoming fiscal year.

## POLICY GUIDANCE/INTERPRETATION

A&E transported by a commercial carrier within Canada is not considered to be under the direction or control of the Minister of National Defence unless it is escorted by a DND employee or a CAF member. For A&E to be shipped without a DND/CAF escort, the *Explosives Regulations, 2013* require the issuance of a certificate of authorization by Natural Resources Canada's Explosives Regulatory Division (NRCAN ERD), the application for which relies on the ability to provide extensive A&E technical data not always readily available within the department.

In light of the department's unique operating environment and in recognition of its A&E certification process<sup>5</sup>, the DND has been working with NRCAN ERD, Transport Canada and the Department of Justice to amend the MND's exemption from the *Explosives Regulations, 2013*. The proposed amendment would allow DND/CAF to ship A&E on public roads via commercial carrier without the requirement for a NRCAN-issued certificate of authorization. The amendment is expected to form part of the Canada Gazette in December 2021. Promulgation of the revised Act and associated Regulations is expected in 2022.

**BOTTOM PICTURE:** Royal Canadian Air Forces (RCAF) members conduct a jettison flare shoot with HMCS WINNIPEG's CH-148 Cyclone helicopter during Operation PROJECTION-NEON on 22 September 2020.



<sup>4</sup> This publication is currently issued under the authority of DAER.

<sup>5</sup> Both NRCAN and DND rely on the certification standards as established by the United Nations.

## EXTERNAL POLICY ENGAGEMENT

### North Atlantic Treaty Organization

The North Atlantic Treaty Organization (NATO) Allied Committee 326 Sub Group C is responsible for developing and maintaining standards and guidance for in-service and operational A&E safety. Chaired by Canada, the subgroup work on revising quantity distance (QD) tables and on updating the airfield criteria within the Allied Ammunition Storage and Transport Publication 1 (AASTP-1), *NATO Guidelines for the Storage of Military Ammunition and Explosives* has been completed. The revised QD tables take into account the fragmentation and thermal consequences of an unintended explosion as well as blast. Canada intends to ratify the changes to the QD methodology in AASTP-1 with an implementation date of 01 April 2022. Existing QD licences that are still valid on 31 March 2022 will remain valid until their expiry date, after which there will be a requirement to license the facilities in accordance with the revised tables.

During the reporting period the Ports Criteria Working Group (PCWG) continued to work on the content of AASTP-1, Part IV, Chapter 6, Naval and Military Ports. In particular, the PCWG agreed in principle on using a risk-informed approach to address operational requirements to keep A&E onboard naval and military vessels while berthed.

The intent is to provide commanders with operational flexibility while recognizing and accepting the potential for increased safety risks. Promulgation of the revised AASTP-1 is expected in April 2022.

### United Nations

The United Nations (UN) International Ammunition Technical Guidelines (IATG) are designed to assist States without an existing A&E regulatory framework to create national standards and national standard operating procedures by providing a frame of reference which can be used, or adapted for use, as a national standard. The department continued to provide a representative on the Technical Review Board to ensure coordination of the comparable guidelines between NATO, the UN and Canada as well as review and update the IATGs.

## CONCLUSION

Throughout the reporting year, the department pursued its goal of continuous improvement by reviewing and amending its A&E safety policies in support to DND/CAF operations. A stronger commitment by the CA's functional authority for EOD would strengthen the department's A&E safety program by ensuring the timely review and promulgation of EOD safety policies and associated standards.



Air crew members from CH-148 Cyclone helicopter, Raptor, fire a C6 general purpose machine gun while in flight to practice engagements during Operation REASSURANCE on 27 August 2020.





*After securing the vessel carrying 250 kilos of cocaine and 100lbs of marijuana, HMCS SASKATOON preps to perform a demolition of the hazard to navigation while deployed on Operation CARIBBE in the Pacific Ocean 24 March 2021.*

# AMMUNITION PROGRAM COMPLIANCE OVERSIGHT

## INTRODUCTION

A&E safety compliance oversight within DND and the CAF is accomplished, in part, through the execution of compliance activities against the elements of the Ammunition Program (figure 1) and a careful review and consideration of organizational practices around the AESP.<sup>6</sup>

While offices of primary interest (OPIs) have been identified for each element of the Ammunition Program, A&E safety compliance activities are applied against Program Elements as per the department's A&E safety compliance model (figure 2).

The following paragraphs provide the results, by program element, of A&E safety compliance verification and assurance activities over the reporting period.

## ELEMENT 2 – A&E EQUIPMENT PROGRAM MANAGEMENT

Groups and Commands with a responsibility for the life cycle management and engineering of A&E are subject to annual compliance activities as per figure 2. Overall, the assessed state of the A&E equipment program management has been assessed as **acceptable**.

### Observations and findings

#### *Ammunition and explosives safety audits*

A first compliance audit of the life cycle management and engineering functions within ADM(Mat)'s Director General Land Equipment Program Management (DGLPEM)/DAEME organization was executed in August 2020 following ADM(Mat)'s endorsement of the ammunition and explosives safety audit (AESAs) standard. The audit yielded positive results with only minor observations. While initial discussions to broaden the scope of the AESAs to include the life cycle management and engineering functions under the Director General Aerospace Equipment Program Management had been initiated during the year, progress was curtailed as a result of regulatory resource constraints.

<sup>6</sup> Section 3 of this report addresses safety compliance activities executed for Ammunition Program elements 1, 2, 4, 6 and 7. Elements 5 and 8 will appear in subsequent annual reports as their respective ammunition and explosives safety inspections are developed and incorporated into the compliance assurance program. Elements 3 and 9 are currently not within scope but may be subject to safety compliance activities in subsequent annual reports.





DAER	SJS	PROGRAM ELEMENT	ELEMENT TITLE	OPI
ELEMENT 1 REGULATORY PROGRAM	ELEMENT 3 AMMUNITION PROGRAM PERFORMANCE MEASUREMENT	2	A&E Equipment Program Management	ADM(Mat) / CANSOFCOM
		4	A&E Operations Support and Readiness	RCN / CA / RCAF CANSOFCOM / CJOC ADM(Mat) / ADM(IE) / ADM(DRDC) / VCDS
		5	Strategic Ammunition Program Policy and Doctrine	SJS
		6	A&E Practitioner and Professionalization	ADM(HR-Civ) / CMP / SJS
		7	A&E Infrastructure	ADM(IE)
		8	A&E Systems	ADM(IM) / SJS
		9	A&E Inventory	SJS
A&E SAFETY PROGRAM				
SAFETY POLICIES, ORDERS, DIRECTIVES				

A&E SAFETY COMPLIANCE

Figure 1 – Ammunition Program-based regulatory model

### Demilitarization and disposal

Within the previous report, DND's stockpile<sup>7</sup> awaiting disposal was established at approximately 9 100K kg. Since then, the department collectively reduced its stockpile by 1 566K kg through sale, demilitarization and destruction operations (table 1). The current stockpile awaiting disposal is estimated at approximately 7 500K kg. The remaining items awaiting disposal are expected to decrease substantially when the ADM (Mat)-led initiative to acquire a suite of A&E demilitarization equipment achieves full operational capability throughout 2021 and 2022. Unfortunately, Exercise DUSTY THUNDER could not be hosted in 2020 due to COVID constraints.

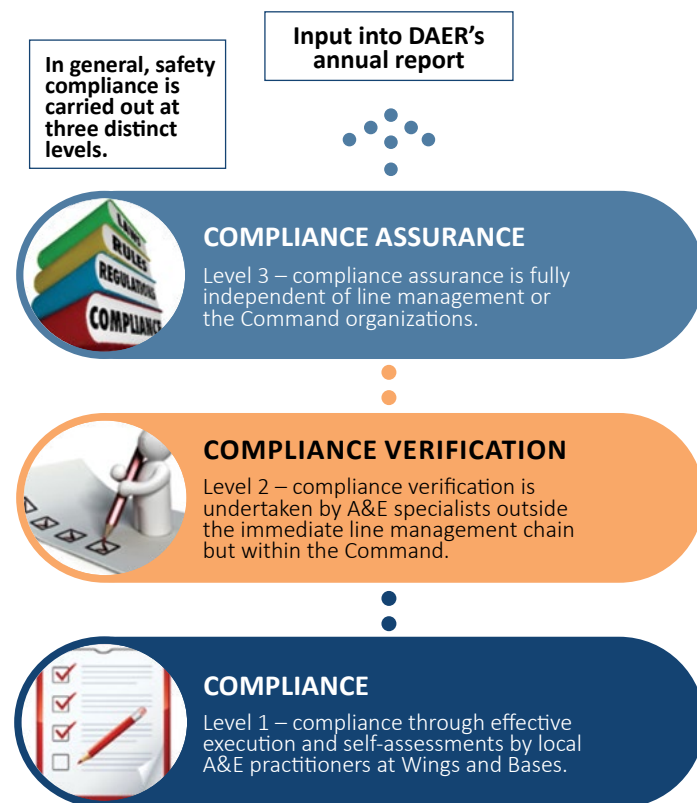


Figure 2 – A&E safety compliance model

ITEMS	QUANTITY	METHOD
Reduction of aids to production	293 706 kg	Disposal
Reduction of ammunition salvage, excluding brass	319 237 kg	Disposal
Reduction of brass	687 525 kg	Sales
Disposal of live A&E	54 161.92 kg	Conducted by OB/OD, breakdown or disposal
Non-explosive items	212 238.99 kg	Disposal
Total disposed in FY 2020-2021	1 566 868.91 kg	

**Table 1 – Stockpile reduction by group items**

Demilitarization and disposal services contracts. A total of 825K kg net explosives quantity (NEQ) of 155mm howitzer M119 series artillery charge propellant (red bag) was in inventory at the beginning of the reporting period, with 207K kg NEQ designated to be used during ammunition technician trade training. During the reporting period, DND awarded a commercial contract for the disposal of the remaining 618K kg NEQ. As of the end of the reporting period, 98K kg NEQ had been shipped to the contractor for destruction. The disposal of the remaining red bag propellant is expected to be completed by the summer of 2022. Work towards the objective of disposing of 344K kg NEQ of CRV7 rocket motors has also progressed, with active industry consultations currently ongoing. This is expected to be completed by 2027.

#### **ELEMENT 4 – A&E OPERATIONS SUPPORT AND READINESS**

Groups and Commands with a responsibility for the safe storage and handling of A&E or management of A&E facilities are subject to annual compliance activities as per figure 2. Overall, the assessed state of the A&E operations support and readiness has been assessed as **improvement required**.

Whereas the COVID-19 pandemic prevented the execution of in-person DAER-led AESA, as an alternative, DAER Inspectors executed virtual audits of Groups and Commands using information recorded within the ammunition and explosives safety information management system (AESIMS) and the ammunition information & maintenance system (AIMS), and results from Group/Command self-assessed ammunition and explosives safety inspections (AESI) executed by the Group/Command ammunition technical authority (ATA). Despite its limitations<sup>8</sup>, a virtual audit did provide some insight into Group/Command levels of compliance as well as the competencies of the ATA.

#### **Observations and findings**

Table 2 represents the aggregate self-assessed results within the respective Groups/Commands across the seven pillars of the safety inspection under Element 4. Overall, the combined results can be considered as **improvement required**. Specific areas of attention were centred on a failed safety inspection within Canadian Special Operations Forces Command (CANSOFCOM) and the CA's inability to inspect ten (10) of its eleven (11) second line A&E facilities. Of note, both CANSOFCOM and the CA have taken positive measures to address the self-assessed shortfalls with improvements expected over the coming reporting period.

<sup>7</sup> Includes A&E that is surplus, obsolete, deteriorated and time-expired, as well as munition scrap and spent brass/steel cartridge cases.

<sup>8</sup> Virtual audits reduce the amount of attention normally paid to certain details during on-site visits. This creates gaps in the observations that normally guide and assist in the identification of strengths and areas for improvement.

GROUP/COMMAND	AESI SELF-ASSESSMENT SUMMARY	
	FY 2019/2020	FY 2020/2021
RCN	Acceptable	Improvement Required
CA	Acceptable	Attention Required
RCAF	Acceptable	Acceptable
CJOC/Canadian Materiel Support Group (CMSG)	Improvement Required	Acceptable
CJOC Operations	Attention Required	Improvement Required
CANSOFCOM	Acceptable	Improvement Required
ADM (DRDC)	Attention Required	Acceptable
ADM (Mat)	Acceptable	Acceptable
VCDS	Improvement Required	Acceptable

#### LEGEND

Acceptable	Average score is greater than or equal to 80% for all pillars.
Improvement Required	Average score is between 65% and 79% for at least one pillar.
Attention Required	Average score is less than 65% for at least one pillar.

**Table 2 – Group/command aggregated safety inspection results**

The following specific observations were recorded:

ATA appointment. ATAs provide subject matter expertise and advice to their Groups/Commands and oversee the application of A&E safety policies on behalf of their respective Advisor/Commander. During the reporting year, the Assistant Deputy Minister (Defence Research and Development Canada) [ADM(DRDC)] successfully secured the services of an ATA through service level agreements with the Royal Canadian Air Force (RCAF) and the ADM(Mat) for its facilities at the Canadian Forces Base (CFB) Suffield and DRDC Valcartier, respectively. Similarly, the Vice Chief of the Defence Staff (VCDS) secured ATA services through CANSOFCOM and the Royal Canadian Navy (RCN) for its facilities at Canadian Forces Support Group (Ottawa-Gatineau).

AESI execution. Despite COVID-related travel constraints, most Groups and Commands successfully executed their respective AESIs through either in-person safety inspections, table-top virtual safety inspections or a hybrid of in-person and virtual safety inspections. Although the ADM(DRDC) was unable to conduct its annual AESI at their facility located at Suffield during the last two reporting years, the requirement was met this year through the support of the RCAF.

#### Emergency preparedness

- CJOC. Areas of concern were identified within CJOC for depot and expeditionary operations. There is a requirement for the execution of annual A&E-related exercises and drills as well as a better understanding of the roles and responsibilities of personnel (practitioners and emergency responders) in the event of an A&E occurrence. Furthermore, the implementation of an adequate emergency response plan (ERP) at the NATO Enhanced Forward Presence Battle Group in Latvia, remained a challenge. Acknowledging the complexities associated with a multinational operation and despite the absence of a local fire-fighting capability within Camp Adazi, progress has been observed within the storage facility with the addition of a fire suppression system to Storage Point (SP) 2, fire detection alarms added to SP2 and SP4 and firefighting points added to the ammunition holding area. More notably an ERP has been developed with the intent to conduct a first exercise in fiscal year 21/22.
- CANSOFCOM. At the CANSOFCOM/CA co-located A&E storage facility. During the reporting period, it was observed that while both organizations had established ERPs, the plans were segregated with the potential for confusion. An integrated ERP would support a coordinated and comprehensive response and ensure personnel awareness of organizational roles and responsibilities. In response, CANSOFCOM generated

a management action plan to address the issue and a service level agreement to clearly outline unit/Command roles and responsibilities.

A&E warehousing and management. Where the previous reporting period witnessed a decline in the quality of A&E inventory warehousing and management oversight within CANSOFCOM and CJOC, this year saw an overall improvement. AESI results were assessed as acceptable, with exceptional improvement within CJOC.

AESIMS. Used to effectively record, monitor and manage a robust and active A&E safety program within the department, AESIMS is the system of record for all A&E safety inspections and is to be used at the unit, wing/base, Group/Command and headquarter levels. **A repeat observation with a downward trend**, this year witnessed

an overall and continued lack of understanding, an underutilization and an absence of enforcement for the implementation of AESIMS. In instances where monthly and quarterly wing/base/unit safety inspections were not executed and/or results not recorded, there is a concern that safety-critical risks are left unchecked and unaddressed, with the potential to adversely impact personnel safety, infrastructure and CAF operations. Overall, it was observed that the level of oversight required to ensure the prompt identification, implementation, tracking and completion of management action plans is significantly lapsing. Though there is a requirement for increased vigilance and oversight at all levels, this is particularly important at the Group/Command level to ensure prompt tracking and completion of explosives safety-related management action plans.



*Canadian contingent members of enhanced Forward Presence Battle Group – Latvia conduct live-fire with the C-16 during Exercise HAVOC SKYFALL, December 18, 2020 at Camp Adazi Training Area, Latvia, in order to refine Canadian Armed Forces' firepower applications and capabilities within a mechanized infantry unit.*



## ELEMENT 6 – A&E PRACTITIONERS

A&E practitioner competency requirements are diverse in DND and the CAF. They include both military and civilian personnel with varying levels of A&E-related proficiencies, ranging from basic familiarity with how to safely use or manage A&E to advanced technical knowledge. Groups and Commands with a responsibility for the training, employment and management of the A&E practitioner community are subject to annual compliance activities as per figure 2. Overall, the assessed state of the practitioner community has been assessed as **improvement required**. The following paragraphs discuss the development of assessment standards for element 6 as well as specific observations made throughout the reporting period.

### Observations and findings

#### *AESI standards*

DAER continued developing the A&E practitioner safety inspection standards for element 6. Socialization of the draft standards with affected Groups and Commands will continue while implementation has been delayed due to resource constraints within DAER.

#### *Risk management*

An ammunition and explosives risk assessment safety case (AERASC) is a risk-based approach that identifies, assesses, mitigates and allows for the acceptance of an increased level of residual risk in support to an operational requirement where departmental A&E safety policies cannot be met. Although the process is straightforward, the steps of identifying, analysing and mitigating safety risks are complex and require trained and experienced personnel. Where progress was observed in the practitioner community's ability to assess safety risks and establish appropriate risk mitigation measures, there is a requirement for continued Group/Command vigilance and oversight to sustain the current positive trend and bridge the acknowledged training capability deficiency which could expose personnel to increased safety risks and/or degrade mission capability.

### Ammunition and explosives practitioners

#### *Group / Command ammunition technical authorities*

While there is room for improvement, most Groups/Commands were assessed as being competent in the execution of AESIs for their respective second/third line organizations. Conversely and **a repeat observation**, it was noted that Groups and Commands' ATAs continued to be challenged in their ability to review, track or provide

adequate oversight into safety audit observations and occurrence reports, assess safety risks, oversee explosives storage licensing and oversee Group/Command safety-critical activities. In line with their delegated authorities and in support to their respective L1 Advisor or Commander, there is a requirement for ATAs to become proficient in the execution of their duties and responsibilities, as per their respective terms of reference.

#### *Ammunition technician occupation*

Ammunition technician positions will be under-filled in fiscal year 2022/2023 by approximately 40 positions out of total of 252 positions. While there are sufficient personnel at the ranks of private and corporal, there is a shortage of personnel at the ranks of sergeant to master warrant officer, with a projected vacancy rate of 24%. Considering the key role played by these senior positions in managing and supervising A&E activities, there is a risk that the department will be unable to staff safety-critical positions over the coming years.

#### *Civilian ammunition technician occupation health*

Although presently concerning, the status of full-time civilian ammunition technicians (CAT) is improving. This is attributed to the introduction of standardized training material delivered through a decentralized online platform. It is projected that 29 direct entry CAT 2 level technicians will graduate by 2022, with an additional 14 new CAT 3/CAT 4 level technicians to be generated using the new training system.

#### *Occupational analysis (OA)*

As previously reported, a problem definition paper (PDP) was produced in 2016 outlining systemic gaps and shortfalls in the attraction, training, education, employment, succession planning, retention, and specialty structure for ammunition specialty officers. The additional complexity of an employment model that groups five occupations and shares two qualifications to meet tri-service requirements was also assessed as a challenge with respect to experience and currency of the ammunition practitioner.

Although the ammunition specialist officer occupational analysis has suffered some delays, Phase 2 (Work and Structure Analysis) was completed during the reporting year, with Phase 3 (Feasibility Analysis) intended to be completed in 2021. Completion of Phase 3 will require a decision from the sponsoring organization, the Strategic Joint Staff (SJS), on whether to proceed with Phase 4 (Military Employment Structure Implementation Plan) and transition the OA into implementation.

## Training

### ***Ammunition program qualification standardization for officers***

Despite centrally established A&E qualification requirements, it was observed that, for the same qualification, different training establishments applied different training standards.<sup>9</sup> A comparison of the qualification standards and training plans for each qualification was conducted by the SJS to identify discrepancies and shortfalls and to provide recommendations to the Ammunition Program Steering Committee and stakeholders. It was assessed that a disconnect existed between the authorized A&E tasks and what was being taught in the various qualifications for officers. The length of the training, delivery methods, course content and training confirmation varied greatly from one training establishment to another for the same A&E-related tasks. In some instances, certain A&E tasks were not taught although they formed part of the qualification.<sup>10</sup> The discrepancies in training standards represent a significant safety risk, from which stems the requirement for a holistic review and a coordinated effort to resolve. In response, SJS has initiated requisite dialogue with L1s to work towards an improved standardization model.

### ***AESIMS***

**A repeat observation**, the integration of AESIMS within Groups/Commands requires significant improvement. The absence of an adequate AESIMS curriculum within the training institutions<sup>11</sup> is directly impacting the community's proficiency in using AESIMS. Where the Canadian Forces School of Aerospace Technology and Engineering (CFSATE) has begun to integrate AESIMS into the curriculum for the aerospace engineering officer (AERE) classification and the aviation systems technician (AVN) trade (including new qualification standards to be implemented in 2022), there has been little, if any, progress within the Canadian Forces Logistics Training Centre (CFLTC) and the Naval Fleet School (Atlantic). Consequently, the absence of adequate training on AESIMS undermines any and all training on functions that rely on the proficient use of the DND/CAF system of record.

<sup>9</sup> The Canadian Forces Logistics Training Centre (AEXN), the Royal Military College (AKKS) and the Canadian Forces School of Aerospace Technology and Engineer (ADOT) grant the qualification to investigate A&E occurrences but each program conducts the training to a different standard in terms of time, course material and method of instruction.

<sup>10</sup> The qualification for logistical disposal of A&E is granted under the ADOT course code for AERE officers who also have a Conventional Munitions Disposal qualification without the material being instructed at CFSATE. The qualification to conduct A&E risk assessment safety cases was granted under the AEXN course code for ATOs without the material being instructed at CFLTC prior to 2018. The qualification to conduct A&E investigations is granted under the NCS ENG Head of department code for the NCS ENG trade without the material being instructed at the Naval Fleet School (Atlantic).

### ***Command ATA training symposium***

SJS and DAER co-hosted an annual ATA training symposium for incoming Group/Command ATAs and their staff providing an overview of the role and responsibilities within the overall A&E program. The symposium highlighted recent A&E policy changes and provided guided training on the various systems available to ATA staff. The training symposium was conceived to fill an assessed training gap that exists between initial Ammunition Technical Officer (ATO) and Advanced Ammunition Engineering training and employment at the operational level. This training symposium is assessed as a stopgap measure and consideration must be given to addressing the shortfalls around ATO and Advanced Ammunition Engineering training requirements and standards.

## **ELEMENT 7 – A&E INFRASTRUCTURE**

Groups and Commands with a responsibility for A&E-related infrastructure are subject to annual compliance activities as per figure 2. Overall, the assessed state of the A&E infrastructure has been assessed as **improvement required with a positive trend**.

### **Observations and findings**

#### ***Ammunition and explosives safety inspection standard***

During the reporting period, ADM(IE) finalized its comprehensive explosives safety assessment framework (ESAF) to assist in evaluating the existing state of the A&E-related infrastructure across the DND/CAF inventory. While implementation of the ESAF pilot initiative was initially planned for FY 2020/21, it has been postponed until FY 2022/23 following COVID-19 prompted travel restrictions.

#### ***Canadian long span earth-covered magazine***

The 2018/2019 DAER report discussed the construction standards of the Canadian long span earth covered magazines (CLSECM) at the Canadian Forces Ammunition Depot in Bedford and identified excessive depth of common earth cover between magazines. In the event of an accidental explosion, the earth could act as a medium to transmit the shockwave, placing adjacent magazines at risk. A departmental review of all storage facilities also identified CFB Petawawa's CLSECMs as having excessive depth of common earth cover. In response, ADM(IE) is considering an engineering solution to re-grade the earth cover overlap between CLSECMs to return the storage

<sup>11</sup> CFLTC for ammunition technicians and ammunition technical officers; the Naval Fleet School (Atlantic) for naval technical officers, magazine custodians and magazine yeomen; CFSATE for aerospace engineering officers and aircraft technicians.

capacity to that of the original CLSECM design. As a mitigating measure, CJOC and the CA have re-licensed the CLSECMs using safety distances appropriate to the earth cover overlaps, thereby managing safety risks to within accepted standards by limiting explosives storage capacity within the affected magazines.

### **Infrastructure siting**

An increased understanding of and adherence to policies surrounding the siting of ammunition facilities was observed during the reporting period. Enhanced lines of communication between the ATAs, ammunition facilities, real property management and ADM(IE) have led to a better understanding of requirements and informed decision making. Continued oversight is recommended to

ensure site approvals are sought during the planning phase of new construction to mitigate any unforeseen impact on storage capacity and CAF operations.

### **A&E risk management**

AERASCs enable A&E operations when safety policies/standards cannot be met. A temporary measure, an AERASC is valid for up to five years while accountable organizations work to implement long-term sustainable measures that meet departmental A&E safety standards/policies. Of the nine active AERASCs within the department, six are directly linked to infrastructure challenges, two of which will expire in the upcoming FY with no identified long-term solution (table 3). Renewed AERASCs will be required to meet the continued capability deficiencies.



#### *Exercise GUERRIER NORDIQUE*

*A soldier from the 35 Canadian Brigade Group (CBG) of the Arctic Response Company Group (ARCG) fires a C9A2 Light Machine Gun as part of Exercise GUERRIER NORDIQUE in CFB Valcartier on March 2, 2021.*



GROUP/COMMAND LOCATION	AERASC SERIAL #	TYPE	RESIDUAL RISK LEVEL	EXPIRY	OPI
CA Gagetown	0105-2020-001	A&E Storage (Magazine)	Low	2025	ADM (IE)
RCAF Comox	3235-2019-01	A&E Storage (Magazine)	Significant	2025	ADM (IE)
ADM (DRDC) Valcartier	1430-2014-01	A&E Operations (Workshop)	Low	2021	ADM (IE)
ADM (DRDC) Valcartier	1430-2015-02	A&E Operations (Workshop)	Low	2021	ADM (IE)
CANSOFCOM Ottawa	6399-2016-01	A&E Storage (Magazine)	Medium	2021 <sup>12</sup>	ADM (IE)
ADM (Mat)	2107-2018-01	Disposal (SAA Brass)	Low	2023	DAEME
CJOC Op REASSURANCE ATF	ORATF-2019-001	A&E Operations (Workshop)	Low	2024	Host Nation
CJOC Op REASSURANCE EFP LATVIA	6923 - 2020 - 001	Transit Operations	Significant	2025	Host Nation
CJOC Op REASSURANCE EFP LATVIA	6923-2020-002	Storage – encroachment	Significant	2025	Host Nation

**Table 3 – Current AERASCs**

**BOTTOM PICTURE:** Air Weapons Systems Technician Corporal Joey Chow performs post flight procedures after the CF-18 Hornets return from a combat training flight during Operation REASSURANCE – Air Task Force Romania on September 22, 2020 at Mihail Kogălniceanu Air Base, Romania.



<sup>12</sup> Of note, a long-term infrastructure solution has been identified and is pending project implementation. Consequently, the intent is to extend this AERASC for a three-year term as an interim measure.





*The Royal Canadian Dragoons, C Squadron conducts a Leopard 2A4 tank shoot during an exercise at 5 Canadian Forces Support Base (5 CDSB) Gagetown, New Brunswick, October 23, 2020.*

## CONCLUSION

Throughout the year, Ammunition Program compliance oversight through the execution of a comprehensive and repeatable AESI expanded beyond element 4 to include element 2 where ADM(Mat)'s DGLEPM was evaluated using the AESI methodology. Collaborative discussions to include DGAEPM and DGMEPM remained ongoing.

Collectively, the department successfully reduced its stockpile by 1 566K kg through sale, demilitarization and destruction operations. As a result and for FY 2020/21, DND's stockpile awaiting disposal was established at approximately 7 500K kg.

Where element 4 results reflect some improvement within Groups and Commands, there remain safety concerns around the integration of and reporting through AESIMS.







*Operation PROJECTION/ARTEMIS*

*Corporal (Cpl) Shannon Clayton, an Aviation Systems Technician, Cpl Brendan Wales, an Aircraft Structures Technician and Master Corporal Malcom Martin, an Air Weapons Systems Technician, load a torpedo on to a CH-148 Cyclone helicopter during Operation PROJECTION in the Indian Ocean, 14 April 2021.*



# AMMUNITION AND EXPLOSIVES SAFETY PROGRAM

## INTRODUCTION

A&E are used extensively in almost all facets of military operations and have the potential to cause death or serious injury, destroy, damage or disable materiel, and damage infrastructure or the environment. A hazardous occurrence<sup>13</sup> involving A&E can also result in mission failure, or otherwise impact operations.

The aim of DND AESP is to enable and support CAF operations and departmental goals by preserving operational capability and minimizing personal injury and death, materiel loss, and damage to the environment. The success of the AESP is predicated on top-down engagement by leadership with bottom-up execution by CAF members and DND employees, enhancing the overall institutional culture of A&E safety.

This section is a review of the reporting practices as well as the types of incidents and accidents witnessed by the department over the reporting year. Through an analytical lens, this section highlights departmental progress and areas for improvement aimed at strengthening the department's AESP.

## OBSERVATIONS AND FINDINGS

### AESIMS

Introduced in April 2017, AESIMS is the DND's and the CAF's system of record for A&E occurrence reporting, providing next to real-time safety information to Groups and Commands. In its fourth year of implementation, reporting through AESIMS remains a significant departmental challenge. Where the department previously averaged 228 reported occurrences annually, the average number of reported occurrences since the introduction of AESIMS has dropped by more than 50% (figure 3).

The significant reduction in reporting can be attributed to:

- Online training. Access to AESIMS is contingent upon the successful completion of a DWAN-based self-paced user training module. A review of AESIMS user accounts has revealed that not all users were trained in the use of AESIMS. There is a requirement for tighter access controls by the Group/Command Explosives Safety Regional System Administrator;
- Institutional training. The integration of AESIMS within training delivered by Groups/Commands requires significant improvement. The absence of an adequate

<sup>13</sup> An A&E occurrence is defined as any type of hazardous occurrence involving A&E.



AESIMS curriculum within the various training institutions<sup>14</sup> is directly impacting the community's proficiency in using AESIMS;

- c. Accessibility. The initial release of AESIMS limited accessibility to the ammunition practitioner communities. This was recognized as a significant limiting factor and, as a result, future releases of AESIMS granted unit access through the unit explosives safety officer and/or unit ammunition representative; and
- d. Reporting culture. As the departmental safety margin<sup>15</sup> for this reporting year is 2.3:1, there remains a significant concern around the underreporting of A&E-related occurrences.

### Occurrence reporting

All hazardous occurrences, including near misses, hazardous situations and even the slightest of injuries or equipment damage, must be reported in accordance with DAOD 3002-4, *Reporting of Ammunition or Explosives Accidents, Incidents, Defects and Malfunctions*.

### Ammunition or explosives defects and malfunctions

There is a requirement to report ammunition and explosives defects and malfunctions (DM) through AESIMS as they could represent increased safety risks. DM reports ensure adequate technical information is

provided to the respective technical authority to enable the implementation of appropriate and timely corrective or mitigation measures.

During the reporting period, 362 DM reports were initially recorded and 58 were cancelled as they did not meet the definition of a defect and/or malfunction.<sup>16</sup> Command ATAs for the RCN, RCAF, CJOC and CANSOFCOM were assessed as maintaining diligent oversight over Command DM reports (figure 4).

### Ammunition or explosives incidents and accidents

The following paragraphs address specific observations made throughout the year:

- a. **Reporting timelines.** As per A&EI 69 – Accident / Incident Reporting Timelines, the departmental requirement for submitting an initial report is 24 hours. The intent of an initial report is to quickly inform the community of potential safety risks and avoid a recurrence. Of the 117 occurrence reports submitted, 46% were reported within 24 hours, compared to 34% in the previous year. While this represents a positive trend, the average overall time for submitting an initial report increased from 14 to 20 days during the reporting period. **A repeat observation with a significant downward trend,** extended delays in reporting represent a safety risk<sup>17</sup>;

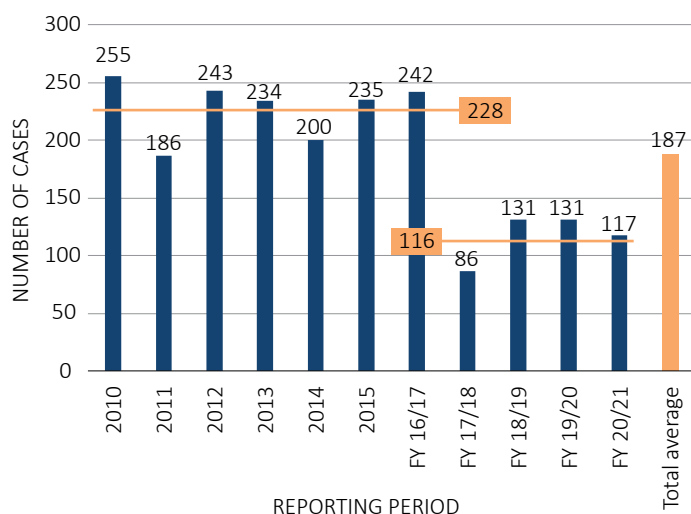


Figure 3 – Average reported annual occurrences

<sup>14</sup> The Canadian Forces Logistics Training Centre, the Canadian Forces School of Aerospace Technology and Engineering and the Naval Fleet School (Atlantic).

<sup>15</sup> Safety margin is defined as the incident to accident ratio.

<sup>16</sup> An ammunition or explosives defect is defined as a design deficiency, or a manufacturing defect of, tampering with, or damage to, an ammunition item or explosive, that could or has resulted in less than effective performance. A malfunction is a failure of an ammunition item or explosive to function in an expected or satisfactory manner.

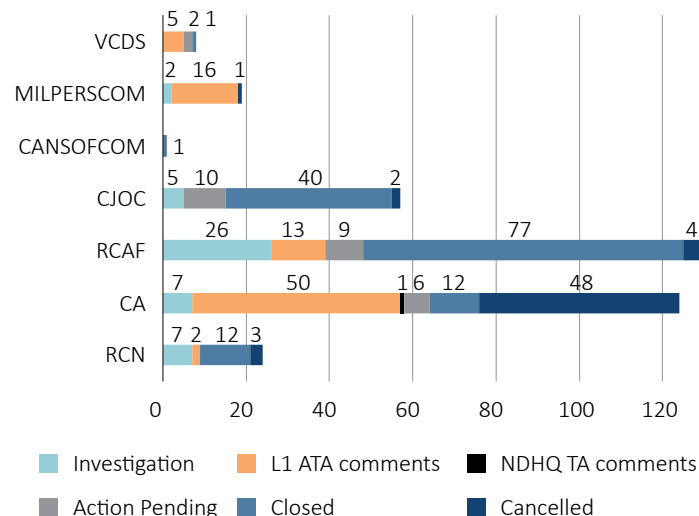
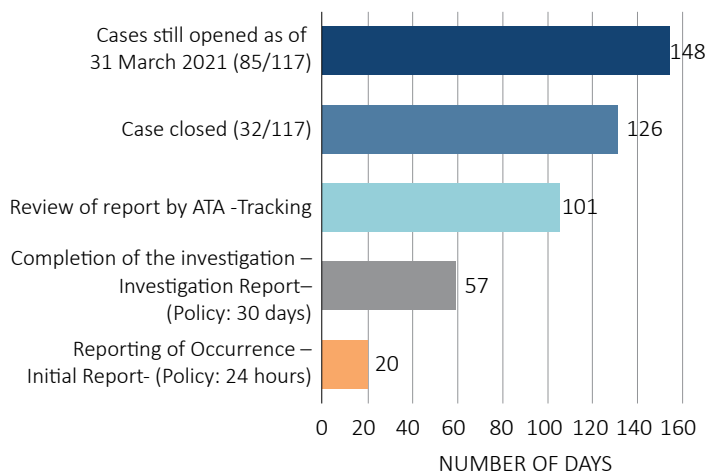


Figure 4 – Status of defect and malfunction reports

<sup>17</sup> In one instance an air-deployed flare (LUU-2) ignited too close to an aircraft but the incident was not reported until several days after the occurrence; meanwhile, the same lot of flares was used on another mission and resulted in a similar incident which could have led to injuries and/or damage to materiel.

- b. Investigation timelines. **This is a repeat observation applicable to all Groups/Commands with a three-year downward trend.** The departmental requirement to complete an investigation report is 30 days. Over the reporting period, the average number of days to complete investigation reports increased from an average of 50 (reported in FY 2019/20) to 57 (figure 5). There is a requirement for Groups and Commands to significantly improve investigation timelines;
- c. Report review by Commands/Groups (tracking). **This is a repeat observation.** Once an investigation report was released by the unit, Groups/Commands averaged 126 days to review and close cases in AESIMS. Of the 117 cases initiated during the reporting period, 32 were closed as of 31 March 2021, leaving 85 active cases pending Group/Command review and action, the majority of which fall under the CA. While there has been some effort towards closing reports at year end, there remain 171 active reports awaiting Group/Command action since the implementation of AESIMS in April, 2017 (figure 6). The importance of Group/Command review and tracking of occurrence reports cannot be overstated and outstanding cases are lost opportunities to capitalize on lessons learned and prevent recurrence. Without the timely dissemination of accurate information, CAF members and DND employees are potentially exposed to unnecessary safety risk. The RCN, CJOC, CANSOFCOM and VCDS are to be recognized for their effort in reviewing and closing their respective occurrence reports during the year.
- d. Preventive measures. **This is a repeat observation applicable to all Groups/Commands with a downward trend.** During the reporting period, it was observed that while preventive measures (PMs) were being recorded within AESIMS, 46% of the PMs were not being actively tracked and/or updated by responsible Groups/Commands. While there may be several contributing factors that could delay the implementation of PMs, failure to action PMs or update AESIMS and maintain an accurate system of record could lead to increased safety risks and potential departmental liabilities; and
- e. Quality of investigations. **This is a repeat observation applicable to all Groups/Commands with a downward trend.** Investigations of A&E occurrences are to be completed by suitably qualified and experienced personnel and require technical knowledge of the A&E as well as an understanding of the associated weapon system and operational environment. While a significant number of reports were explicit in defining “what” had occurred, only 21% of the reports addressed the “why” and the “how” of occurrences, adversely affecting the department’s ability to identify root causes and appropriate PMs. A review of individual A&E practitioner training programs indicated that instruction covering event analysis, identification of causal factors and understanding systemic causes of failure in complex systems is insufficient at best or missing entirely. The absence of comprehensive A&E training aimed at standardizing investigations and identification root causes and effective PMs across the department represents a real concern and contributes to the department’s challenge in preventing a recurrence or mitigating its consequence(s).



**Figure 5 – Average timeline per case state**

## OCCURRENCE ANALYSIS OVERVIEW

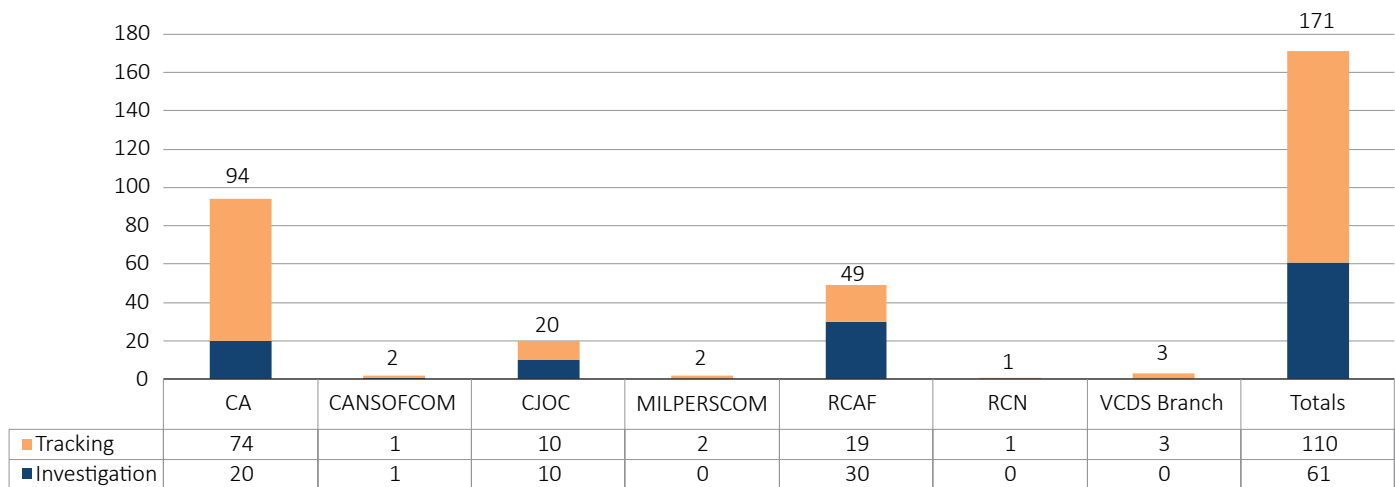
### A&E incident/accident ratio

The Heinrich 300-29-1 model<sup>18</sup> suggests that for every 300 near misses there are 29 minor injuries and 1 major injury (figure 7). The resulting safety margin is therefore established at 10:1 for this particular model.

While model values may vary depending on supporting studies, the relationship between near-miss events (incidents) and injuries or damage (accidents) is indicative of the health of an organization’s safety program and culture. Regardless of the precise ratio in any given field of work, the key point is to capture and understand incidents

<sup>18</sup> The Heinrich Model was also referenced in the Haddon-Cave report “The Nimrod Review – An Independent Review into the Broader Issues Surrounding the Loss of the RAF Nimrod MR2 Aircraft XV230 in Afghanistan in 2006”.





**Figure 6 – Outstanding report since 2017**

before they recur in slightly different circumstances and result in an accident. Focusing on near misses and trends will help provide forewarning, changing the fundamental approach of hazard management from reactive to proactive.

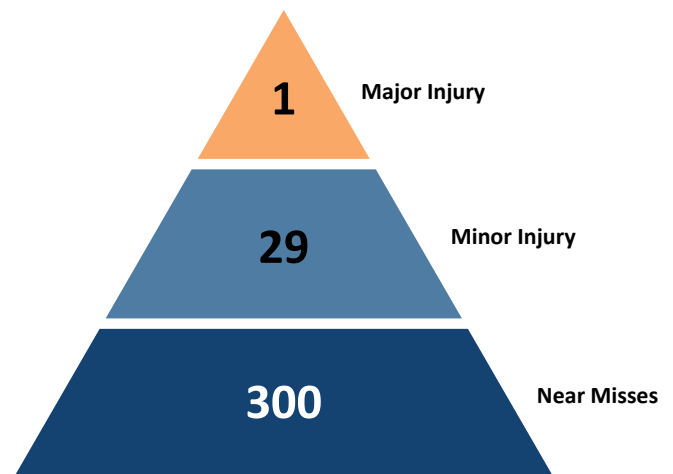
Of the 117 occurrences reported in AESIMS during the reporting period, there were 85 incidents and 32 accidents, representing an incident/accident ratio of 2.3:1<sup>19</sup> and a slight improvement from the previous year's 1.7:1 (figure 8).

Organizational reporting is an essential part of a successful AESP and has a direct impact on personnel safety, readiness and capabilities.

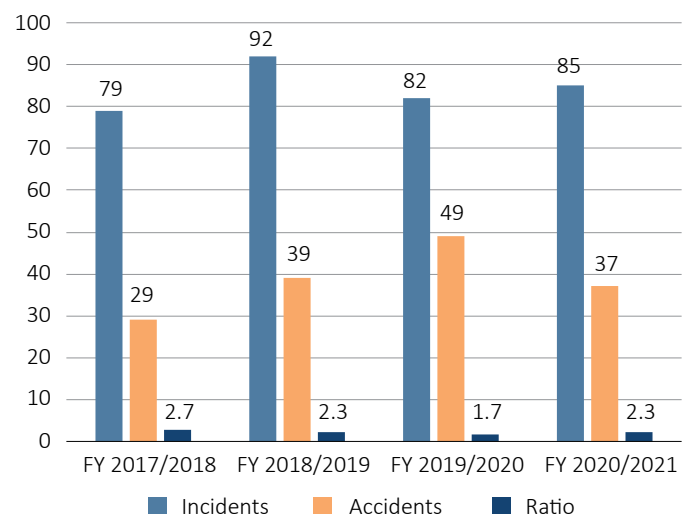
### Safety margin per Command

Despite environmental differences, Command safety margins should be indicative of the departmental incident to accident ratio. Figure 9 depicts the safety margin for each Command over the last three years.

Each Command is able to effect positive change to its incident to accident ratio by strengthening its reporting culture and implementing targeted, data-driven PMs as part of its Command AESP. The higher an organization's ratio, the better its ability to safely execute and sustain its operations.



**Figure 7 – The Heinrich model**



**Figure 8 – Safety Margin**

<sup>19</sup> Although AESIMS records indicate 85 incidents and 32 accidents, there were an additional five A&E-related accidents that were recorded through the General Safety Program (GSP) but were not reflected in AESIMS. The GSP reports were considered when calculating the safety margin.

## Cause factor trends and analysis

A cause factor is defined as the presence or absence of an action, condition or circumstance that leads to an occurrence. The process of identifying the reasons for an occurrence allows for the implementation of preventive measures that will lead to a safer A&E environment.

**A repeat observation applicable to all Groups and Commands**, an analysis of occurrence cause factors showed that almost half of all occurrences within the department were attributable to insufficient supervision, improper handling of ammunition and/or limited experience. Furthermore, close to 24% of all occurrences were recurring occurrences, indicating an organizational challenge to capture and apply lessons learned related to A&E safety.

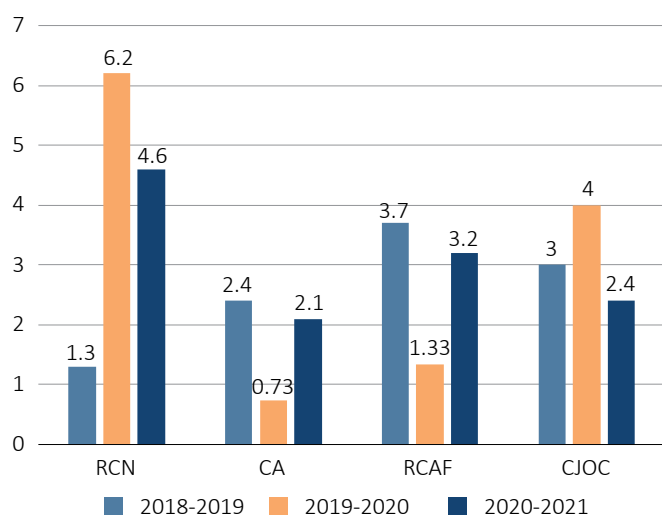


Figure 9 – Safety margin per Command

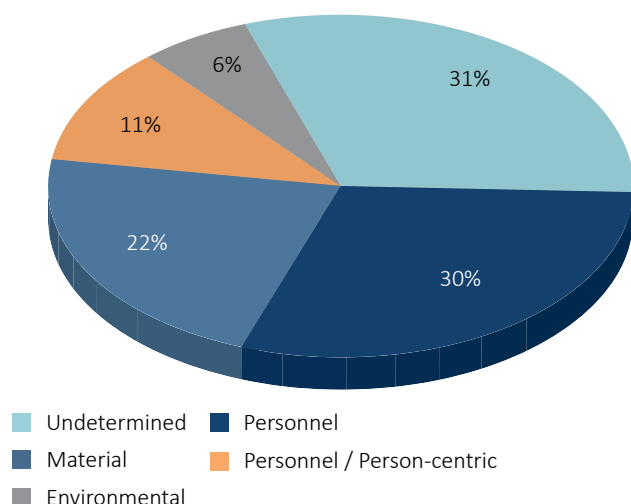


Figure 10a – Initial cause factors assigned by Groups and Commands

There were 12 injuries reported through the reporting period.<sup>20</sup> While this represents a 15% reduction in the number of injuries over the last reporting period, of the 12 injuries, 11 were attributable to a human cause factor and were therefore preventable. There was one fatality reported during the reporting period; a similar accident occurred in April 2019 under similar conditions.

Symptomatic of the challenges associated with investigating and reporting within DND and the CAF, a detailed review of all AESIMS reports indicated that 31% of all Group- and Command-assigned cause factors were labelled as “Undetermined” or “Not yet determined”. Whereas figure 10a illustrates the cause factors as initially assigned by Groups and Commands, figure 10b illustrates the re-assignment of more than 75% of the cause factors following a careful review by DAER. **A repeat observation with a significant downward trend,**<sup>21</sup> the departmental challenges in identifying and assigning appropriate cause factors are adversely affecting the organization’s ability to capture lessons learned and prevent recurrence. There is a continued departmental requirement for a better understanding of the conduct of investigations, the assignment of cause factors and, more specifically, the Human Factors and Analysis Classification System (HFACS) methodology.

<sup>20</sup> When cross referencing safety data with the department’s Occupational Health and Safety Program (reported through the DND 663 and CF 98 forms) it was observed that five (5) injuries involving A&E were not reported as accidents in AESIMS. All of them involved use of artillery simulators too close to personnel, leading to various hearing injuries.

<sup>21</sup> During the previous reporting period, 50% of the initial cause factors were re-assigned following a careful review by DAER.

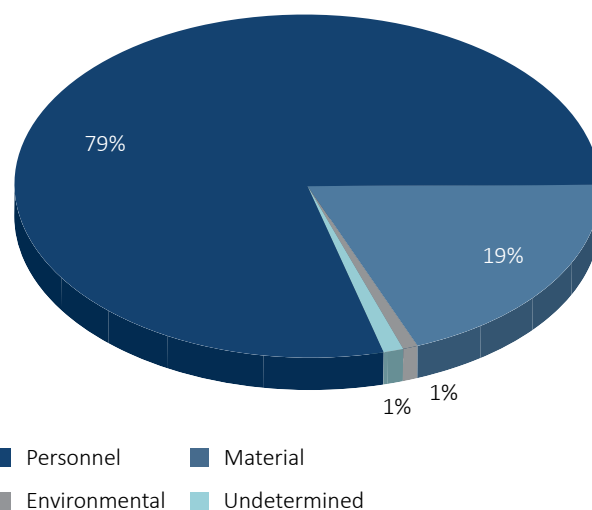


Figure 10b – Revised cause factors as assigned by DAER

An analysis of cause factors using data retrieved from AESIMS yielded the following observations:

- a. Person-Centric Cause Factor. **A repeat observation**, 13 cases of all cause factors (representing 11%) were assigned “Person-Centric”, signifying a purposeful deviation from established procedures based on personal motives, gains or goals. This qualifier involves reckless, wilful, or negligent behaviour or misconduct that may be carried out to demonstrate perceived prowess or skills. Following the re-assignment of cause factors, none of the 13 cases initially identified as “Person-Centric” met the criteria for the assigned cause factor;
- b. Distribution of occurrences. 82% of all occurrences involved the weapon system operator while 18% involved personnel from the A&E practitioner community. In this reporting period, there are 92 cases (78%) related to human factors. The following four common types of occurrences represent 24% of all cases and could have been mitigated by following proper procedures and through increased supervision:
  - (a) 15 cases involving live ammunition mixed with salvage return;
  - (b) 5 cases involving improper arming of marine location markers (MLM);
  - (c) 4 cases of unsecured ammunition falling off vehicle or equipment (maintenance stand, forklift, DND vehicles); and
  - (d) 4 cases of altered ammunition (removal of tracer rounds from ammunition belts).

In most circumstances, post-occurrence review and preventive measures were not comprehensively considered and/or implemented, resulting in a high percentage of recurrence;

- c. Storage. While the majority of reported occurrences were directly linked to the in-service use of A&E, it is encouraging to note that there were A&E infrastructure-related observations reported through AESIMS:
  - (1) four (4) occurrences related to the fire protection system of a magazine; and
  - (2) one (1) case related to an electrical system on a range that resulted in the simultaneous ignition of three burn trays.

This provides ADM(IE), as the departmental custodian, an opportunity to gain insight into infrastructure-related A&E safety concerns and identify potential mitigating measures.

- d. Unqualified A&E investigator. As per A&EI 07 – Ammunition Accident/ Incident Investigation and Reporting, all ammunition or explosives accident/ incident investigations must be undertaken solely by qualified personnel with a good understanding of the weapon system and associated drills and procedures. Of the 117 cases investigated by 66 different lead investigators, 13 investigators did not meet the qualification standard; and
- e. Occurrence reporting per command. **A repeat observation**, figure 11 shows the state of all incident/ accident reports initiated by Commands during this reporting period. The importance of reviews and

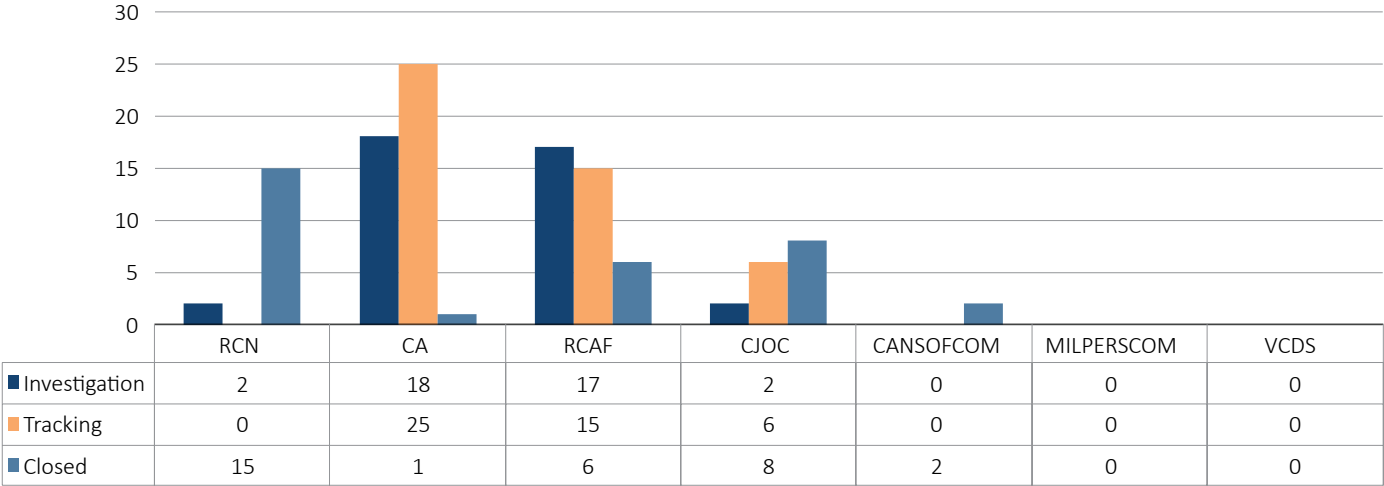


Figure 11 – Case state by Command



tracking of occurrence reports cannot be overstated; outstanding cases are lost opportunities to capitalize on lessons learned and prevent recurrence. The RCN, CJOC and CANSOFCOM are to be recognized for having successfully closed 50+% of their respective cases.

Many factors can influence a reporting culture. As safety is a Command responsibility, there is a requirement for continued senior leadership engagement in advocating the importance of reporting and tracking occurrences as well as closing reports within their respective AESP. There is also a requirement for Groups and Commands to leverage AESIMS to foster a healthy departmental AESP.

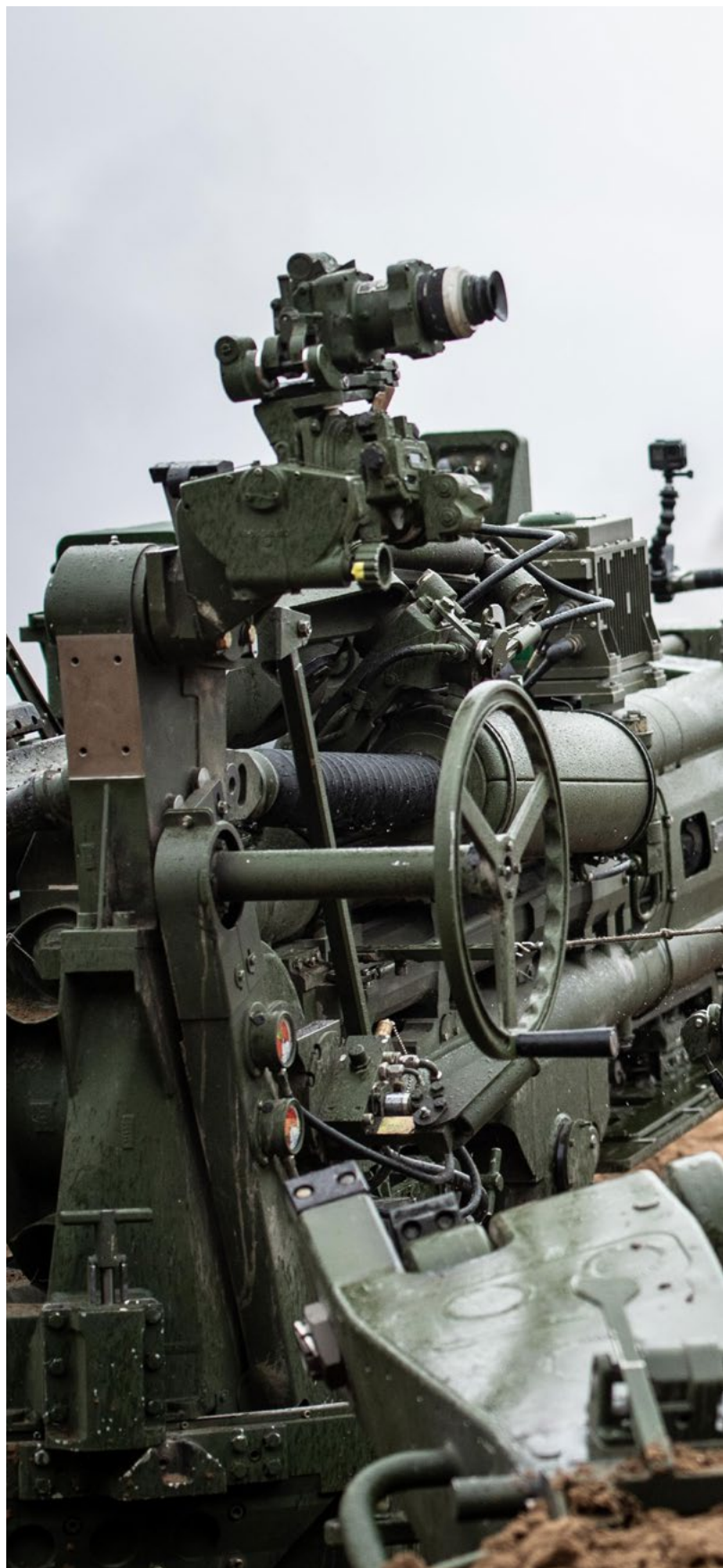
### **AESIMS monthly reports**

Groups and Commands were provided with monthly and quarterly reports highlighting areas for improvement within their respective occurrence reports. Throughout the year, with the exception of CJOC and RCN, it was observed that very little progress had been made in the quality of reports and/or the closing of outstanding reports. There is significant room for improvement in Group/Command response to the monthly and quarterly observations that would facilitate the identification and implementation of effective preventive measures to address safety occurrences and prevent recurrence.

### **CONCLUSION**

A&E occurrence reporting, tracking and Group/Command oversight continue to represent a significant departmental challenge. Belated reporting and incomplete investigations are indicative of a struggling safety program and represent an increased potential for repeat occurrences. Effective training, timely reporting with increased Group/Command oversight are key to capturing lessons learned and avoiding recurrence with the potential for catastrophic consequences and/or mission failure. Continuous improvement in reporting and investigating ammunition and explosives occurrences must remain a priority.

Where regulatory efforts will continue to focus on improving AESIMS, its accessibility to the warfighter, and the quality of occurrence reports, key enablers towards strengthening the AESP remain Group and Command engagement and continued senior leadership commitment. Overall, the assessed state of the department's Ammunition and Explosives Safety Program has been assessed as **improvement required**.

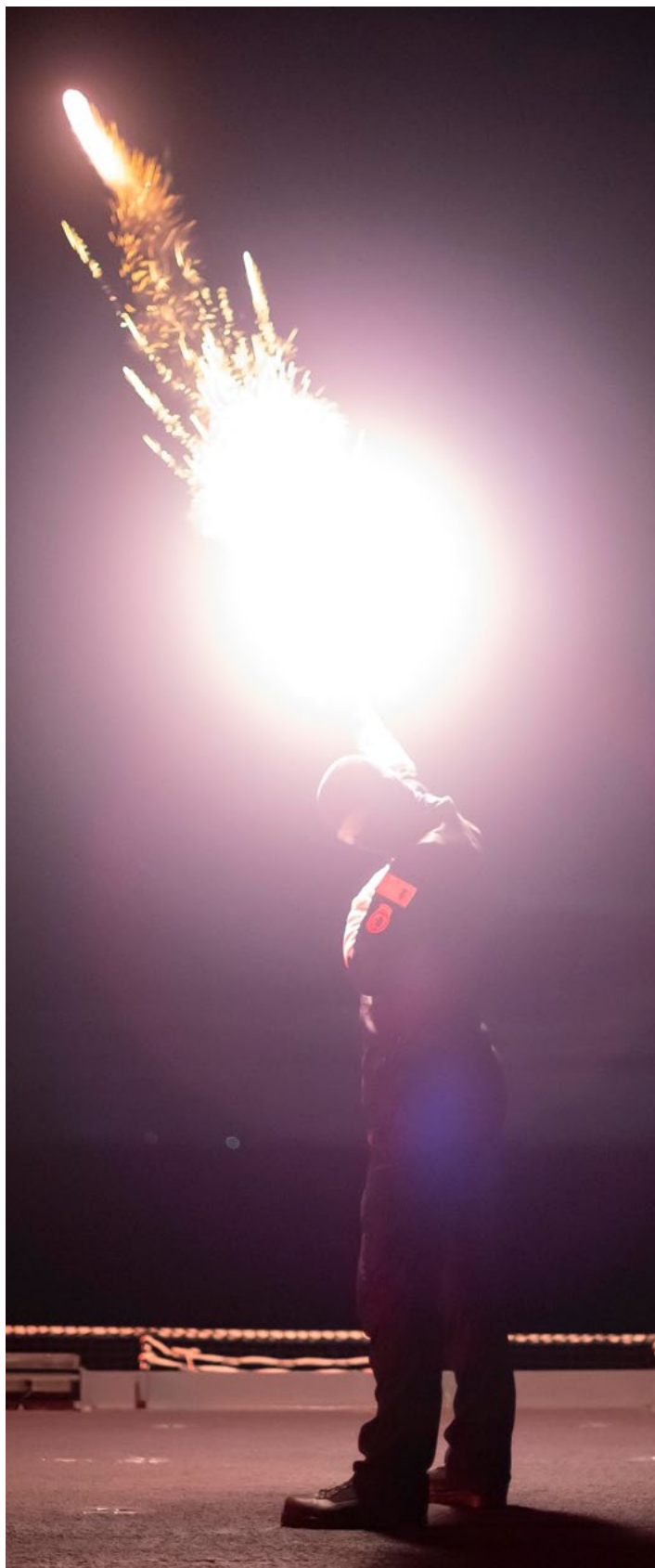






*Members of enhanced Forward Presence Battle Group participate in Exercise BOOMING THUNDER, a challenge between Canada, Slovenia and the Czech Republic with emphasis on technique and accuracy, during Operation REASSURANCE in the Camp Adazi Training Area, Latvia, November 16, 2020.*

# CONCLUSION



Ongoing efforts towards developing ammunition and explosives safety inspection standards for elements 2 (Ammunition and Explosives Equipment Program Management) and 7 (Ammunition and Explosives Infrastructure) of the Ammunition Program continued over the reporting period and will contribute towards greater departmental ammunition and explosives regulatory oversight. Furthermore, the department witnessed progress in its efforts towards reducing its stockpile of surplus, obsolete, deteriorated, and time-expired munitions. However and despite progress made in some areas, **the overall state of ammunition and explosives safety within the Department of National Defence and Canadian Armed Forces has been assessed as improvement required.**

Observations recorded in this report continue to adversely impact the department's ability to achieve and maintain a healthy ammunition and explosives safety program which hinges on its ability to effectively address and oversee the challenges that have been identified. Barring the implementation and effective oversight of management action plans, the department's Ammunition and Explosives Safety Program will continue to be adversely affected, impacting safety and operational capability.

This year witnessed an overall lack of understanding, an underutilization and an absence of enforcement for the implementation of the Ammunition and Explosives Safety Information Management System as the department's system of record. Where safety inspections were not executed and/or results not recorded, there is a significant concern that safety-critical risks are left unaddressed and could adversely impact personnel safety and operations. Furthermore, extensive delays in reporting and investigating ammunition and explosives occurrences as well as the quality of the investigations and reports continue to represent a significant departmental challenge.

An organization's ability to learn from its mistakes is centred on its ability to capture and apply lessons learned and is a critical component for institutionalizing safety and creating a healthy safety culture. The absence of comprehensive ammunition and explosives training aimed at standardizing investigations and identifying root causes and effective preventive measures across the department represents a real concern and contributes to the department's challenge in preventing a recurrence or mitigating consequences.



While there has been some progress in specific areas, the underlying ammunition and explosives safety and reporting cultures within the department require strengthening. Continuous improvement in reporting and investigating ammunition and explosives occurrences must remain a departmental priority.

The complexities around the observations raised within this report are strategic in nature and require a concerted effort and whole-of Ammunition Program approach to resolve. In the spirit of continuous improvement, a program of this complexity would benefit from enhanced leadership, an effective governance model, commitment and strong collaboration between Groups, Commands and the Director Ammunition and Explosives Regulation.



*Members of The Royal Canadian Dragoons (RCD) conduct level 2 and 3 patrols, which are troop level firing movements, to be operationally ready for deployments or foreign expeditions, in the training area of Garrison Petawawa on March 25, 2021.*

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## Abbreviations

A&E	ammunition and explosives
A&EIs	ammunition and explosives instructions
AASTP-1	Allied ammunition storage and transport publication 1
ADM(IE)	Assistant Deputy Minister (Infrastructure and Environment)
ADM(Mat)	Assistant Deputy Minister (Materiel)
ADM(DRDC)	Assistant Deputy Minister (Defence Research and Development Canada)
AERASC	ammunition and explosives risk assessment safety case
AESI	ammunition and explosives safety inspection
AESIMS	Ammunition and explosives safety information management system
AESP	ammunition and explosives safety program
ATA	ammunition technical authority

ATO	Ammunition technical officer
CA	Canadian Army
CAF	Canadian Armed Forces
CANSOFCOM	Special Operations Forces Command
CFAD	Canadian Forces Ammunition Depot
CFB	Canadian Forces base
CFLTC	Canadian Forces Logistics Training Centre
CJOC	Canadian Joint Operations Command
CLSECM	Canadian long span earth-covered magazine
DAEME	Ammunition and explosives management and engineering
DAER	Director Ammunition and Explosives Regulation
DAODs	Defence administrative orders and directives
DND	Department of National Defence
DRDC	Defence Research and Development Canada
eFP	Enhanced forward presence
EOD	Explosive ordnance disposal
ERP	Emergency response plan
ESAF	Explosives safety assessment framework
FY	Fiscal year
HFACS	Human Factors and Analysis Classification System
IATG	International Ammunition Technical Guidelines
MILPERSCOM	Military Personnel Command
MND	Minister of National Defence
NATO	North Atlantic Treaty Organization
NRCAN ERD	Natural Resources Canada's Explosives Regulatory Division
OPI	Office of primary interest
PCWG	Ports Criteria Working Group
PDP	Problem definition paper
PM	Preventive measure
RCAF	Royal Canadian Air Force
RCN	Royal Canadian Navy
SAA	Small arms ammunition
SOP	Standard operating procedures
UN	United Nations
VCDS	Vice Chief of the Defence Staff

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# ***AMMUNITION AND EXPLOSIVES SAFETY***

## **CALL TO ACTION**



### **IMMEDIATELY...**

report all Ammunition and Explosives (A&E) incidents and accidents



### **24 HOURS...**

to input all incidents and accidents in the Ammunition and Explosives Safety Information Management System (AESIMS) through your Unit Explosives Safety Officer (UESO)



### **30 DAYS...**

for a qualified Ammunition and Explosives investigator to complete the investigation report

***Don't wait, respect timelines,  
A&E safety is a force enabler!***

# **REPORT IT!**