



National  
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# DIRECTOR AMMUNITION AND EXPLOSIVES REGULATION

## Annual Report

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

A Review from

1 April 2018 to 31 March 2019



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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# 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.

This report is divided into six parts:

- Executive summary;
- Section 1 – Prologue;
- Section 2 – Policy review;
- Section 3 – Ammunition Program compliance assurance;
- Section 4 – Ammunition and Explosives Safety Program; and
- Section 5 – Report conclusion.

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 not subject to safety compliance activities and will not be discussed in this report. While this 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 to address many of the observations. The following paragraphs provide an overview of key observations made during the course of the fiscal year.

## KEY OBSERVATIONS – AMMUNITION PROGRAM COMPLIANCE ASSURANCE

### Ammunition Program-based safety compliance assurance model

The Assistant Deputy Minister (Materiel), the Assistant Deputy Minister (Infrastructure and Environment) and the Director Ammunition and Explosives Regulation continued to dedicate significant effort towards collaboratively developing ammunition and explosives safety inspection protocols and questionnaires for elements 2 (Ammunition and Explosives Equipment Program Management) and



7 (Ammunition and Explosives Infrastructure) of the Ammunition Program. These initiatives are expected to culminate in fiscal year 2020/21 with a first ammunition and explosives safety inspection for each element.

#### **Ammunition and explosives safety inspections – Results for second and third line facilities**

Overall, Department of National Defence and Canadian Armed Forces ammunition and explosives safety inspection results for element 4 remained robust within second and third line ammunition facilities with only one (1) failed inspection. The requirement to complete annual ammunition and explosives safety inspections proved to be challenging for the Canadian Army and the Assistant Deputy Minister (Science and Technology), who lacked the resources in personnel to fully implement the inspection cycle. As a result, the ammunition and explosives safety inspections for four (4) facilities were not executed and will require prompt re-scheduling.

#### **Appointment of ammunition and explosives competent personnel**

It was observed during compliance assurance activities that some units within one organization of the Canadian Army did not have qualified unit ammunition representatives and/or unit explosives safety officers appointed. There is a requirement to appoint qualified personnel for the effective implementation and management of the Department of National Defence and Canadian Armed Forces Ammunition and Explosives Safety Program.

#### **Ammunition and explosives storage licences**

Discrepancies between ammunition and explosives facility licences and the information tracked within the Ammunition Information & Maintenance System can lead to unsafe storage conditions and increase departmental risks. During the reporting period, it was observed that Group and Command ammunition technical authorities have remained diligent in maintaining data integrity between both systems, leading to a significant reduction in the number of discrepancies. Overall, observed discrepancies were minor in nature and are mostly attributable to the implementation of the new Ammunition and Explosives Safety Information Management System program to track unit licences.

#### **Periodic inspections**

Ammunition practitioners carry out periodic inspections at second and third line ammunition and explosives storage facilities at prescribed intervals throughout the life of the ammunition and explosives to safeguard against degradation and deterioration due to storage conditions while ensuring

stock serviceability. Through concerted efforts, the number of outstanding periodic inspections has decreased by 52%. The majority of outstanding overdue inspections are for ammunition and explosives that have been condemned or are awaiting disposal (through sale or demilitarization).

#### **Ammunition and explosives practitioners**

The Director Ammunition and Explosives Regulation initiated the development of an ammunition and explosives compliance safety inspection for element 6 – Ammunition and Explosives Practitioners, of the Ammunition Program. This initiative is aimed at supporting responsible authorities in ensuring there is adequate management of safety risks related to the education, training, professional development and employment of ammunition and explosives practitioners across the institution, and to identify areas for improvement.

#### **Ammunition and explosives risk assessment safety cases – Infrastructure**

It was observed that more than 75% of current risk assessment safety cases were related to infrastructure shortfalls, and hence largely out of the control of Group or Command organizations. This is indicative of the state of ammunition and explosives infrastructure where 22% of the facilities have been assessed as being in poor to critical condition. With nearly half of the extant safety cases expiring in 2020, the affected Groups and Commands will continue to assume safety risks while the Assistant Deputy Minister (Infrastructure and Environment) completes its characterization and prioritization efforts of the department's real property portfolio.

### **KEY OBSERVATIONS – AMMUNITION AND EXPLOSIVES SAFETY PROGRAM**

#### **Reporting culture**

Delays in reporting and investigating ammunition and explosives occurrences as well as the quality of the reports represent a departmental challenge. Timely reporting and 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.



## Safety culture

An analysis of occurrence cause factors showed that almost half of all occurrences within the Department of National Defence and Canadian Armed Forces were attributable to insufficient supervision, improper handling of ammunition and/or limited experience. Furthermore, close to a quarter of all safety occurrences were recurring occurrences, indicating an organizational challenge to capture and apply safety lessons learned.

There is a requirement to maintain independence between occurrence investigations with the sole purpose of capturing lessons learned and investigations that could lead to disciplinary measures. Free and open sharing of critical safety information between managers and operational personnel, without the risk of punitive action, represents the basis of the ammunition and explosives safety program's fundamental principle of a "Just" culture.



*A member of HMCS REGINA's Naval Tactical Operations Group conducts live fire training during Operation PROJECTION Asia Pacific, March 23, 2019.*





*The staff of Exercise ARDENT DEFENDER test the capabilities of the BootBanger, a water disruptor for use against vehicle-borne improvised explosive devices (IEDs), at the explosive ordnance disposal range at CFB Borden, Ontario on October 1, 2018.*

# 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’s and Canadian Armed Forces’ functional authority for ammunition and explosives safety, the Director Ammunition and Explosives Regulation has adopted the following regulatory oversight strategy, which sets the stage for the report:

- safety through the provision of policies, orders and directives;
- safety through the execution of an Ammunition Program-based, risk-informed compliance assurance program; and
- 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 one organizations, at the technical staff and senior leadership levels, during the reporting year and prior to finalization.







*Able Seaman Steven Trask, a Naval Electronic Sensor Operator, loads the Multi Ammunition Softkill System (MASS) on Her Majesty's Canadian Ship (HMCS) TORONTO for mission operations in the Mediterranean Sea during Operation REASSURANCE, January 29, 2019.*



# POLICY

## INTRODUCTION

Except as provided by the *Explosives Regulations, 2013*, the *Explosives Act* does not apply to or in respect of any 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 A&E technical authorities are distributed across several Groups and Commands, DAER is responsible, through stakeholder engagement, for overseeing the development of departmental A&E safety policies to ensure they remain accurate, relevant and current. This is achieved through a three-year policy review cycle and collaborative engagement with departmental stakeholders.

This section of the annual report discusses major amendments and findings as they relate to A&E safety policies. Supporting documents and general policy information can be found on the DAER intranet site <http://materiel.mil.ca/en/joint-common-ammo-explosives/regulation.page>.

## A&E SAFETY POLICY REVIEWS

Table 1 depicts the review status of departmental A&E safety policy reviews.



DOCUMENT	TITLE	REVIEW SCHEDULED (FISCAL YEAR)	STATUS	RATIONALE/IMPACT
DAOD 3002-0	Ammunition and Explosives	2018/19	Delayed	Due to protracted engagement during the stakeholder review process, the policy review was not completed. Last modification: 2016
DAOD 3002-1	Certification of Ammunition and Explosives	2018/19	Delayed	Due to protracted engagement during the stakeholder review process, the policy reviews were not completed. Last modification: 2017
DAOD 3002-2	Insensitive Munitions	2019/20	On Schedule	
DAOD 3002-3	Ammunition and Explosives Safety Program	2018/19	Delayed	Delayed due to staff turnover Publication scheduled: 2019
DAOD 3002-4	Ammunition or Explosives Accident, Incident, Defect or Malfunction Reporting	2018/19	Delayed	Delayed due to staff turnover Publication schedule: 2019
DAOD 3002-5	Use of Firearms, Ammunition and Explosives	2018/19	Delayed	Due to protracted engagement during the stakeholder review process, the policy reviews were not completed. Last modification: 2007
DAOD 3002-6	Display Fireworks	2019/20	On Schedule	
DAOD 3002-7	Ammunition and Explosives Risk Management	2020/21	On Schedule	
C-09-005-001/TS-000	Volume 1 – Program management and Life Cycle Safety	2019/20	On Schedule	
C-09-005-002/TS-001	Volume 2 – Storage and Facility Management	2020/21	On Schedule	
C-09-005-003/TS-000	Volume 3 – Transportation	2019/20	On Schedule	
C-09-005-004/TS-000	Volume 4 – Demilitarization and Disposal	2020/21	On Schedule	
C-09-005-005/TS-000	Volume 5 – Deployed Operations	2018/19	Delayed	Awaiting NATO standard update publication to align documents. Last revision: 2014
C-09-005-006/TS-001	Volume 6 – Naval Vessels	2018/19	Review Completed	Undergoing stakeholder review prior to translation
C-09-005-007/TS-001	Volume 7 – Certification of Ammunition, Explosives and Accessories for Service Use	2019/20	On Schedule	
C-09-005-008/TS-001	Volume 8 – Siting, Design and Construction Standards	2018/19	Review Completed	Publication Pending
C-09-005-009/TS-001	Volume 9 – Hazards of Electromagnetic Radiation to Ordnance (HERO)	2020/21	On Schedule	
A-GG-040-006 / AG-001	DND Explosives Safety Program	2019/20	On Schedule	
A-GG-004-006 / AG-002	DND Ammunition Accident/ Incident/Defect/Malfunction Reporting	2019/20	On Schedule	

**Table 1: Status of A&E safety policy reviews**

## DEFENCE ADMINISTRATIVE ORDERS AND DIRECTIVES (DAODS)

DAOD 3002-1 and DAOD 3002-5 are linked and must be jointly revised and promulgated. The current review seeks to transfer content from DAOD 3002-5 to DAOD 3002-1. Publishing them independently would likely result in duplication and possibly confusion. While there has been prolonged engagement with the Canadian Army (CA), delays in the review process are associated with differences in interpretation of departmental policies and authorities for A&E safety. There are no immediate safety implications associated with the proposed changes and both organizations remain committed to resolving the issue to ensure further delays do not lead to confusion over departmental policy requirements.

## AMMUNITION AND EXPLOSIVES INSTRUCTIONS (A&EIS)

A&EIs are issued to communicate changes to A&E safety policies outside the 3-year review cycle. A&EIs are used for the timely promulgation of relevant information for users and technical support personnel and are issued on the authority of the Deputy Minister and Chief of the Defence Staff.

A&EI 58 – Packaging and Handling of Class 1 Dangerous Goods. Released in May 2015, A&EI 58 detailed departmental policy requirements relating to the certification of packaging for Class 1 goods for shipment. In support of meeting the *Transportation of Dangerous Goods Act* and *Regulations* when shipping A&E by commercial carriers, Strategic Joint Staff's (SJS) J4 Ammunition is developing a training package and recertification process for all DND employees and CAF members. The training package is expected to be available on the Defence Learning Network in fiscal year (FY) 2019/20.

A&EI 66 – Ammunition and Explosives Safety Inspection (AESI) Policy Amendments. This policy amendment addressed two specific issues: AESI frequency for element 4 and repeat safety inspection observations.

- AESI frequency for element 4. AESIs are an integral function that assess the overall health of a unit's ammunition and explosives safety program (AESP). The intent of this top-down review of a base, unit or facility by its respective Group/Command ammunition technical authority (ATA) is to provide an objective assessment of the safety of A&E storage and operations within each organization. Through consultation, all Groups and Commands, save the Canadian Army (CA), favoured annual inspections over performance-based timelines due to potential safety concerns that could arise over an extended period between inspections. While the CA's resource constraints to accomplish AESIs were acknowledged, annual AESI cycles were implemented across all Groups and Commands as of 1 April 2018 to establish consistent baseline standards across organizations and to allow for objective and consistent reporting to the DM and CDS; and
- Repeat observations. Recommendation 7 from the 2018 ADM(RS) Audit of Ammunition and Explosives Management stated: "*It is recommended that DAER update and communicate guidance to track, assess and report on outstanding corrective action plans such that deficiencies are resolved on a timely basis and the overall status of the AESI/AESS accurately reflects the safety conditions at A&E facilities*". As of 1 April 2018, all Group/Command ATAs incorporated the practice of highlighting "Repeat" observations that would result in an automatic "Yellow" status for a given AESI pillar, despite the actual score. A second "Repeat" observation would result in a "Red" or failure status for the affected AESI pillar and automatically trigger a requirement for a six-month re-inspection<sup>1</sup>.

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<sup>1</sup> A&EI 66, 15 May 2018.





*An unexploded explosive ordnance found on July 20, 2019 during the underwater cleanup mission on shipwreck S.S. Rose Castle off the coast of Bell Island, Newfoundland still displays the make and manufacturing number engraved on the firing ring.*

These changes will be incorporated into Part 8 of the next revision of C-09-005-001/TS-000, Ammunition and Explosives Safety Manual (AESM), Volume 1, Program Management and Life Cycle Safety.

A&EI 71 – Use of Portable Computers in A&E Facilities. The use of portable automated data processing equipment (computer tablets) is a method to enhance documentation that falls within the controlled articles authorities of the commanding officer of a Canadian Forces Ammunition Depot or the officer in charge of an ammunition facility. An assessment by the Quality Engineering Test Establishment has led to the authorized indoor use of the Panasonic Toughbook portable computer (model CF-20) in explosives areas in locations where explosive gases and vapours are not present and exposed explosive dusts are limited or unlikely to be present, such as in ammunition storage magazines (in support to stocktaking) and transit buildings (in support to receipts and issues).

## **AMMUNITION AND EXPLOSIVES RISK ASSESSMENT SAFETY CASE (AERASC)**

A training video was launched through the DAER website on A&E risk management to assist practitioners in developing risk-based licences to address the community's assessed training and experience shortfalls.

## **EXTERNAL POLICY ENGAGEMENT**

### **NATO**

NATO Allied Committee 326 Sub Group C is responsible for developing and maintaining standards and guidance for in-service and operational safety. Chaired by Canada, the sub group continued its work on revising quantity distance tables found in Part 1 of Allied Ammunition Storage and Transport Publication 1 (AASTP-1) and on updating the airfield criteria found in Part IV Chapter 5 of that publication. These revisions will affect AESM Volume 2 – Storage and Facility Operations (C-09-005-002/TS-001 and TS-002) and Safety Orders for Canadian

Forces Air Weapons Systems (B-GA-297-001/TS-000)<sup>2</sup>. In addition, a new working group was established by Canada in March 2019 to update the criteria for ports and harbours (AASTP-1 Part IV Chapter 6); this will result in amendments to Volume 6 – Naval Vessels (C-09-005-006/TS-001 and TS-002).

In support to NATO Standard Allied Logistics Publication 16, Explosives Safety and Munitions Risk Management (ESMRM) in NATO Planning, Training, and Operations, Canada led the amendment of the policy and developed a record of decision document establishing a standardized decision document for NATO Commanders approving A&E safety cases.

### **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 (SOPs) by providing a frame of reference which can be used, or adapted for use, as a national standard. DAER provides a representative on the Technical Review Board (TRB) to ensure coordination of the comparable guidelines between NATO, the UN and Canada. Work continues on reviewing and updating of the IATGs with the next edition due to be published in 2020.

## **CONCLUSION**

While there were delays in promulgating key policy documents, DAER continued to oversee and coordinate A&E safety policy reviews with the designated technical authorities (TAs) within individual Groups and Commands. Through continued active engagement with NATO and Partnership for Peace nations, Canada continued to lead significant A&E safety policy initiatives.

<sup>2</sup> Recently renamed "Air Weapons Safety for the Canadian Armed Forces"





*An Air Weapons Systems Technician maintains a Dillon M134D gun during Operation PRESENCE-Mali, May 30, 2019.*



# AMMUNITION PROGRAM COMPLIANCE ASSURANCE

## INTRODUCTION

A&E safety oversight within DND and the CAF is accomplished, in part, through the execution of compliance activities against the Ammunition Program-based, risk-informed, regulatory model (figure 1) and a careful review and consideration of organizational practices around the AESP.

While offices of primary interest have been identified for each element of the Ammunition Program, A&E safety compliance activities within DND and the CAF are applied against the elements of the Ammunition Program and can be categorized into three distinct levels (figure 2):

Level 1 – **compliance** through effective execution and self-assessment by local A&E practitioners at wings, bases and third line facilities (monthly/quarterly inspections);

Level 2 – **compliance verification** through the Group/Command ATA outside the immediate line management chain; and

Niveau 3 – **compliance assurance** by the functional authority that is fully independent of line management or a Group/Command.

## COMPLIANCE OBSERVATIONS BY AMMUNITION PROGRAM ELEMENT

The following paragraphs provide the results, by Ammunition Program element, of A&E safety compliance activities over the reporting period.

### Element 2 – A&E equipment program management

#### **AESI status**

The development of comprehensive AESI standards for the Ammunition Program's element 2 – A&E Equipment Program Management, has continued over the reporting period. Specifically, an AESI tool to evaluate the A&E safety and suitability for service (S<sup>3</sup>) function as well as the life cycle materiel management (LCMM) function within the Director General Land Equipment Program Management was developed and trialed in consultation with ADM(Mat). The tool will be further refined and expanded to include the Director General Aerospace Equipment Program Management, the Director General Maritime Equipment Program Management, the Director General Major Project Delivery (Air and Land) and the Director General Major Project Delivery (Sea) over the next reporting period.



DAER	SJS	Program Element	Ammunition Program 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)
		5	Strategic Ammunition Program Policy and Doctrine	SJS
		6	A&E Practitioner and Professionalization	ADM (HR) / CMP
		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				

Figure 1 – Ammunition Program-based regulatory model

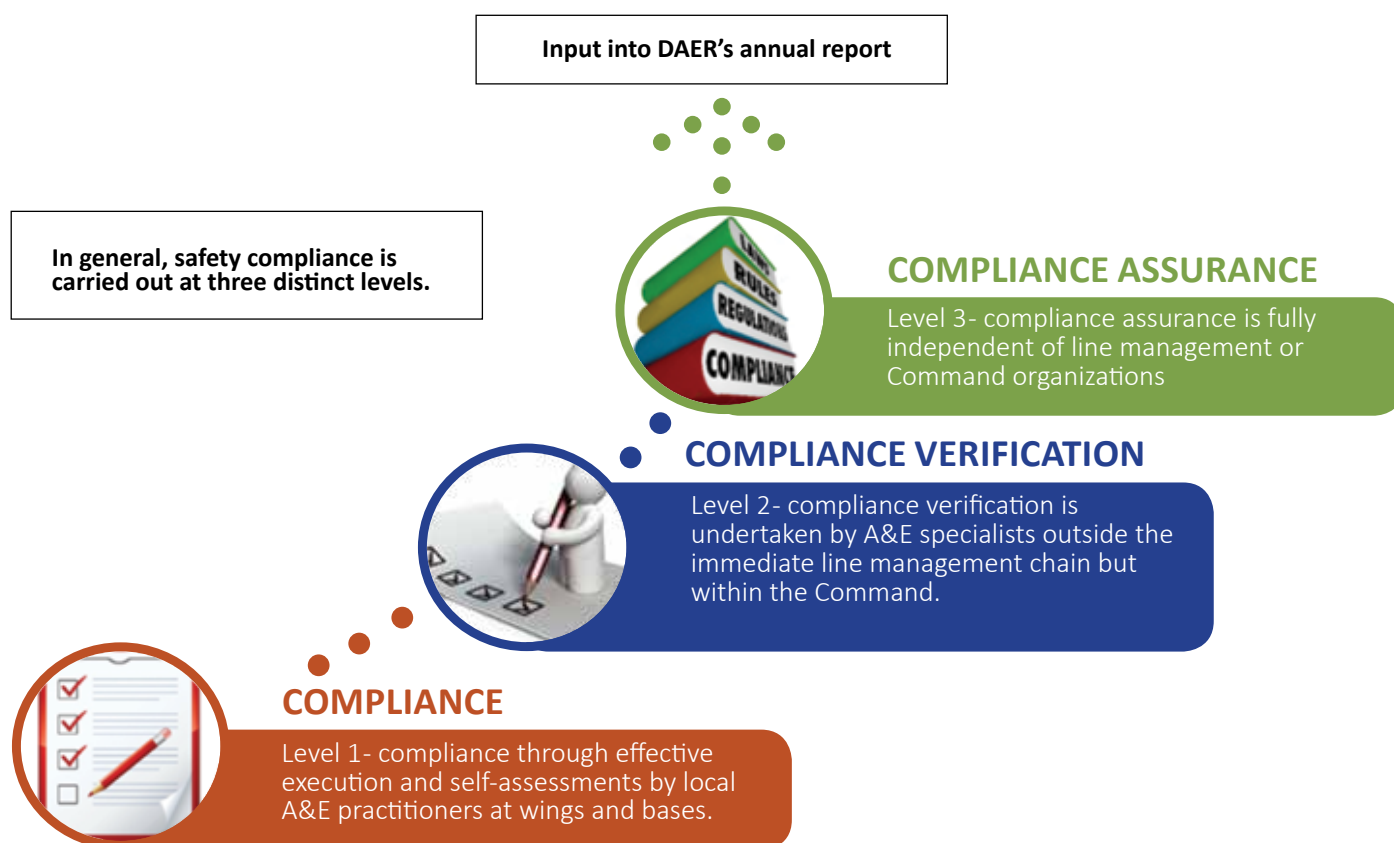


Figure 2 – Levels of compliance

## ***Demilitarization and disposal***

In FY 2018/19, DND's stockpile of surplus, obsolete, deteriorated and time-expired A&E awaiting disposal was established at approximately 8 500 tons. The majority of the materiel consists of munition scrap, spent brass/steel cartridges, small arms ammunition (SAA), artillery propellant and rocket motors. To mitigate the associated safety risks, ADM(Mat) initiated the following procurement strategy aimed at reducing A&E stockpiles awaiting disposal at second and third line facilities:

- the acquisition of a system for the mutilation of aids to production;
- the acquisition of a system to process SAA and expended cartridges;
- the acquisition of equipment to heat treat munition scrap; and
- the acquisition of equipment to heat treat unserviceable live SAA.

These demilitarization/disposal capabilities are expected to be operational by the end of FY 2021/22.

## ***SAA brass disposal***

An AERASC by the A&E TA led to a change in departmental policy recognizing a visual inspection as a valid means of achieving level 4 confirmation for expended SAA-related brass. As a result, the sale of expended SAA brass resumed during the year where DND was able to successfully and safely dispose of approximately 260 tons of inventory (representing 40% of the SAA brass backlog). The terms and conditions for effecting such disposal action will be incorporated into the Supply Administration Manual, enabling disposal by sale by wings, bases and third line facilities.

## ***A&E disposal activity***

The Canadian Materiel Support Group (CMSG) annual A&E disposal activity, Exercise DUSTY THUNDER, continued to play an important role in stockpile management by successfully disposing by destruction of 225 tons of defective and time expired A&E.

## ***S<sup>3</sup> extraordinary decisions***

LDAEME oversees the S<sup>3</sup> process to ensure A&E have an acceptable level of risk and inherent safety characteristics throughout their established life cycle. As part of that process, an extraordinary decision (EX) allows for the short-term in service use of A&E if the timely completion of an Ammunition Safety and Suitability Board (ASSB) phase two decision, or decision amendment, is not feasible due to immediate operational imperatives. The EX process is well established and, once completed, is valid for a maximum of three years with possible extensions of two additional 12-month periods for a maximum of five years<sup>3</sup>.

During the reporting period, it was also observed that EX #16-035 authorized the in-service use of the 7.62mm ball and tracer for the M134D Mini-gun in 2016 in support to OP IMPACT and OP PRESENCE while EX #10-17A1 had authorized a similar in-service use in 2011 in support of operations in Afghanistan. The repeat EX submission for the same ammunition nature in the same weapon system exceeded the five-year authority normally granted through the EX process, inadvertently circumventing the more comprehensive ASSB phase two S<sup>3</sup> process. There is a requirement for improved oversight of the EX submission process to align with departmental policy to ensure safety risks are as low as reasonably practicable.

## ***Element 4 – A&E operations support and readiness***

### ***AESI status***

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 AESIs.

The FY 2018/19 AESI cycle saw the introduction of the Ammunition and Explosives Safety Information Management System (AESIMS) inspection module to record and track AESI results. The Group/Command AESI self-assessment summary (table 2) represents the aggregate results within the respective Groups/Commands across the seven pillars of the AESI under Element 4. Overall, these combined results indicate that A&E safety remained robust within second and third line A&E facilities, with only one failed inspection at the Canadian Forces Ammunition Depot (CFAD) Bedford.

<sup>3</sup> C-09-005-007/TS-001 – Volume 7, Certification of Ammunition, Explosives and Accessories for Service Use.



GROUP/COMMAND	AESI SELF-ASSESSMENT SUMMARY FY 2018/19
RCN	Acceptable
CA	Acceptable <sup>4</sup> – 2 Facilities of 11 not assessed <sup>5</sup>
RCAF	Acceptable
CJOC Domestic	Acceptable
CJOC Expeditionary	Acceptable
CANSOFCOM	Acceptable
ADM(S&T)	Attention Required – 2 Facilities of 2 not assessed <sup>6</sup>
ADM(Mat)	Acceptable
VCDS	Acceptable

#### LEGEND

Acceptable	Aggregate Group/Command average score is over 75 percent for all pillars.
Improvement Required	Aggregate Group/Command average score is between 60 percent and 75 percent for at least one pillar.
Attention Required	Aggregate Group/Command average score is below 60 percent for at least one pillar.

**Table 2: Aggregated element 4 AESI results**

While AESI results for A&E second and third line facilities remained robust, there were some areas that represented opportunities for improvement:

- AESI execution. The requirement to complete annual AESIs at all second and third line A&E facilities<sup>7</sup> proved to be challenging for the CA who lacked the resources in personnel to implement the new inspection cycle (table 2 refers). This represents a potential increase in safety risk considering the high turn-around in personnel and the technical skill fade at all levels;
- Canadian Joint Operations Command (CJOC) ATA Support. Whereas the CJOC ATA has historically supported Military Personnel Command (MILPERSCOM), the Vice Chief of the Defence Staff (VCDS) and the Assistant Deputy Minister (Science and Technology) (ADM(S&T)), CJOC informed supported Groups/Commands that it would cease to provide ATA support as of 1 April 2019 in an effort to improve its effectiveness in supporting expeditionary operations. As a result, ADM(S&T) was unable to execute the ATA function within its Group, potentially affecting safety. There is a requirement for MILPERSCOM, VCDS and ADM(S&T) to secure the services of an ATA to ensure continued safe management and use of A&E;
- UAR and UESO. The appointment of unit ammunition representatives (UAR) and unit explosives safety officers (UESO) is required for the effective implementation and management of the DND/CAF AESP<sup>8</sup> at the unit level. While the UAR is responsible for bringing A&E into the unit, the UESO functions as safety advisor to the commander and is responsible for the implementation of all aspects of the AESP within the unit by providing guidance and advice on A&E matters. Both the UARs and the UESOs support an effective AESP through properly trained, qualified and authorized personnel. It was observed during compliance assurance activities that some units within one (1) organization of the CA did not have qualified UARs and/or UESOs appointed;
- Emergency preparedness. Areas of concern identified for the RCAF and CJOC (expeditionary operations) were the execution of A&E-related annual exercises and drills and the continuing education and understanding of roles and responsibilities amongst all practitioners and emergency responders in the event of an A&E incident/accident at the base/wing. This shortfall contributes to the degradation of a robust emergency response plan that must be coordinated to effectively address A&E occurrences;

<sup>4</sup> Of the inspected bases.

<sup>5</sup> Facilities not inspected were 2 Canadian Division Support Base Valcartier, Detachment St-Jean (Farnham) and 4 Canadian Division Support Base Petawawa, 2 Service Battalion).

<sup>6</sup> Facilities not inspected were Defence Research Establishments Valcartier and Suffield.

<sup>7</sup> A&EI 66, 15 May 2018.

<sup>8</sup> CANFORGEN 216/16 241659 NOV 16 and A&EI 56 15 May 2017

- A&E warehousing and management. A decline in A&E inventory warehousing and management procedures under the Storage pillar of the AESI was observed within the RCAF and CJOC. There were observations related to A&E storage, A&E compatibility, tracking of net explosives quantities within magazines and the use of authorized and appropriate standard operating procedures. A&E storage/operating procedures are paramount to ensuring best practices are maintained while minimizing risk to personnel and property within all A&E-related facilities; and
- AESIMS. The rollout of the Inspection and Licensing modules within the management system has facilitated and improved data entry and tracking within the A&E practitioner community. ATAs as well as A&E managers and supervisors must continue to provide oversight and guidance to ensure the employment of these modules is ingrained and remains aligned with departmental policy.

### ***Expeditionary operations***

This reporting period witnessed the successful execution of the department's first compliance assurance activity for expeditionary operations at NATO's enhanced Forward Presence (eFP) Battle Group in Latvia. A collaborative effort between CJOC and DAER, the inspection also supported efforts to identify and mitigate A&E risks and led to the successful completion of Canada's first A&E risk assessment under NATO governance. The cooperative approach highlighted a wide range of A&E challenges that are to be expected when operating in a complex multinational environment.

The ongoing review and development of AESI standards for the Ammunition Program's element 4 – A&E Operations Support and Readiness<sup>9</sup>, continued and will continue to be refined within the context of continual improvement.

### ***A&E storage licences – AIMS data integrity***

The warehousing of ammunition (including licensing of storage facilities) is managed through the Ammunition Information & Maintenance System (AIMS) and is subject to an annual compliance evaluation to ensure alignment between A&E storage licences and the information found in AIMS. Discrepancies between the licences and AIMS can lead to unsafe storage conditions and increase departmental risks. During the reporting period, it was observed that Group and Command ATAs have remained

diligent in maintaining data integrity between both systems, leading to a significant reduction in the number of discrepancies. Overall, discrepancies were minor in nature and are mostly attributable to the implementation of AESIMS that enables unit tracking of licences. In an effort to improve departmental oversight, a notification feature within AIMS will be developed that will flag changes to the net explosives quantities for a given magazine to both SJS and Group/Command ATAs. This new capability is expected to be implemented in May 2019.

### ***Periodic inspections***

Domestic operations. Ammunition practitioners carry out periodic inspections at second and third line A&E storage facilities at prescribed intervals throughout the life of A&E to safeguard against degradation and deterioration due to storage conditions while ensuring stock serviceability. In September 2016, DAER conducted an audit of the periodic inspections recorded in AIMS and noted 3,108 overdue periodic inspections (cumulative). Consequently and as the departmental TA for A&E, ADM(Mat)/Director Ammunition and Explosives Management and Engineering (DAEME) directed Group/Command organizations to take corrective action to ensure inspections were completed in accordance with departmental policy<sup>10</sup>.

A review of periodic inspection policies and the rationale behind the periodicity of specific natures was also conducted by the TA. This review determined that periodic inspections of SAA were no longer required. The Ammunition Program Materiel Acquisition & Support Working Group adopted the proposal in November 2018, resulting in a 14% reduction in overall outstanding periodic inspections and a reduction in workload at second and third line A&E facilities as well as in operational theatres.

Through concerted efforts over the last three years, the number of outstanding periodic inspections has decreased by 52% (figure 3). The majority of outstanding overdue inspections are for A&E items that have been condemned or are awaiting disposal through sale or demilitarization (figure 4). As the rate of degradation of these items could represent a safety concern, it is important to ensure that they continue to be inspected to ensure they remain safe for storage, transportation and/or sale.

<sup>9</sup> To include ADM(IE)'s A&E domestic UXO Legacy sites operations.

<sup>10</sup> C-74-300-B02/NJ-000, Ammunition and Explosives Manual, Inspection of Ammunition

PERIODIC INSPECTION TRENDS

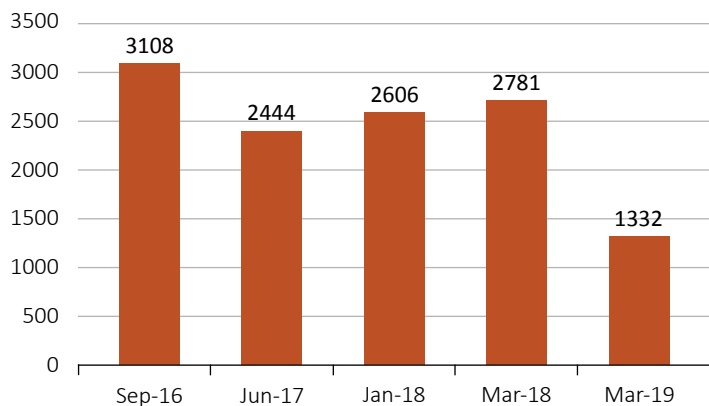


Figure 3 – Total number of lots awaiting periodic inspection

SERVICEABILITY CATEGORY

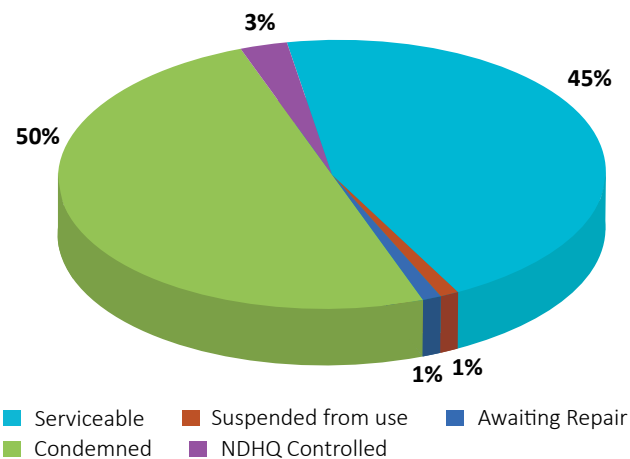


Figure 4 – Breakdown of ammunition by serviceability category



Members of the Canadian Armed Forces clear a jammed projectile from the M777 Howitzer during a test fire at the Lawfield Observation Point in the 5<sup>th</sup> Canadian Division Support Base Gagetown training area on October 17, 2018.



Deployed operations. This is a repeat observation. Some A&E sent to theatres of operations and A&E being held in Canada as reserve stock were not subjected to the required periodic inspections. As most theatres of operations do not have the infrastructure (workshops) or capacity to carry out periodic inspections safely in a location away from the ammunition stockpiles, the lapse in executing periodic inspections prior to deployment represents an unnecessary increase in safety risk that requires addressing through renewed procedures and/or mechanisms.

#### ***Assessment of Group/Command ATAs***

In general, Group/Command ATAs were assessed as being competent in the execution of AESIs. The criteria for assessment were based on AESI execution and team conduct. The reintroduction of a Group/Command ATA training session by SJS in FY 2019/20 should support and guide newly appointed Group/Command ATAs in the performance of their duties and responsibilities.

### **Element 6 – A&E practitioner**

#### ***AESI status***

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 very advanced technical knowledge. There is a requirement to develop competencies through an integrated process involving personnel selection, education, training and professional development. To that end, DAER has initiated the development of an A&E practitioner AESI which will support responsible authorities in ensuring there is adequate management of risks related to the education, training, professional development and employment of A&E practitioners across the institution. A requirement supported by the 2005 Chief of Review Services evaluation of the DND and CAF Ammunition Safety Program, the practitioner compliance assurance AESI will be focused on:



- a qualitative assessment providing assurance that the content and structure of A&E practitioner education, training and professional development meet the current and future DND/CAF operational requirements, and adequately enable effective risk management in A&E-related activities; and
- a quantitative assessment, providing assurance that there are sufficient numbers of appropriately trained and experienced A&E practitioners to effectively and safely deliver the current Ammunition Program across the strategic, operational and tactical levels, and that they are being appropriately employed in support of these objectives.

A comprehensive AESI for element 6 is expected to be completed over FY 2019/20 with implementation anticipated for FY 2020/21.

### ***Ammunition technical officer training***

In accordance with CAF policy, individual training and education must be conducted in accordance with the Canadian Forces Individual Training and Education System management model, which requires a formal validation to ensure a close match between the training and education and the duties the members perform, as identified through an occupational analysis. If validation is not conducted routinely, the possibility exists that the delivered material does not satisfy the performance requirements of the course. This could potentially affect personnel safety and compromise CAF missions.

During this reporting period, it was observed that the Ammunition Technical Officer (ATO) Training Program was never subject to an occupational analysis or a course validation since it was brought to Canada from the United Kingdom in 2012. As a result, SJS and MILPERSCOM

**BOTTOM PICTURE:** *Members of Duke's Company with the enhanced Forward Presence Battle Group Latvia, conduct an 84mm and M72 Light Anti-Tank Weapon range in the training area of Ādaži Military Base, Latvia on December 26, 2018.*



acknowledged the requirement to initiate an analysis of the programme and committed resources towards executing an occupational analysis and course validation throughout FY 2019/20.

## **Element 7 – A&E infrastructure**

### **AESI status**

During the reporting period, ADM(IE) and DAER continued to collaborate on developing metrics and criteria to support an AESI for A&E-related infrastructure. Steps have been taken to refine the methodology for both executing inspections and collecting data on asset suitability, facility condition, and explosives safety for A&E infrastructure.

More specifically, ADM(IE) further developed element 7 of the Ammunition Program and established a cyclical, risk-informed, custodial inspection program. Director Architecture and Engineering Services, in consultation with Directorate, Real Property Programme Management and Canadian Forces Real Property Operations Group, developed a proposed Explosives Safety Assessment Framework to meet requirements. These assessments are based on the following three indices:

- Suitability Index. Annual user inspections with technical guidance and support from ADM(IE) which evaluate whether facilities are “fit for purpose”. Executed at the asset level by non-technical evaluators such as the ammunition facility users/operators, these evaluations address factors such as space adequacy, operational suitability and fire safety;
- Facility Condition Index. Custodial inspections that assess the integrity of the facility from environmental degradation and operational wear and tear, to be completed across the entire portfolio once every five years (20% of assets per year). Executed at the asset level by technical evaluators such as professional engineers, these evaluations address the structural integrity of infrastructure and issues related to systems and utilities; and
- Explosives Safety Index. Custodial inspections that evaluate the facility against explosives safety considerations, including the categorization of assets based on facility design and other technical criteria, to be completed across the entire portfolio once every five years (20% of assets per year). Executed at the asset level by both technical and non-technical personnel, these evaluations address factors such as net explosives quantities, blast hardening and explosives hazard safety.

This positive initiative will continue throughout FY 2019/20, with the aim of implementing a pilot AESI to assess the feasibility and resource requirements as well as to further refine the methodology for conducting safety inspections across the A&E portfolio.

### ***Canadian long span earth-covered magazine (CLSECM)***

A follow-on review of the construction standards of the CFAD Bedford CLSECMs identified excessive depth of common earth covers between magazines. In the event of an accidental explosion, the earth would act as a transmitter for the shock wave, placing adjacent magazines at risk. ADM(IE) has proposed to allocate FY 2019/20 funding to study the matter and develop an engineered solution for CFAD Bedford. In the interim, CJOC has 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 magazine.

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

AERASCs enable A&E operations and functions to continue when extant A&E safety standards cannot be achieved. Risk is determined by assessing multiple factors affecting the probability and consequences of an unintended event. DAER currently plays a review and advisory function within the AERASC process to support Groups/Commands in identifying and establishing adequate risk mitigation measures reducing the risk to levels as low as reasonably practicable. An AERASC is a temporary measure allowing for sufficient time (to a maximum of five years) for the accountable organization to implement long-term sustainable measures that meet departmental A&E safety standards/policies. Table 3 lists all current AERASCs. Amplifying details for these AERASCs can be found in the Group/Command ATA input section of this report.

While there remain 200 A&E facilities to undergo a facility condition assessment, 78% of the inspected infrastructure assets are in good to fair condition, while 22% are in poor to critical condition and approaching the end of their economic life cycle. The latter lead to a requirement to operate under risk-based licences with limited storage capacity. There is a continued requirement for a comprehensive understanding of the state of A&E infrastructure supporting the AP to assess if the concerned facilities still meet their A&E storage designation in order to prioritize repair and/or replacement requirements.



GROUP/ COMMAND LOCATION	AERASC SER #	TYPE	RESIDUAL RISK LEVEL	EXPIRY	OPI
CA Gagetown	0105-2014-001	A&E Storage (Magazine)	Low	2020	ADM(IE)
CA Suffield	0142-2014-001	A&E Storage (Magazine)	Medium	2020	ADM(IE)
RCAF Comox	3235-2013-01	A&E Storage (Magazine)	Medium	2020	ADM(IE)
ADM(S&T) Valcartier	1430-2014-01	A&E Operations (Workshop)	Low	2021	ADM(IE)
ADM(S&T) Valcartier	1430-2015-02	A&E Operations (Workshop)	Low	2021	ADM(IE)
CANSOFCOM Ottawa	6399-2016-01	A&E Storage (Magazine)	Medium	2021	ADM(IE)
CJOC – Deployed Latvia	6923-2018-01	A&E Storage (Magazine)	Significant	2023	NATO/Host Nation
ADM(IE) Lac St Pierre	UXO1-2015-01	UXO Procedures	Medium	2020	ADM(IE)
ADM(Mat)	2107-2018-01	Disposal (SAA Brass)	Low	2023	DAEME

**Table 3: Current AERASCs**

## CONCLUSION

The compliance assurance program has continued to develop and expand over this reporting period for elements 2 and 7 of the Ammunition Program, with plans to conduct initial AESIs for those elements during FY 2020/21. Work will also begin on the development of an AESI for element 6 – A&E Practitioners. Expeditionary operations will be a focus of attention again in FY 2019/20 with the intent of accompanying the CJOC ATA to at least one deployed operation. The continued development of AESIMS will allow for greater audit capabilities as well as the development of customized AESIs to better serve the needs of Groups and Commands.

On a broader front, DAER will continue to seek out opportunities through NATO to enhance and develop knowledge in collaboration with our allies particularly in Lithuania and Estonia with the eFPs led by Germany and the United Kingdom, respectively. Concerns related to the ATO specialty and A&E practitioner shortfalls have also been raised and will be more comprehensively addressed following the development of an AESI for element 6 – A&E Practitioner.

## GROUP/COMMAND INPUT

Groups/Commands were provided an opportunity to report on systemic issues, recurring A&E safety observations and any other concerns of note affecting their respective organizations. The following is a synopsis of returns received by Groups/Commands that should be considered as supporting or additional observations.

### RCN

As per NAVORD 3002-3, the RCN ATA conducted annual inspection visits to both Maritime Forces Atlantic and Pacific. In both cases, the RCN AESP was found to be in good working order. The migration of the Formation Explosives Safety Officers from Formation Safety to the Formation Ammunition Technical Authorities proved successful with only minor issues that have since been resolved. The RCN inspection checklist in AESIMS was also fully implemented and proved successful on both coasts. Although technical issues associated with ship connectivity continued in accident and incident reporting, workaround solutions were found and progress was made. The RCN ATA was appointed as the Royal Canadian Navy Representative supporting NATO's Ports Criteria Working Group, with the first meeting being held in London, UK. A lot of positive discussions were held as alliance members each explained the application of NATO guidelines in their navies. The RCN looks forward to continued participation in the development of updated guidelines to make naval operations better and safer. Overall, it was another positive year.



*Gunners from 1<sup>st</sup> Regiment, Royal Canadian Horse Artillery fire the 105-mm C3 Howitzer gun at Rogers Pass, British Columbia during Operation PALACI on 22 November 2018.*

## CA

The AESI scoring results of CA 2<sup>nd</sup> Line A&E facilities were all higher than 90% with all seven pillars being in the “Acceptable” range. A&E Safety Committee meetings in CA A&E facilities are held, but not always quarterly as mandated. No critical safety issues were observed, however the state of A&E infrastructure continues to be a mission degrader within the CA. It has been noted that CA 2<sup>nd</sup> line ammunition facilities that have not been inspected for 18-24 months are still maintaining high standards. The CA has two AERASCs in place at Suffield and Gagetown respectively, both expiring in 2020. A workaround solution may be feasible at Suffield with the transfer of a magazine from British Army Training Unit Suffield (BATUS) to the CAF. The Gagetown solution is currently unfunded and involves the construction of a second roof over the existing transit building to afford it the required heavy roof designation as an exposed site.

## RCAF

AESI results are generally good with an average score of 88%. The emergency readiness element is often weak due to insufficient documentation in the respective wing Emergency Response Plans, a lack of proper familiarization briefs to first responders and the absence of annual practice exercises. Significant progress has been made regarding overdue A&E periodic inspections; resolution of this issue is expected to occur by October 2019. AESIMS reporting is increasing and reporting delineation (Flight Safety vs AESIMS) at the wings and units is clear. Misunderstanding of what constitutes an incident is still an issue as incidents are sometimes confused with malfunctions. As a result, the RCAF is engaging the Wing ESO and maintenance community during inspections and venues to highlight the differences.

The RCAF has one AERASC that will expire in January 2020. This AERASC is for 19 Wing Comox and concerns the explosives workshop. The workshop's proximity to an explosives storage magazine limits operations. Mitigation in the form of reduced maximum credible event and frequency of use of the workshop are proposed as mitigating factors for the re-submission in 2020.

## **CJOC**

The largest explosives safety challenge faced by CJOC this year was the difficulty in force generating ammunition specialists for expeditionary missions and AESIs through the Canadian Forces Task Planning and Operation (CFTPO) system. This resulted in a significant amount of work by the J4 Ammo staff to source suitable ammunition technicians and ammunition technical officers to fill established positions in missions such as OP REASSURANCE enhanced Forward Presence (eFP) Latvia, OP UNIFIER, OP IMPACT and OP PRESENCE. A similar difficulty in finding experienced assistance to conduct AESIs domestically required CJOC J4 Ammo staff to coordinate directly with Level 1 (L1) taskers to ensure NO FILL positions were pushed to other L1s. It may be more effective to direct all CFTPO taskings for ammunition specialists to the SJS trade advisors, who can recommend specific individuals to assist in the nomination process.

Effective 1 Apr 2019, the CJOC ATA ceased to provide ATA support to VCDs, ADM(S&T) and MILPERSCOM in order to streamline CJOC ATA responsibilities and improve effectiveness in supporting expeditionary operations. Additionally, CJOC J4 Ammo will be delegating some ATA responsibilities to CMSG J4 Ammo. Lastly, small domestic units/ops (such as JTF(N) and Op PALACI) will have their AESIs conducted by an ammunition technician from their supporting A&E base/division. In the case of small missions (OP KOBOLD, OP SOPRANO, OP CROCODILE, and OP SNOWGOOSE) that hold less than 3 kg of small arms ammunition, it will be conducted via table top exercise (TTE). The TTE will include copies to the mission's explosives safety program, pictures of the ammunition and its packaging condition, and a monthly checklist.

Infrastructure issues continue to reduce the CFADs' ability to manage A&E with all aspects of safety effectively addressed, primarily for the two coastal depots. CFADs Bedford and Rocky Point are currently assessing the explosive risk associated with their challenges to properly inspect large munitions, including Harpoon missiles and torpedoes, due to explosives workshop space and the required material handling equipment to move them.

The Canadian Forces Fire Marshal has noted that the fire suppression systems in CFAD Dundurn require extensive work to ensure water is available throughout the explosives storage area. Recommendation: Continued engagement with ADM(IE) to eliminate the asbestos exposure issues, correct high humidity levels causing mould, and address the fire suppression issue.

## **ADM(IE)**

ADM(IE) does not have A&E under their control as do other Groups/Commands. As a result, there is no requirement for an AESI under the format used to evaluate element four of the AP. Director Contaminated Sites (DCS) is determining what type of unique AESI could be generated to capture the contractor-performed unexploded explosive ordnance (UXO) work. A draft DCS AESI for discussion on the matter will follow soon.

ADM(IE)/DCS has only one AERASC in place, for UXO clearance work at Lac St-Pierre, which expires in May 2020. The objective of this AERASC was to collect data to demonstrate that semi-permanent marking, in conjunction with a permanent marking, could be used as a tool for the correct identification of inert projectiles. This part is in place. The second part is to collect data and recognize the Munitions and Experimental Test Centre specific permanent marking (knurling) as marking that represented the absence of energetic material in the entire projectile. This part is still under way. However, until statistically significant data can be produced, projectiles will be perforated, collected and added to munition scrap. Due to the nature of this AERASC, it will require renewal until the clearance operation is complete or sufficient data has been collected to definitively classify those projectiles without energetic material present.

## **CANSOFCOM**

All units had successful AESIs scoring from 92-96 % with all fields in the "Acceptable" range. Common issues and trends generally related to operational tempo and personnel shortages are being mitigated by increased appointment and employment of UARs. These appointments will also serve to offset the ammunition technicians belonging to units performing UAR functions. CANSOFCOM has one medium risk level AERASC that is expiring 23 Sep 2021. Future mitigation will require the construction of a new facility; no other mitigation measures can be taken for the AERASC renewal in 2021.



To maintain operational security CANSOFCOM mainly operates on a secure network and continues to have a need for a secure AESIMS in order to better enable the Command to meet reporting timelines. The Command also requires to be fully integrated into the CAF Ammunition Infrastructure review. To support its diverse mandates, CANSOFCOM has ammunition stored in several locations cross-country. A robust all-encompassing infrastructure plan to include a complete third line facility will alleviate the demands on individual units and set the conditions for optimal and flexible ammunition support to the Command.

CANSOFCOM continues to evolve and improve on its AESP with increased awareness, better communications and change in culture. Achieving support for a Command ammunition infrastructure solution and secure tools (AESIMS) will enable CANSOFCOM to retain its agility in executing its mandate while respecting operational security and remaining compliant within the CAF AESP.

### **VCDS**

The Canadian Forces Support Unit (Ottawa) (CFSU(O)) Ammo Compound at Canadian Forces Base Uplands continues to operate with restrictions – ceasing the distribution of hazard divisions (HDs) 1.1 and 1.2 due to the results of the AESI carried out by CJOC on 8 March 2017. The findings of this inspection revealed that CFSU(O) Ammo does not have the capability to continue to prepare ammunition issues and to accept returns of HD 1.1 and 1.2 stores due to licensing restrictions. An AERASC was not sufficient to justify supporting these tasks to carry on at this location and to continue to do so would be in violation of current regulations under the departmental AESP.

The location of the CFSU(O) Ammo Compound is a concern as the surrounding public infrastructure has developed in closer proximity to the site over the years. There was no suitable existing alternate site found locally to continue to support the National Capital Region (NCR) clients (across all Groups/Commands) for these ammunition supplies (including Connaught Ranges). This issue was identified in the Ammunition Program Infrastructure Study when the VCDS Group return was submitted to highlight CFSU(O) Ammo Compound shortfalls / deficiencies. There is currently no information available to confirm if any projects are in the works to rectify this issue. This significantly constrains the VCDS group in being able to provide full services that the CFSU(O) Ammo Compound was tasked to provide to NCR clients and will continue to impact operations until a new location is found and a facility built.





*Soldiers from the Royal Regiment of Canadian Artillery School (RCAS), 2<sup>nd</sup> Regiment, Royal Canadian Horse Artillery (2 RCHA) and 5<sup>e</sup> Régiment d'artillerie légère du Canada (5 RALC) conduct M777 Howitzer training as part of The Battery Commander's Exercise course at CFB Gagetown in Oromocto, New Brunswick, April 5, 2019.*

# 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 injuries, destroy, damage or disable materiel and damage infrastructure or the environment. These occurrences can also result in mission failure, or otherwise impact operations.

The aim of the DND AESP is to enable and support CAF operations and departmental goals by preserving operational capability, 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.

Strengthening of the department's AESP was observed throughout the reporting period in specific areas such as the analysis of incident and accident reports, the continued development of AESIMS and revisions of AESP policies. On the other hand, DND and the CAF have continued to struggle to improve the reporting and safety cultures, areas that necessitate sustained senior leadership engagement.

## OBSERVATIONS AND FINDINGS

### AESIMS – UESO engagement

Introduced in April 2017, AESIMS is 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. This new capability allows for trends analysis and the identification of safety risks. With training available at the unit level, UESOs are able to view and track A&E safety occurrences in AESIMS.

As the A&E safety advisor to unit commanding officers (COs), UESOs are an integral part of a Group's/Command's AESP. Active engagement by the UESO during A&E occurrence reporting and investigations will provide unit COs with better situational awareness over safety occurrences affecting operations, and will act as a force multiplier to the Group/Command ATA in his/her efforts in advising the L1 Advisor or Commander on the state of A&E safety within their respective organization.





To facilitate reporting within the department, consideration is being given to extending the authority to initiate occurrence reports to UESOs. This change would ensure unit engagement and contribute to strengthening the reporting culture with the department.

## Reporting culture

A&E incidents and accidents are typically associated with one or a combination of the following factors: a failure or a defect in a piece of materiel; a weapon system; handling or operating procedure; or, environmental conditions. In line with departmental policy, all hazardous occurrences must be reported, including near misses, hazardous situations and even the slightest of injuries or equipment damage.

As indicated in the tenth annual report, the timelines for Group and Command organizations to submit the “Initial” and “Investigation” reports within AESIMS were revised from 12 hours and 7 days to 24 hours and 30 days, respectively. This was assessed as necessary to allow for sufficient time to conduct detailed investigations and to align with reporting timelines of similar safety programs within the department. The changes were reflected in departmental policy over the current reporting period<sup>11</sup>.

While personnel familiarity with AESIMS may have been a contributing factor, an 18% increase in reporting was observed throughout the department (Figure 6). This positive trend could also reflect a better understanding of the importance of reporting. Acknowledging the progress in reporting occurrences, overall A&E reporting within DND and the CAF requires improvement in the following areas:

- Reporting timelines. This is a repeat observation applicable to all Groups/Commands. The average number of days for submitting an “Initial Report” decreased considerably from the last reporting period from 27.5 days to 11 days. Of the 131 occurrence reports, 63 cases (48%) were reported within 24 hours. While this is a marked improvement in the submission of “Initial” reports, there remains room for improvement for Group and Command organizations to submit “Initial Reports” within 24 hours;
- Investigation timelines. This is a repeat observation applicable to all Groups/Commands. The average number of days to complete “Investigation Reports” increased from an average of 36, reported in FY 2017/18, to 46 during the current reporting period, representing a significant downward trend. Furthermore and once the “Investigation Report”

was released at the unit level, Group/Command ATAs averaged 123 days to review and close a case in AESIMS. It is important to note that of the 131 cases filed during the reporting period, only 33 cases were closed as of 31 Mar 2019 with the remaining 98 cases remaining open pending Group/Command ATA action (Figure 7). A&E occurrences could adversely impact personnel/public safety and operations, and not only degrade mission capability but also erode personnel confidence in A&E and their associated weapon systems. Timely reporting and investigation of A&E occurrences is critical and an indicator of a healthy safety program. Delays in reporting and investigating A&E occurrences represent a departmental shortfall and increase the potential for repeat occurrences. Timely reporting and increased Group/Command oversight are key to capturing and sharing lessons learned and avoiding similar occurrences with the potential for catastrophic consequences and mission failure;

- Outstanding reports. This is a repeat observation applicable to all Groups/Commands. Figure 8 outlines, by Group/Command, the 115 outstanding “Investigation Reports” awaiting ATA action since the implementation of AESIMS in April 2017. The importance of the ATA’s role in reviewing occurrence reports within their respective organizations cannot be overstated. Their ability to advise their respective chain of command is predicated on their knowledge and understanding of the state of A&E safety within the Group/Command. As safety is a command responsibility, outstanding reports represent missed opportunities; and
- Quality of reporting. This is a repeat observation applicable to all Groups/Commands. Investigations of A&E occurrences require investigative techniques in addition to technical knowledge of the A&E, the associated weapon system and an understanding of the operational environments. Throughout the reporting period, it was observed that while reports were explicit in defining “what” had occurred, very few addressed the “why” or the “how” of occurrences, thereby preventing the identification of root causes and appropriate preventive measures (PMs). Consideration should be given to the delivery of a departmental investigators’ course aimed at standardizing the investigative approach, identifying root causes and ensuring effective PMs are identified that would prevent recurrence.

<sup>11</sup> Ammunition and Explosives Instruction 69, Accident / Incident Reporting Timelines, 26 November 2018

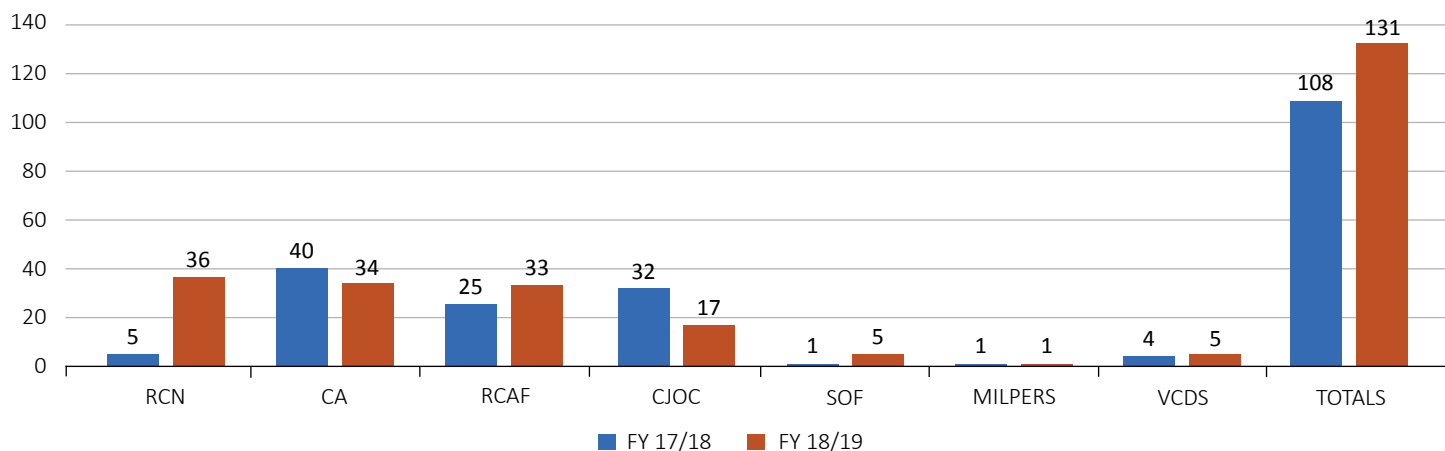


Figure 6 – FY 2018/19 occurrence reports by Group/Command

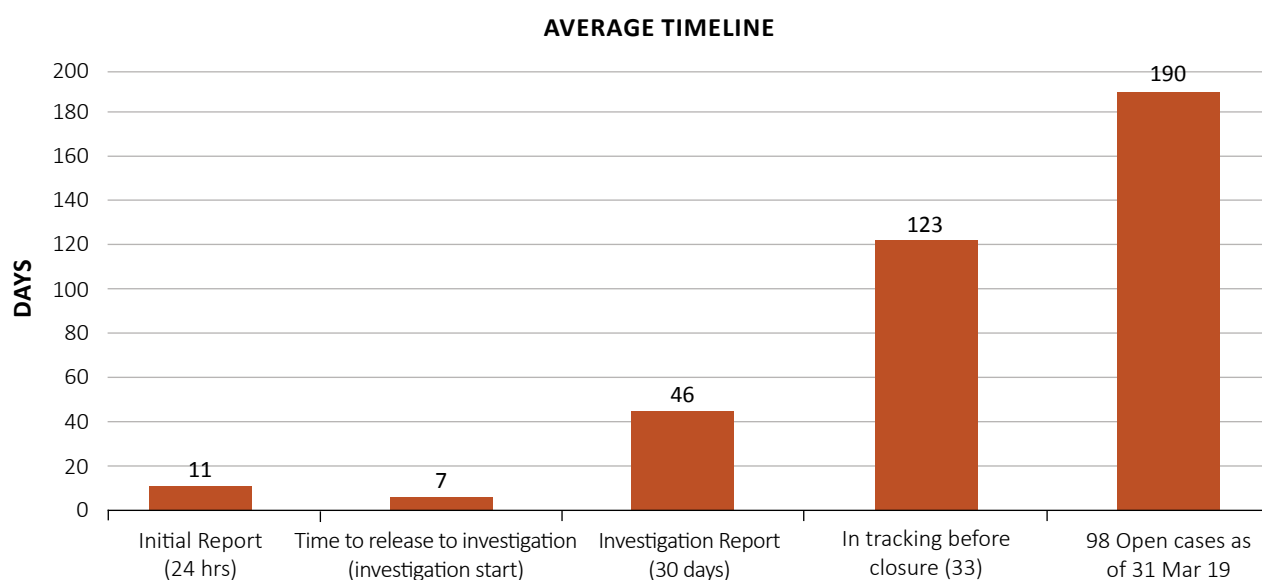


Figure 7 – Average timeline from occurrences to report closure

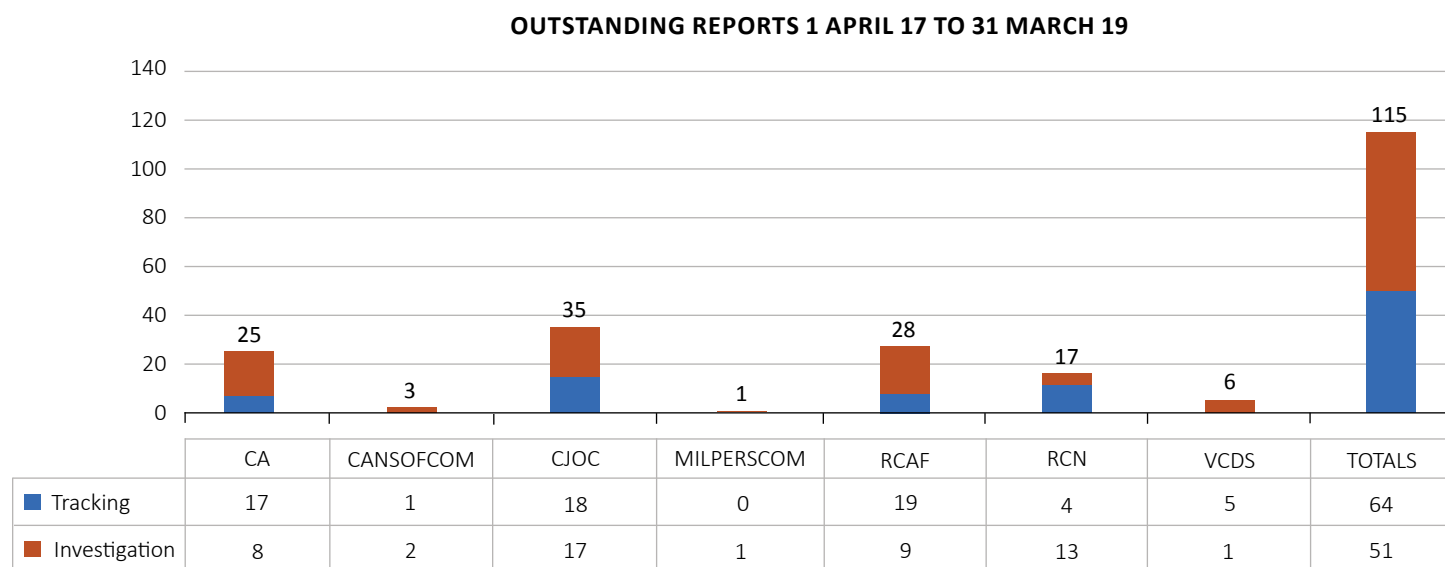


Figure 8 – Outstanding reports

## AESIMS MONTHLY REPORTS

In support to Groups and Commands, DAER reviews all occurrences and provides monthly reports highlighting observations made and areas for improvement within the report. There is significant room for improvement on Group and Command response times in addressing observations. Timely Group/Command ATA review of monthly reports is required to increase the quality of reports, leading to the identification of effective PMs.

## OCCURRENCE ANALYSIS OVERVIEW

### A&E Incident/Accident Ratio

The Heinrich 300-29-1 model<sup>12</sup> suggests that for every 300 near misses there are 29 minor injuries and 1 major injury (figure 9). The resulting incident to accident ratio is therefore established at 10:1 for this particular model.

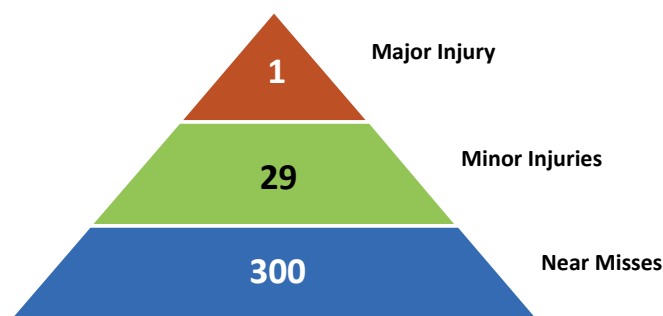


Figure 9 – The Heinrich model

While model values may vary depending on supporting studies, the relationship between near-miss events (incidents) and injuries (accidents) is indicative of the health of an organization's safety program, and its reporting and safety cultures. Whatever the precise ratio in any given field of work, the key point is to capture and understand incidents before they recur 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. Each Group/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 Group/Command AESP. The higher an organization's ratio, the better its ability to execute and sustain its operations.

Of the 131 occurrences reported, there were 92 incidents and 39 accidents, representing an incident to accident ratio of 2.4. The results represent a downward trend in the department's A&E safety margin when compared to the previous reporting period where a ratio of 2.7:1 was recorded (figure 10).

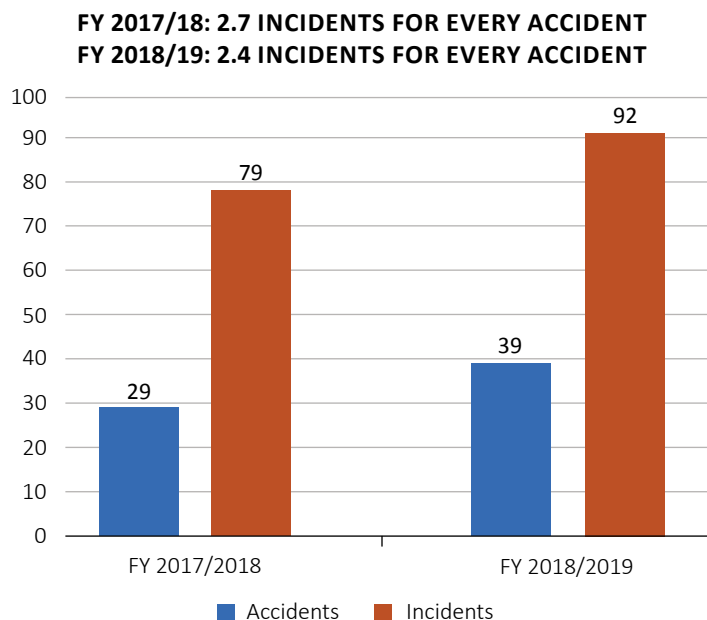


Figure 10 – Incident/Accident ratio

### Injuries

There were 15 separate occurrences resulting in a total of 16 injuries, representing a 14% increase over the last reporting period. Fourteen (14) injuries were associated with military personnel while the remaining two (2) were civilian employees.

Over the reporting period, 79% of all injuries were attributable to human factors and were preventable. Furthermore, a detailed analysis of recorded near misses highlighted serious concerns where several incidents were considered "near misses with the potential for catastrophic consequences".

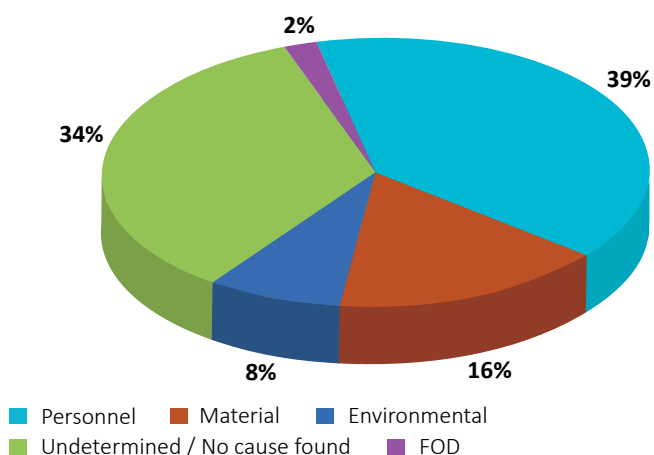
### Human Factors Analysis and Classification System

The Human Factors Analysis and Classification System (HFACS) methodology is based on the work of James Reason and Shappell and Wiegmann and is used to categorize human cause and contributing factors.

<sup>12</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".



The Director Flight Safety (DFS), recognizing that most DND/CAF incidents and accidents were directly related to personnel, introduced the HFACS methodology into the department in 2004. Following some enhancements, the “CF HFACS” model is now significantly different from the Shappel and Wiegmann model and provides a taxonomy that analyzes and identifies, in general terms, the human element of an occurrence so that conclusions can be reached and PMs can be formulated that will lead to a safer environment.



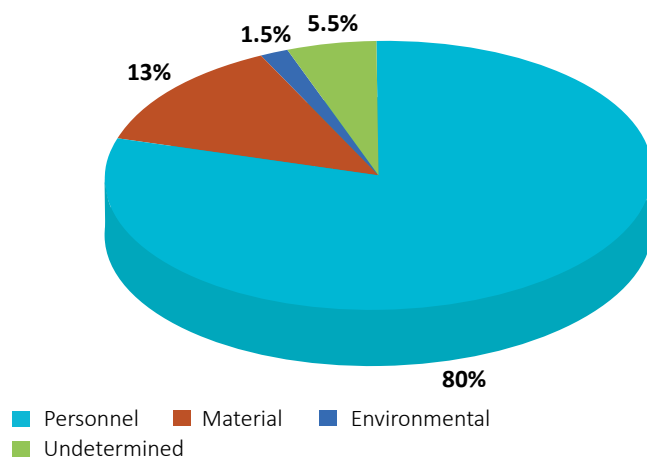
**Figure 11.a – Initial cause factors**

### Cause Factor Trends and Analysis

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

- Supervision, Control and Experience. 42% of all occurrences within DND and the CAF were attributable to insufficient supervision, poor control of ammunition (e.g. mixing live or dud ammunition with salvage) and/or limited experience. In some instances, post-accident risk mitigation measures were not comprehensively considered and/or implemented;
- Procedures. Common user natures such as small arms ammunition and pyrotechnics, as well as natures most frequently used by the operating environments, continue to be involved in a high percentage of reported occurrences. Approximately 21% of all DND/CAF occurrences were procedural

A detailed review of all AESIMS reports indicated that 34% of assigned cause factors had been mislabelled as “Undetermined” or “No Cause Found”, triggering a requirement to review all occurrences and re-label the recorded cause factors for a significant number of occurrences. Where figure 11a illustrates the cause factors as initially assigned by Groups and Commands, figure 11b illustrates the cause factors as re-assigned by DAER. While the HFACS methodology is new to the ammunition practitioner community, a better understanding by Group and Command ATAs of its application will lead to the accurate identification of root causes and the implementation of effective mitigation measures.



**Figure 11.b – Revised cause factors**

in nature following the use of A&E (e.g. not using or improper use of the amnesty program, improper handling of ammunition). Unit control of ammunition and ammunition processes as well as A&E safety awareness within the department require strengthening; and

- Repetitive occurrences. 23% of all cases reported during the reporting period were recurring occurrences. It is vital to address recurring occurrences as they can lead to systemic symptoms at the organizational level.

The Group/Command ATA plays a critical role in supporting their L1 Advisor or Commander by fostering safe practices in A&E management and use. As the initial point of contact and liaison between subordinate units and higher headquarters, the ATA’s responsibility to review, mentor and provide feedback to the subordinate units and to close reports in a timely fashion is key to the L1 Advisor’s/ Commander’s success in implementing strong reporting and safety cultures.



*A door gunner from the Tactical Aviation Detachment keeps watch as a CH-146 Griffon helicopter flies over Iraq during Operation IMPACT in Iraq on April 23, 2019.*



## “Just” Culture

While safety is a command responsibility, the requirement to report A&E occurrences and conduct investigations is legislated<sup>13</sup> and therefore not discretionary. Over the course of the reporting period, there has been extensive engagement between DAER and the CA to align A&E occurrence reporting practices with extant departmental policies in an effort to maintain independence between technical safety investigations and investigations that could lead to administrative and/or disciplinary measures. To successfully determine causes and contributing factors, an investigation must be directed toward fact finding for prevention. Free and open sharing of critical safety information between managers and operational personnel, without the risk of punitive action, represents the basis of the AESP fundamental principle of a “Just” culture. Personnel must be able to report occurrences, hazards or safety concerns as they arise, free of sanction or embarrassment.

## AESP COMMUNICATION

Resource constraints prevented the implementation of a much-needed departmental communication strategy; nevertheless, the DAER Intranet (DWAN) website was continuously updated and continued to serve as the central repository for all AESP publications as well as NATO and other international A&E references, ensuring continuous access to references to the practitioner community. Furthermore, DAER participated in key activities<sup>14</sup> such as its engagement with similar safety programs within DND.

## CONCLUSION

While there has been progress in reporting occurrences in some areas, the overall reporting and safety cultures within DND and the CAF continue to require strengthening. As the Group/Command subject matter expert, an ATA’s ability to effectively advise their respective chain of command and units is predicated on their knowledge and understanding of the state of ammunition and explosives safety within their respective organizations. The lapse in Group/Command reporting timelines, investigative technique and the quality of occurrence reports necessitates greater engagement of the ATA on behalf of their respective L1 Advisor/Commander.



<sup>13</sup> *Canada Occupational Health and Safety Regulations*; and *Canada Labour Code, Part II*.

<sup>14</sup> The annual Fight Safety conference and the Joint Counter Explosives Threat working group.





*Members of the enhanced Forward Presence Battle Group Latvia prepare to defend their position against the enemy during the Integrated Capstone Exercise at Camp Ādaži, Latvia, January 25, 2019.*

# CONCLUSION

Departmental oversight over ammunition and explosives safety continues to increase to address all elements of the Ammunition Program. The execution of and associated results for self-assessed ammunition and explosives safety inspections of Commands under element 4 can be characterized as healthy. Repeat strategic observations made by the Director Ammunition and Explosives Regulation will, however, necessitate additional focus in order to ensure enhanced compliance in future years.

Ongoing efforts to develop ammunition and explosives safety inspections for elements 2 (Ammunition and Explosives Equipment Program Management) and 7 (Ammunition and Explosives Infrastructure) have also been successful, while efforts to establish an ammunition and explosives safety inspection for element 6 (Ammunition and Explosives Practitioner) are well under way.

An organization's ability to learn from its mistakes is predicated on capturing lessons learned and is a critical component for institutionalizing safety and creating a healthy safety culture. While there has been some progress in reporting occurrences and timelines, the underlying ammunition and explosives safety and reporting cultures within the department require strengthening. The Department of National Defence and Canadian Armed Forces' ability to conduct ammunition and explosives safety occurrence investigations remains a challenge and will require additional oversight.

A program of this complexity, with its rigid reporting and safety culture, can always, in the spirit of continuous improvement, benefit from enhanced communications, awareness, and collaboration between the regulator and the regulated.







Crewmembers of the air detachment onboard Her Majesty's Canadian Ship (HMCS) TORONTO load Raptor, the embarked CH-148 Cyclone with MK-46 torpedoes during Operation REASSURANCE, while sailing the Black Sea, April 15, 2019.



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