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DIRECTOR AMMUNITION AND EXPLOSIVES REGULATION

Annual Report

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

A Review from

1 April 2019 to 30 March 2020



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.

The report is divided into six parts:

- Executive summary;
- Prologue;
- Policy review;
- Ammunition Program compliance oversight¹;
- Ammunition and Explosives Safety Program; and
- Report conclusion.

The executive summary provides an overview of key observations made during the course of the reporting year and ends with the assessed 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 to address many of the 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.

¹ 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.



Compliance assurance program

Comprehensive 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 were collaboratively developed with the Assistant Deputy Minister (Materiel) and the Assistant Deputy Minister (Infrastructure and Environment), respectively. Implementation is expected in fiscal years 2020/21 and 2021/22 respectively, following Level 1 endorsement.

The department initiated the development of ammunition and explosives compliance safety standards for element 6 – Ammunition and Explosives Practitioners. This initiative is aimed at supporting responsible authorities in ensuring adequate management of safety risks related to the education, training, professional development and employment of ammunition and explosives practitioners across the institution. Continued development is expected throughout fiscal year 2020/21.

Infrastructure facility condition assessment

During the reporting period, the Assistant Deputy Minister (Infrastructure and Environment) completed its assessment of the ammunition and explosives infrastructure portfolio, resulting in an assessed average facility condition assessment of fair. This important milestone will further inform the Department of National Defence and Canadian Armed Forces infrastructure portfolio decisions.

Demilitarization and Disposal

In fiscal year 2019/20, the department's stockpile² awaiting disposal was established at approximately 9,100 tons. Collectively, the department successfully reduced its stockpile by approximately 525 tons through sale, demilitarization and destruction operations. The Assistant Deputy Minister (Materiel)'s sustained efforts in leading a departmental demilitarization and disposal capability will substantially lower the level of risk associated with the storage of surplus, obsolete and deteriorated ammunition and explosives³.

² Includes A&E that is surplus, obsolete, deteriorated and time-expired, as well as munition scrap and spent brass/steel cartridge cases.

³ Includes time-expired A&E, munition scrap and spent brass/steel cartridge cases.

Ammunition and explosives storage licences

During the reporting period, it was observed that Group and Command ammunition technical authorities have remained diligent in maintaining data integrity between facility licences and the Ammunition Information and Maintenance System. Overall, observed discrepancies were minor in nature and are mostly attributable to the ongoing implementation of the Ammunition and Explosives Safety Information Management System program to track unit licences.

Ammunition Specialist Officer Occupational Analysis

In October 2019, Military Personnel Command launched the Ammunition Specialist Officer Occupational Analysis. By the end of the reporting period, Phase I⁴ had been completed and culminated in a brief to the Sponsor Advisory Group comprised of Branch Advisors from the five affected occupations. Some of the safety concerns identified during the brief were effective performance of duties and skill fade. This initiative is recognized as a positive step in establishing departmental requirements for ammunition specialty officers.

KEY OBSERVATIONS – OPPORTUNITIES FOR IMPROVEMENT

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

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 – Ammunition and Explosives Operations Support and Readiness, were assessed as improvement required. During the reporting year, there were two failed inspections, two missed inspections and a second year where a Level 1 organization was unable to execute an annual safety inspection of one of its storage facilities.

⁴ There are five (5) phases to the occupational analysis: Phase I – Ascertain problems/issues; Phase II – Complete a job analysis; Phase III – Complete a structure analysis; Phase IV – Provide a decision brief; and Phase V – Complete an implementation plan.

Ammunition and explosives risk assessment safety cases – Infrastructure

It was observed that 75% of current risk assessment safety cases were related to infrastructure shortfalls, and hence largely out of the control of Group or Command organizations. 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.

Occurrence reporting

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. Effective training, 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.

Practitioner training and experience

Groups and Commands were challenged in their ability to review, track or provide adequate oversight into occurrence reporting, assess safety risks and oversee explosives storage licensing. In line with their delegated authorities and in support to their respective Level 1 Advisor or Commander, there is a requirement for ammunition technical authorities to become proficient in the execution of their duties and responsibilities, as per their respective terms of reference. The appointment of experienced and resourced Group/Command ammunition technical authorities would significantly improve the department's ability to oversee, assess, manage and mitigate domestic and deployed ammunition and explosives safety risks.

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

The overall assessed state of ammunition and explosives safety within the Department of National Defence and Canadian Armed Forces has historically relied on Group and Command input and focussed primarily on element 4 of the Ammunition Program. With the implementation of a comprehensive departmental Ammunition Program-based regulatory model and the increased visibility enabled by the Ammunition and Explosives Safety Information Management System, a more accurate and concerning picture of the overall ammunition and explosives safety program has emerged.

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 oversight⁵ of adequate management action plans, there is the potential that the department's Ammunition and Explosives Safety Program will continue to be adversely affected, impacting safety and operational capability.

Whereas safety observations were previously associated with a specific Group or Command, recent observations related to infrastructure, practitioner competency⁶ 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 a responsible and accountable champion at the Strategic/National level to provide the necessary impetus to address observations raised within this report represents a significant challenge for the Department of National Defence and Canadian Armed Forces.

⁵ Whereas the Ammunition Program Oversight Committee can act as an enabler, it has no authority over responsible Groups and Commands and did not convene during the reporting year.

⁶ Competency is defined as suitably qualified and experienced.



Air Task Force Commander, Lieutenant-Colonel Forrest Rock inspects the Royal Canadian Air Force CF-188 Hornet aircraft before a training flight during Operation REASSURANCE–Air Task Force Romania at the Mihail Kogălniceanu Air Base, Romania on September 6, 2019.

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 safety, the Director Ammunition and Explosives Regulation has adopted the following departmental 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 1 organizations, at the technical staff and senior leadership levels, during the reporting year and prior to finalization.





Canadian Armed Forces soldiers participate in Exercise COLLABORATIVE SPIRIT, a military exercise familiarizing senior government personnel and industry leaders with the combat capabilities of the Canadian Army, in Petawawa, Ontario, September 27, 2019.

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 A&E safety policies. Current status, 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>.

DEFENCE ADMINISTRATIVE ORDERS AND DIRECTIVES (DAODS)

DAODs 3002-3 and 3002-4

DAOD 3002-3, *Ammunition and Explosives Safety Program* and DAOD 3002-4, *Reporting of Ammunition or Explosives Accidents, Incidents, Defects and Malfunctions* were reviewed and amended during the reporting period. These DAODs are the foundation of the Ammunition and Explosives Safety Program (AESP) and emphasize the importance of all aspects of A&E safety, including the concept of a “Just Culture” and the independence of safety investigations from administrative and/or disciplinary investigations. Promulgation of the DAODs is expected for fiscal year 2020/21.



AMMUNITION AND EXPLOSIVES INSTRUCTIONS (A&EIS)

A&EIs are issued on the authority of the Deputy Minister and Chief of the Defence Staff to communicate changes to A&E safety policies outside the established three-year publication review cycle.

A&EI 71 – Use of Portable Computers in Ammunition and Explosives Facilities. Issued during the reporting period, this A&EI provides guidance on the use of specially configured automated data processing equipment in day-to-day ammunition and explosives administrative tasks such as stocktaking and other data recording. This change will be incorporated in the next revision of C-09-005-009/TS-001, Ammunition and Explosives Safety Manual – Volume 9, Hazards of Electromagnetic Radiation to Ordnance (HERO).

A&EI 72 – Explosives Safety and Munitions Risk Management in NATO Planning, Training and Operations. This policy identifies the requirement to incorporate the Allied Logistics Publication (ALP) 16 and NATO explosives safety and munitions risk management (ESMRM) principles into the CAF logistical planning process involving A&E in support of NATO multinational training and/or operations. This change will be incorporated in the next revision of C-09-005-005/TS-000, Ammunition and Explosives Safety Manual – Volume 5, Deployed Operations.

A&EI 73 – Ammunition and Explosives Safety Inspection Scoring Threshold Performance Metric Amendments. This A&EI increased the current scoring threshold for ammunition and explosives safety inspections (AESIs) by 5% as of 1 April 2020. Aligned with the department's efforts for continuous improvement, this change will be incorporated in the next revision of C-09-005-001/TS-000, Ammunition and Explosives Safety Manual – Volume 1, Program management and Life Cycle Safety.

A&EI 75 – Change in Restriction in Limit for the Destruction of Propellant. This amendment increased the quantity of propellant that can be disposed of by open burning at second and third line ammunition facilities from 5 000 kg to 30 000 kg per year. This change will be incorporated into the next revision of C-09-005-004/TS-000, Ammunition and Explosives Safety Manual – Volume 4, Demilitarization and Disposal.

Execution of compliance assurance

The three-tiered A&E compliance model relies heavily on the department's ability to generate and sustain a core of suitably qualified and experienced ammunition practitioners. Acknowledging the shortage in qualified personnel, limited experience in personnel and shortfall of personnel at required rank, Groups/Commands have been challenged in identifying suitable candidates to execute the function of ammunition technical authority (ATA). As a result, and to leverage DAER's extensive expertise and experience, compliance assurance will be achieved by means of a DAER-led regulatory audit of a second/third line A&E facility for all affected Groups/Commands.

This shift in the execution of compliance assurance for element 4 will improve regulatory oversight and contribute towards building the experience levels within the A&E practitioner community by providing a learning opportunity for the accompanying ATA. While the change has been socialized with affected Commands, the corresponding A&EI was delayed following the COVID-19 pandemic. The revised approach will be promulgated during fiscal year 2020/21.

AMMUNITION AND EXPLOSIVES SAFETY MANUALS – C-09-005 SERIES

C-09-005-008/TS-001, Ammunition and Explosives Safety Manual – Volume 8, Siting, Design and Construction Standards was published during the reporting period and replaced C-09-153-001/TS-000 which has been cancelled in its entirety. The target audience for this publication is primarily A&E-related building designers.

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 (EOD) above the high water mark and is currently issued under the authority of DAER. 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, the CA was unable to accept and subsequently update the policy due to reported resource

limitations within the Joint Counter Explosives Threat Task Force. Delays in transferring, reviewing and updating the publication could adversely affect the safety of CAF personnel conducting EOD operations.

D-09-002-010/SG-000, *Standard – Assessment of the Safety and Suitability for Service of Ammunition and Explosives*, is currently issued under the authority of DAER. Efforts to transfer ownership of this procedural manual from DAER to the A&E Technical Authority of the Assistant Deputy Minister Materiel's (ADM(Mat)) Director Ammunition and Explosives Management and Engineering (DAEME) organization have been ongoing since 2017. Last reviewed in 2007, there is a requirement to expedite the transfer of the manual and conduct a comprehensive review to ensure continued alignment with departmental safety policies.

POLICY GUIDANCE/INTERPRETATION

Ammunition and explosives transported by a commercial carrier⁷ outside DND/CAF owned or controlled property 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 A&E to have a certificate of authorization issued by Natural Resources Canada's Explosives Regulatory Division (NRCan ERD), the application for which relies on the ability to provide the A&E technical data. During the reporting period, it was observed that certificates of authorization could not normally be secured by the department due to the absence of A&E technical data, a situation normally associated with A&E acquired through foreign military sales.

In response and in recognition of its unique operating environment, the department has been working with NRCan ERD and Transport Canada to amend the MND's exemption from the *Explosives Act* to include commercial carriers transporting A&E outside DND/CAF owned or controlled property. While progress was slowed following

the COVID-19 pandemic, the intent is to resolve the issue during the upcoming reporting period. To mitigate the impact to operations:

- where feasible, ADM(Mat) is securing certificates of authorization for A&E currently in DND/CAF inventory;
- DND/CAF assets are transporting A&E or escorting commercial shipments of A&E that does not have a certificate of authorization; and
- ADM(Mat) will ensure procurement strategies for new A&E include a requirement for a certificate of authorization.

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 continued its work on revising quantity distance 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*.

The Ports Criteria Working Group (PCWG) was established during the reporting period to review the content of AASTP-1, Part IV, Chapter 6, Naval and Military Ports. The information in this chapter has not been updated for many years and is recognized by NATO AC/326 as being outdated and potentially inaccurate. In particular, the PCWG will address operational requirements to keep A&E onboard all classes of naval and military vessels using a risk-informed approach, providing Commanders with operational flexibility while recognizing and accepting the potential for increased safety risks.

⁷ On public roads, by rail, by waterway or by air.



Canadian Armed Forces members take part in the Infantry DP3 Bravo Platoon Commander Course, which qualifies Infantry Senior Non Commissioned Officers to lead platoons, as well as perform Platoon 2IC duties during combat operations, during the final attack on the fictitious, Groningen Village at the Infantry School, Combat Training Center, 5th Canadian Division Support Base Gagetown, New Brunswick, May 2, 2019.

United Nations

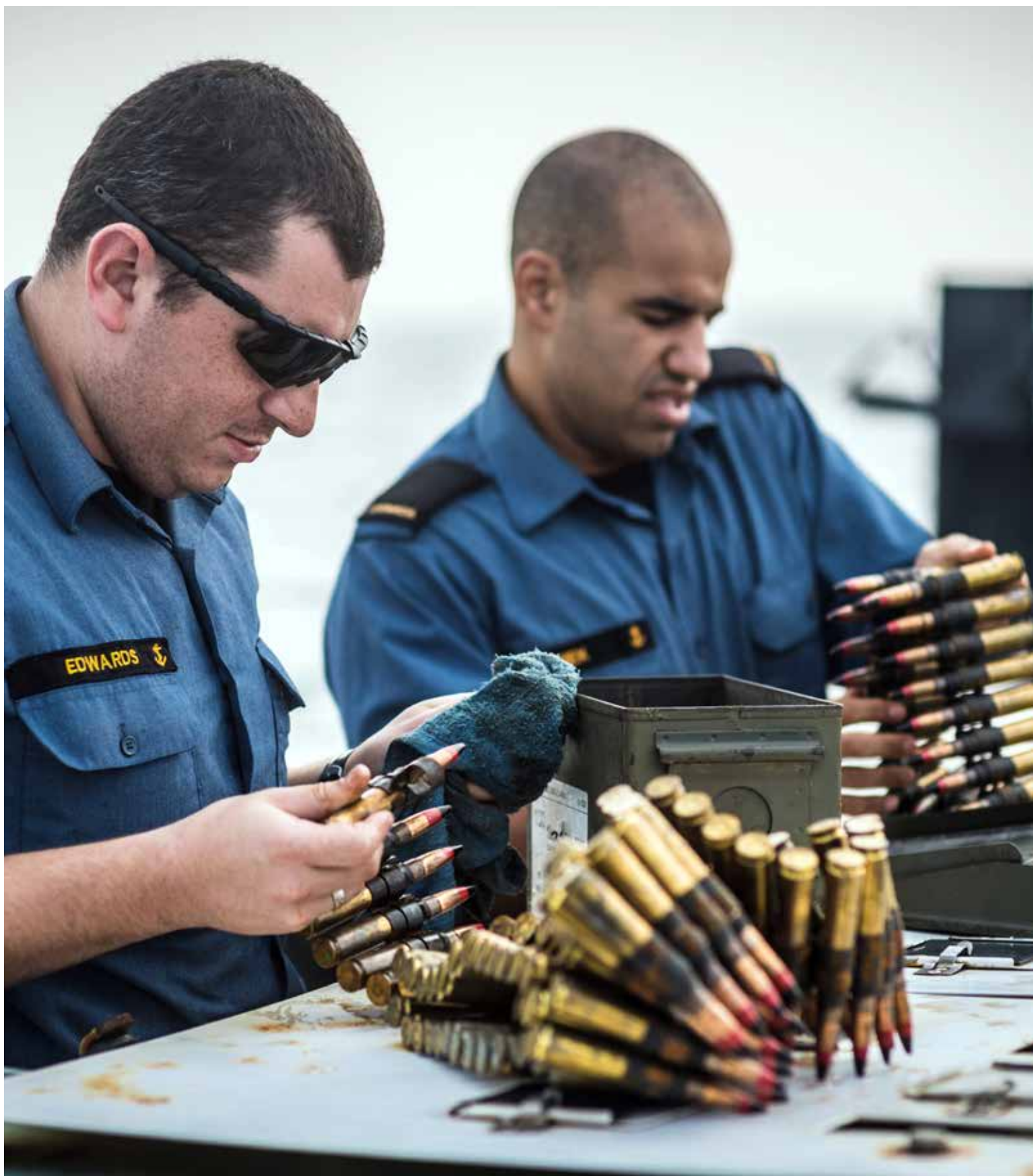
The United Nations (UN) International Ammunition Technical Guidelines (IATG) are designed to assist States without an existing A&E regulatory framework to create national standards and national standard operating procedures (SOPs) by providing a frame of reference which can be used, or adapted for use, as a national standard. The department continued to provide a representative on the Technical Review Board (TRB) to ensure coordination of the comparable guidelines between NATO, the UN and Canada as well as review and update the IATGs that are expected to be published in 2020.

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 Ammunition Program technical and functional A&E authorities would strengthen the department's A&E safety program by ensuring the timely review and promulgation of safety policies and standards, as per the established three-year policy review cycle.



Members from C Squadron of the Royal Canadian Dragoons conduct a firing exercise inside a Leopard 2A4 tank, in the training area of 5th Canadian Division Support Base Gagetown, Oromocto, New-Brunswick on August 27, 2019.



Ordinary Seaman (OS) Kyle Edwards and OS Joseph Zwick clean the .50 calibre rounds as part of maintenance onboard HMCS OTTAWA during Operations PROJECTION and NEON, September 20, 2019.

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.

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

COMPLIANCE OBSERVATIONS BY AMMUNITION PROGRAM ELEMENT

The following paragraphs provide the results, by Ammunition 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.

Ammunition and Explosives Safety Inspection Standards

Comprehensive AESI standards for element 2 of the Ammunition Program were collaboratively developed with ADM(Mat) and a trial inspection yielded positive results that were reviewed by staff from both DAER and ADM(Mat). Minor adjustments were brought to the standards with the intent to secure ADM(Mat)'s endorsement in fiscal year (FY) 2020/21. AESI implementation is also anticipated for FY 2020/21.

Demilitarization and disposal

In FY 2019/20, DND's stockpile⁸ awaiting disposal was established at approximately 9100 tons. Collectively, the department successfully reduced its stockpile by approximately 525 tons through sale, demilitarization and destruction operations.

⁸ Includes A&E that is surplus, obsolete, deteriorated and time-expired, as well as munition scrap and spent brass/steel cartridge cases.



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(S&T)
		5	Strategic Ammunition Program Policy and Doctrine	SJS
		6	A&E Practitioner and Professionalization	ADM(HR) / 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

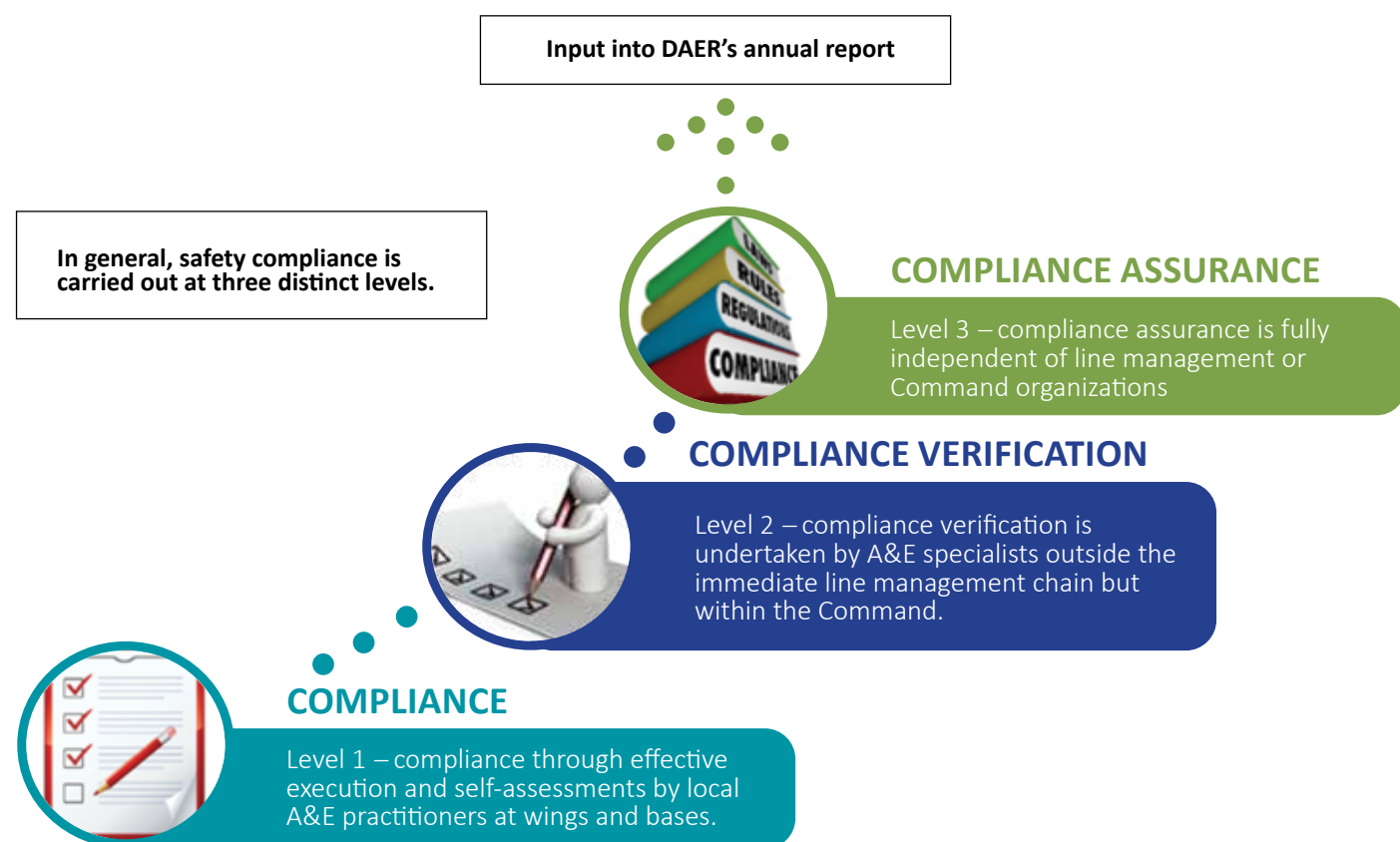


Figure 2 – A&E compliance model

While approximately 315 tons of 57mm and 105mm spent ammunition cartridge cases (representing 40% of the medium/large calibre backlog) were disposed of through sale⁹, the continued disposal of spent SAA cartridge cases through sale has resulted in a 60% reduction to the backlog. The start-up and commissioning of the spent SAA certification system in the summer of 2020 is expected to eliminate the remaining backlog.

The Canadian Forces Ammunition Depot (CFAD) Dundurn was unable to conduct its annual A&E disposal activity, Exercise DUSTY THUNDER, due to the department’s challenges in identifying sufficient personnel with the required qualifications to concurrently conduct disposal operations at CFAD Dundurn and provide instruction at Canadian Forces Logistics Training Centre (CFLTC) Borden.

A lost opportunity¹⁰, the absence of suitably qualified and experienced personnel is impacting the department’s ability to concurrently force generate and conduct operations.

The disposal of the approximately 1100 tons of artillery charge propellant through a commercial service contract is nearing the final stages of contract agreement. The complete disposal of the propellant and CRV-7 Rocket Motors is expected by 2023.

To further mitigate the growing backlog¹¹ and associated safety risks, ADM(Mat) initiated the acquisition of a suite of A&E demilitarization equipment (table 1).

EQUIPMENT	STATUS
Inert material mutilation system	Intended to demilitarize ammunition salvage ¹² , the mutilation equipment has been acquired and delivered to CFAD Dundurn. Currently awaiting the construction of infrastructure to house the equipment, final installation and commissioning of the mutilation equipment is planned for the fall of 2020.
Expended small arms ammunition (SAA) certification system	The thermal treatment unit of the expended SAA certification capability was delivered and is expected to be operational in the summer of 2020. The mechanical sorter and deformer are expected to be operational by late 2021.
Flashing furnace	Used to treat munition scrap, the flashing furnace is expected to be installed and final trials conducted at CFAD Dundurn in the fall of 2020.
Incinerator	Procurement of the SAA incinerator remains ongoing.

Table 1 – Ammunition and explosives demilitarization and disposal suite

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.

Results

The FY 2019/20 AESI cycle saw the continued integration and enhancement 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, the combined results can be

⁹ Enabled by DAEME who conducted technical assessments into the viability of visual inspections as a valid means of achieving level 4 confirmation.

¹⁰ Exercise DUSTY THUNDER successfully disposed of 225 tonnes of defective and time expired A&E during the previous reporting period.
¹¹ Estimated ADM(Mat) annual growth rate is 5%.
¹² Any non-explosive ammunition accessory or component, including fired cartridge cases and links, recovered from the firing point or during explosives workshop operations.

considered as improvement required. Specific areas of attention were centered on the Canadian Joint Operations Command's (CJOC) domestic and expeditionary operations

with a failed inspection at Canadian Forces Ammunition Depot Dundurn and within NATO's enhanced Forward Presence (eFP) Battle Group Latvia.

GROUP/COMMAND	AESI SELF-ASSESSMENT SUMMARY FY 2019/20
RCN	Acceptable
CA	Acceptable
RCAF	Acceptable – 1 location incomplete
CJOC Domestic	Improvement Required
CJOC Expeditionary	Attention Required
CANSOFCOM	Acceptable
ADM(S&T)	Attention Required – 1 Facility of 2 not assessed
ADM(Mat)	Acceptable
VCDS	Incomplete

LEGEND

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

Table 2 – Aggregated element 4 AESI results

Observations

The following specific observations were recorded:

- AESI execution.** The requirement to complete annual safety inspections at A&E facilities continued to be challenging for some Groups/Commands. Responsible for two A&E facilities, the Assistant Deputy Minister (Science and Technology) (ADM(S&T)) was unable to conduct its annual AESI at their facility located at DRDC Suffield. **A repeat observation**, this capability deficiency led to a second consecutive year of a missed annual safety inspection for one of its facilities and is directly linked to the Group's challenges in securing support from an ammunition technical authority (ATA). There is a requirement for ADM(S&T) to secure ATA support in the upcoming FY and assess both of its unique A&E storage facilities;
- 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 period, it was observed that ADM(S&T), Military Personnel Command (MILPERSCOM) and Assistant Deputy Minister (Infrastructure and Environment) (ADM(IE)) do not have appointed Group/Command ATAs. As responsible for A&E activities within elements 4, 6 and 7 respectively, ATA support in the functional areas of research and development, personnel training/qualifications and infrastructure is critical towards ensuring A&E safety oversight in the safe storage, management and use of A&E;

- Emergency preparedness. Areas of concern were identified within CJOC for domestic and expeditionary operations. There is a requirement for the annual execution of A&E-related exercises and drills as well as a need for a better understanding of the roles and responsibilities of personnel (practitioners and emergency responders) in the event of an A&E occurrence. **A repeat observation** for eFP Latvia, the absence of an adequate firefighting capability is concerning¹³. This shortfall contributes to the degradation of a robust emergency response plan;
- A&E warehousing and management. A decline in the quality of A&E inventory warehousing and management oversight under the Storage pillar of the AESI has been observed within CANSOFCOM and CJOC. There were observations related to the storage of A&E, compatibility of A&E items stored, tracking of explosives limits within magazines and the use of current standard operating procedures. A&E storage/operating procedures are paramount to ensuring best practices are maintained while minimizing risk to personnel and property within A&E-related facilities; and
- AESIMS. The Royal Canadian Navy (RCN) continued its implementation of the Inspection and Licensing modules within AESIMS for its Fleets and their land-based dependencies. There is a requirement for all Groups and Commands to provide effective oversight and ensure safety inspections are entered, monitored and completed within AESIMS. The importance of tracking and addressing inspection observations, at all levels, cannot be overstated. To do otherwise represents lost opportunities to capitalize on the lessons learned, and prevent recurrence.

FY 2019/20 presented unique challenges following COVID-19 pandemic travel restrictions. As a result, the Royal Canadian Air Force (RCAF) was unable to complete its scheduled AESI for 9 Wing Gander and the VCDS did not inspect its facility at Canadian Forces Support Unit (Ottawa). Whereas both organizations received acceptable results during the previous reporting period, both locations should be identified as a priority for inspection for FY 2020/21.

Data Analytics and Trend Analysis

Figure 3 depicts AESI results achieved by Commands with and without the presence of DAER inspectors. Following a review of results, it was observed that lower AESI scores are usually achieved in the presence of a regulatory inspector¹⁴. The growing discrepancy in AESI results is concerning and believed to be linked to the limited experience within the practitioner community as a result of the ammunition technical officer (ATO) employment model and the shortfall of personnel at the required rank. This represents an opportunity for improvement in executing compliance oversight.

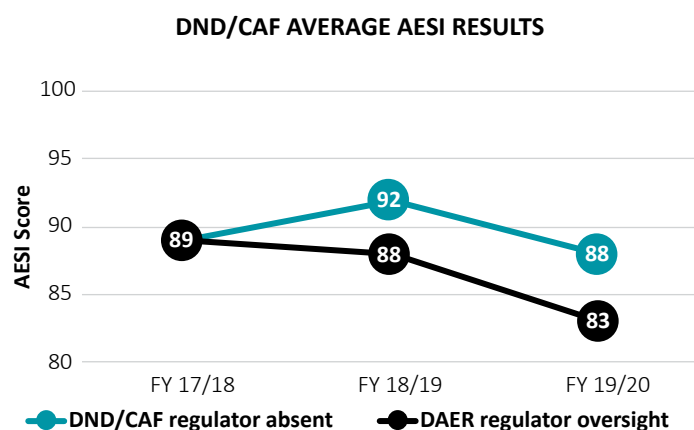


Figure 3 – Average AESI results

Ammunition and explosives storage licences

Discrepancies between ammunition and explosives facility licences and the information tracked within the Ammunition Information and Maintenance System 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. Overall, observed discrepancies were minor in nature and were mostly attributable to the ongoing implementation of AESIMS to track unit licences.

¹³ The last Canadian Forces Fire Marshal (CFFM) inspection conducted in October of 2017 resulted in a “High” risk rating overall and spoke to the numerous risks associated with fire prevention and control within Camp Adazi, including the various ammunition facilities contained within the perimeter.

¹⁴ Resulting in a failed safety inspection in FY 2017/18 and in FY 2018/19, and two failed safety inspections in FY 2019/20.

Element 6 – A&E practitioner

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. 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.

Ammunition and Explosives Safety Inspection Standard

Over the course of the year, A&E practitioner safety inspection standards were developed to 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. The safety inspection standards will continue to be developed and socialized with Groups and Commands during the next reporting year with an intent to implement during FY 2021/22.

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. While the process is relatively straightforward, the steps of identifying, analysing and mitigating safety risks are complex and require trained and experienced personnel. Throughout the reporting period, it was observed that the practitioner community is challenged in its ability to conduct an AERASC. This acknowledged capability deficiency could expose personnel to increased safety risks and/or degrade mission capability.

Group/Command A&E practitioners

This reporting period saw a large rotation and influx of new Group/Command ATAs. While there is room for improvement, in general, Group/Command A&E practitioners were assessed as being competent in the execution of AESIs for their respective second/third line organizations. Conversely, it was noted that Groups and Commands were challenged in their ability to review, track or provide adequate oversight into occurrence reporting, assess safety risks and oversee explosives storage licensing. In line with their delegated authorities and in support to their respective L1 Advisor or Commander, there is a



Weapons Engineering Technician, Able Seaman Elliot Poole cleans the barrel of the .57-millimeter gun as part of pre-fire maintenance on board HMCS OTTAWA while deployed on Operations PROJECTION and NEON on October 17, 2019.

requirement for A&E practitioners to become proficient in the execution of their duties and responsibilities, as per their respective terms of reference.

Occupational Analysis

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 PDP highlighted several safety-related issues that stem from the historic generation and employment of ammunition specialists. Most pertinent was that the CAF's current structure is based on a United Kingdom Army-Logistics model adopted in 1968 that has never been validated against Canada's tri-service requirements. The additional complexity of an employment model that groups five occupations and shares two qualifications to meet tri-service requirements also represents a challenge with respect to experience and currency of the ammunition practitioner.

In October 2019, MILPERSCOM launched the Ammunition Specialist Officer Occupational Analysis. By the end of the reporting period, Phase I¹⁵ had been completed and culminated in a brief to the Sponsor Advisory Group comprised of Branch Advisors from the five affected occupations. Some of the safety concerns identified during the brief were effective performance of duties and skill fade. This initiative is recognized as a positive step in establishing departmental requirements for ammunition specialty officers. Phase II of the occupational analysis is intended to be completed over the next reporting period.

Course validation

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, education and the duties the members perform, as identified through an occupational analysis. If validation is not conducted routinely, the possibility exists that the

¹⁵ There are five (5) phases to the occupational analysis: Phase I – Ascertain problems/issues; Phase II – Complete a job analysis; Phase III – Complete a structure analysis; Phase IV – Provide a decision brief; and Phase V – Complete an implementation plan.



delivered material does not satisfy the performance requirements of the course, potentially affecting personnel safety and compromising CAF operations.

In November of 2019, MILPERSCOM performed a validation of ATO training. The validation consisted of a survey sent to 72 ATOs and 33 supervisors with a response rate of 50% for both groups. The results led to recommendations to address training shortfalls, the review/removal of some tasks, as well as the possibility of conducting ATO training through alternate training means. Observations on ongoing ATO professional development and the possibility of an ATO classification were takeaways that are being considered under the Ammunition Specialist Officer Occupational Analysis, to be concluded in 2021.

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.

Ammunition and Explosives Safety Inspection Standard

During the reporting period, ADM(IE) and DAER continued to collaborate on developing metrics and criteria for AESI standards for A&E-related infrastructure. ADM(IE) developed a 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 following two parallel ESAF pilot initiatives was planned for FY 2020/21, they have been postponed until FY 2021/22 as a result of the COVID-19 pandemic:

- a risk-based Targeted Asset Assessment (TAA). This assessment will mainly focus on the licensing implications of specifically targeted infrastructure that is deemed to be at higher levels of risk as a result of asset degradation; and

BOTTOM PICTURE: Able Seaman Robert Thorpe fires a guide rope from HMCS FREDERICTON to USNS Kanawha to secure the two ships as part of a replenishment at sea during Operation REASSURANCE, February 6, 2020.





Cpl Guay from the 5th Canadian Division team loads 120mm rounds inside a Leopard 2A4 tank during Exercise WORTHINGTON CHALLENGE 2019 at 5th Canadian Division Support Base Gagetown on September 23, 2019.

- an ESAF Pilot study at CFADs Bedford and Rocky Point. ADM(IE) will use the ESAF for the development of an Asset Management Plan (AMP) for A&E assets. The AMP will provide the strategic framework for managing related infrastructure to sustain the portfolio.

Together, the ESAF and the AMP will present ADM(IE) with a risk-managed approach in support of maintaining a safe and optimized A&E-related infrastructure portfolio.

Canadian long span earth-covered magazine (CLSECM)

Last year's report discussed the construction standards of the CLSECMs at CFAD Bedford and identified excessive depth of common earth cover between magazines. In the

event of an accidental explosion, the earth would act as a medium to transmit the shockwave, placing adjacent magazines at risk. This year, a departmental review of all storage facilities has also identified the Canadian Forces Base (CFB) Petawawa's CLSECMs as having excessive depth of common earth cover, causing a significant reduction in the storage capacity. While ADM(IE) is developing an engineered solution for CFAD Bedford and CFB Petawawa, CJOC and the CA have re-licensed their 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

C-09-005-002/TS-001, *Ammunition and Explosives Safety Manual – Volume 2, Storage and Facility Operations*, and C-09-005-008/TS-000 – *Volume 8, Siting, Design and Construction Standards*, contain detailed instructions for A&E practitioners on the process to be followed prior to the construction of new A&E-related facilities. During the reporting year, it was observed that site approval was not sought prior to the construction of a salvage facility and workshops located near a magazine, resulting in increased safety risks to the eFP Battle Group's operations in Latvia and necessitating an AERASC. There is a requirement for better communications and coordination between the ammunition practitioner and real property communities.

A&E risk management

ADM(IE) completed its assessment of the A&E infrastructure portfolio during the reporting year. While 28% of the infrastructure assets remain in poor to critical condition, the

average infrastructure condition has been assessed as fair. Ammunition buildings where condition assessments were not completed remain subject to health, safety and security protocols and are maintained as such¹⁶.

AERASCs enable A&E operations when extant safety 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 ADM(IE) infrastructure challenges, three of which will expire in the upcoming FY with no long-term solution in place (table 3). Renewed AERASCs will be required to meet the continued capability deficiencies. The appointment of, or securing the services of, an ATA would greatly facilitate ADM(IE)'s coordination of A&E-related infrastructure requirements across the department.

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)
ADM(IE) Lac St Pierre	UX01-2015-01	UXO Procedures	Medium	2020	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

Table 3 – Current AERASCs

¹⁶ 406 of the 553 facilities that support the ammunition portfolio have been assessed. Assessments on the remaining 147 assets of the ammunition portfolio were not completed due to the size of the asset (less than 50 m²), their limited operational value, or because they have been identified for disposal.

CONCLUSION

The compliance assurance program has continued to mature over the reporting period and the ongoing development of AESIMS is enabling greater departmental oversight and audit capabilities. ADM(Mat)'s sustained efforts in leading a departmental demilitarization and disposal capability will substantially lower the risk associated with the storage of surplus, obsolete and deteriorated A&E¹⁷. In addition, ADM(IE)'s completion of the facility condition assessment will further inform DND/CAF A&E infrastructure decisions.

While a shift in the execution of compliance assurance for element 4 will improve regulatory oversight and contribute towards building the experience levels within the A&E practitioner community, the appointment of experienced and resourced Group/Command A&E practitioners would significantly improve the department's ability to oversee, assess, manage and mitigate domestic and deployed A&E safety risks. MILPERSCOM's sustained efforts in conducting the occupational analysis is key to addressing the acknowledged shortfalls in the training, employment, retention and specialty structure of ammunition specialty officers.



¹⁷ Includes time-expired A&E, munition scrap and spent brass/steel cartridge cases.



A member of 408 Tactical Helicopter Squadron fires a GAU-21 .50 caliber machine gun on board a CH-146 Griffon helicopter during Exercise STRIKING BAT at Marine Corps Air Ground Combat Centre Twentynine, Palms California on 11 November 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 injury, destroy, damage or disable materiel, and damage infrastructure or the environment. Hazardous occurrences involving A&E 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 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 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 third year of implementation, reporting through AESIMS remains a departmental challenge. Whereas the department previously averaged 228 reported occurrences annually, the average number of reported occurrences since the introduction of AESIMS is 116 (figure 4). Contributing factors remain DND/CAF access to, and personnel familiarity with, the reporting tool as well as a challenging departmental reporting culture.



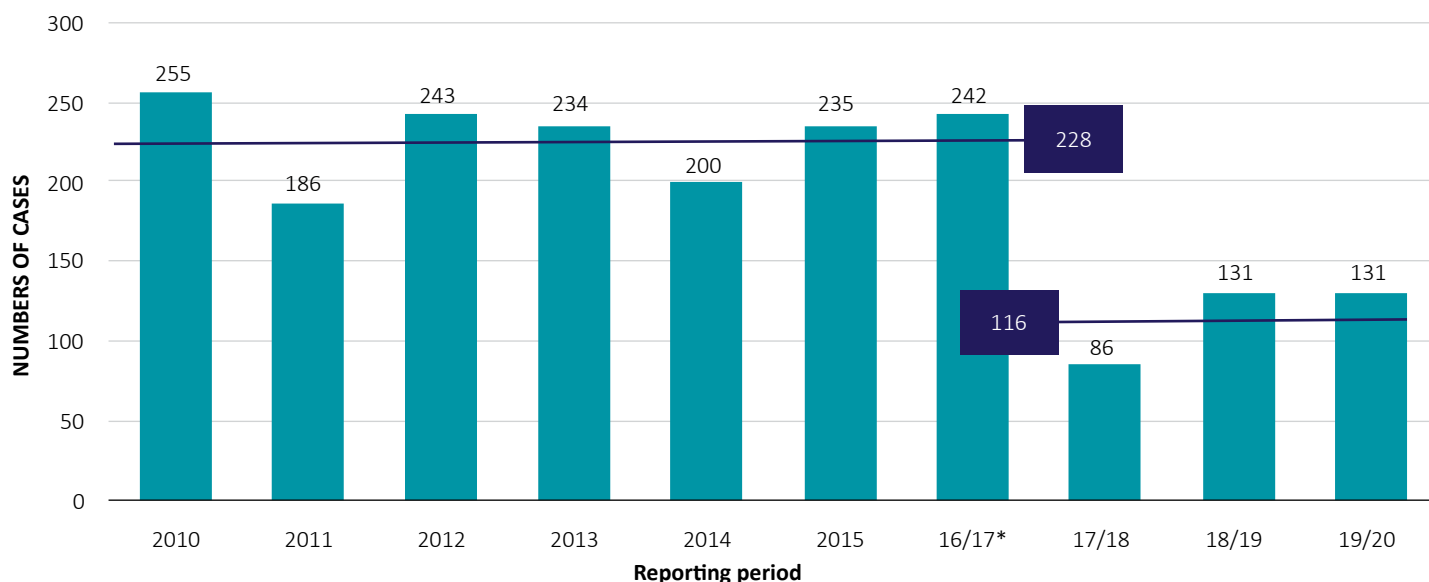


Figure 4 – Average reported annual occurrences

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*. A&E incidents and accidents are typically associated with one or a combination of the following factors: a failure or a defect in materiel, handling/operating procedures, and/or environmental conditions. The following paragraphs address specific observations made throughout the year:

- Reporting timelines. This is a repeat observation applicable to all Groups/Commands.** As per A&EI 69, Accident / Incident Reporting Timelines, the departmental requirement for submitting an Initial Report is 24 hours. The intent of initial reports is to quickly inform the community of potential safety risks to avoid a recurrence. Over the reporting period, the average time for submitting an initial report marginally improved from eleven (11) to nine (9) days. However, of the 131 occurrence reports submitted, only 34% were reported within 24 hours, compared to 48% in the previous year. There is a requirement for Groups and Commands to strengthen their AESP by significantly improving their reporting timelines;

- Investigation timelines. This is a repeat observation applicable to all Groups/Commands.** The departmental requirement to complete an investigation report is 30 days. Over the reporting period and for a second consecutive year, the average number of days to complete investigation reports increased from an average of 46 days reported in FY 2018/19 to 50 days during the current reporting period, representing a continuous downward trend. There is a requirement for Groups and Commands to significantly improve investigation timelines;
- Report review by Commands/Groups (Tracking). This is a repeat observation applicable to all Groups/Commands.** Once an investigation report was released at the unit level, Groups/Commands averaged 114 days to review and close a case in AESIMS. It is important to note that of the 131 cases initiated during the reporting period, only 51 were closed as of 31 Mar 2020, leaving 80 cases open pending Group/Command review and action. While there has been some effort towards closing reports, there remain 131 outstanding investigation reports in various states¹⁸ awaiting Group/Command action since the implementation of AESIMS

¹⁸ In AESIMS, Initial, Investigation and Tracking are statuses of active cases.

in April 2017 (figure 5). The importance of Group/Command reviews and tracking of occurrence reports cannot be overstated and outstanding cases are lost opportunities to capitalize on lessons learned and prevent recurrence;

- d. Defect/Malfunction and Accidental Small Arms Weapon Discharges (ASAWD) Reporting. The aim of Defect/Malfunction and ASAWD reports is to address concerns around the safety of ammunition and/or related weapon systems. During the year, it was observed that of the 485 reported Defect/Malfunction and the 42 reported ASAWD, respectively 38% and 43% had been closed by Groups/Commands. Timely review and closure of reports reduces the likelihood of recurrence and allows materiel managers to address potential safety risks. There is a requirement for Groups and Commands to complete and close reports in a timely manner;
- e. Preventive Measures. During the reporting period, it was observed that while preventive measures (PMs) were being recorded within AESIMS, the status associated with 58% of the PMs were not being actively tracked/updated by responsible Groups/Commands. While there may be several contributing

factors that could delay the implementation of PMs, it is important to update AESIMS and maintain an accurate system of record; and

f. Quality of investigations. **This is a repeat observation applicable to all Groups/Commands.** Investigations of A&E occurrences are to be completed by suitably qualified and experienced personnel and require technical knowledge of the A&E, the associated weapon system and an understanding of the operational environments. While a significant number of reports were explicit in defining “what” had occurred, only 23% 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 A&E practitioner training programs indicates 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 identifying 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).

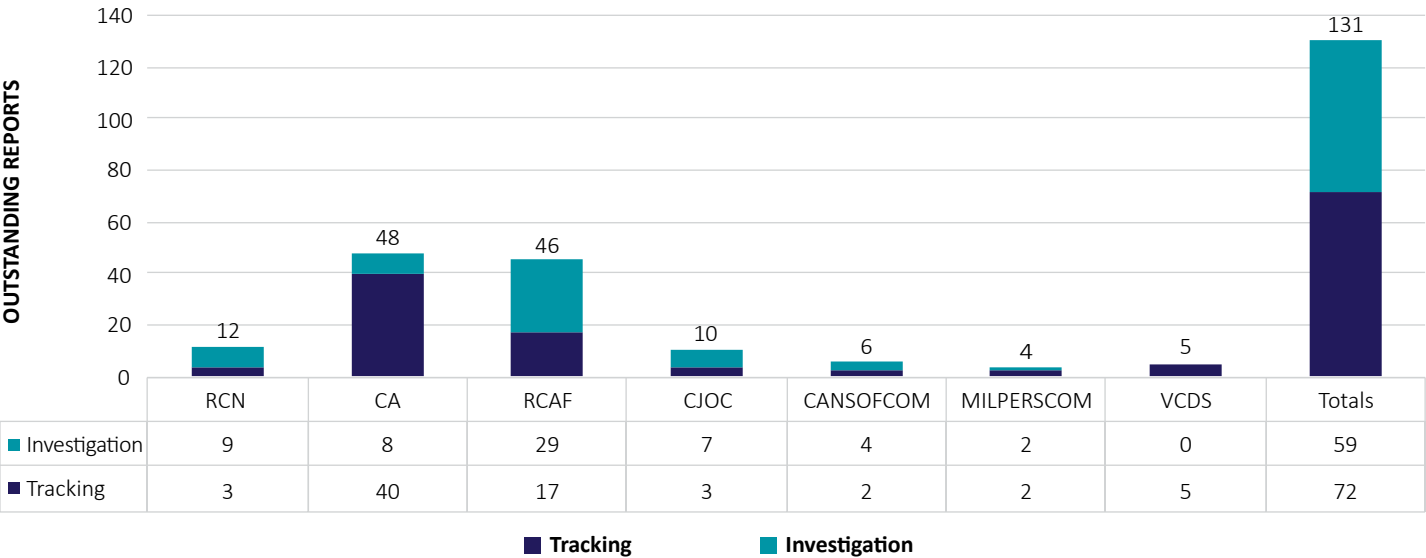
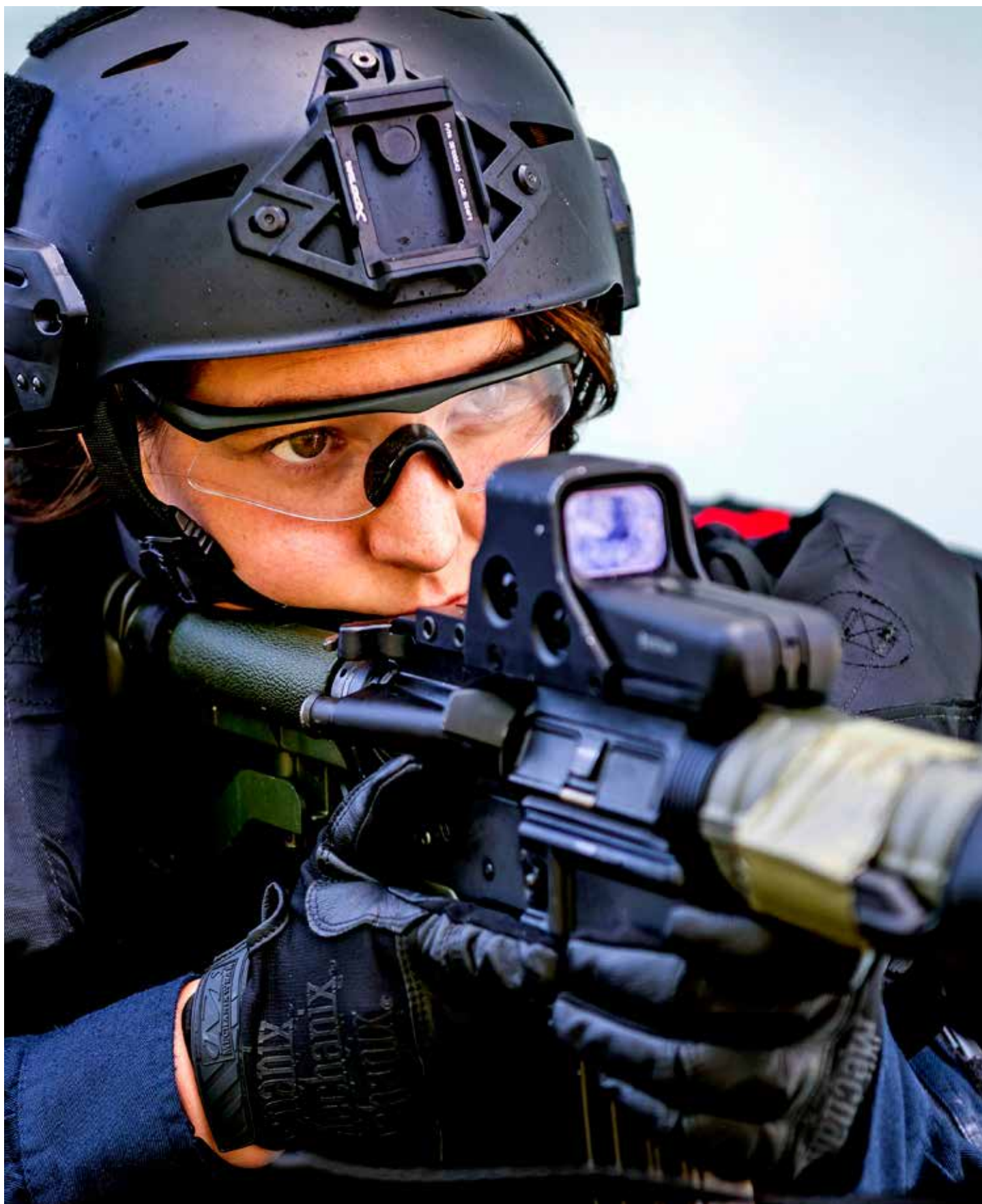


Figure 5 – Outstanding reports since 1 April 19



Leading Seaman Lyra Michelle Mazerolle participates in a boarding party training exercise onboard HMCS HALIFAX during Operation REASSURANCE, in the Atlantic Ocean on July 21, 2019.

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, it was observed that very little progress had been made in the quality of reporting and/or closing of outstanding reports. **A repeat observation applicable to all Groups/Commands**, 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.

OCCURRENCE ANALYSIS OVERVIEW

A&E Incident/Accident Ratio

The Heinrich 300-29-1 model¹⁹ suggests that for every 300 near misses there are 29 minor injuries and 1 major injury (figure 6). The resulting incident to accident ratio 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 (accidents) is indicative of the health of an organization's safety program and culture. Whatever the precise ratio in any given field of work, the key point is to capture and understand incidents before they recur in slightly different circumstances and result in

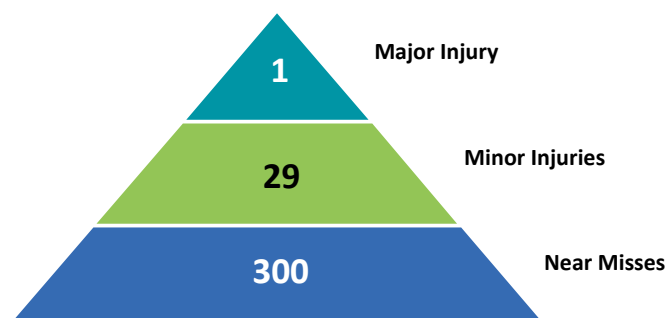


Figure 6 – The Heinrich model

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 safely execute and sustain its operations.

Of the 131 occurrences reported, there were 82 incidents and 49 accidents, representing a departmental incident to accident ratio of 1.7:1 and a continued downward trend in the department's A&E safety margin²⁰ from the previous reporting periods (figure 7).

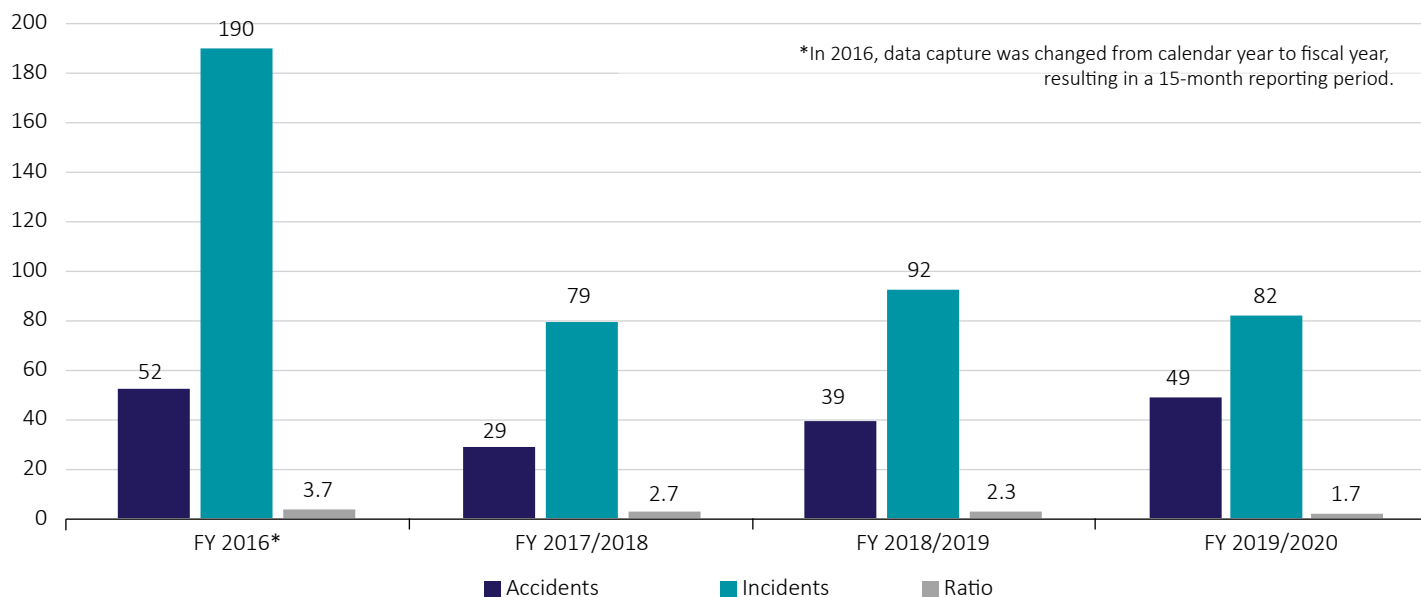


Figure 7– Incident/Accident ratio

¹⁹ 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".

²⁰ A safety margin is defined as the incident to accident ratio.

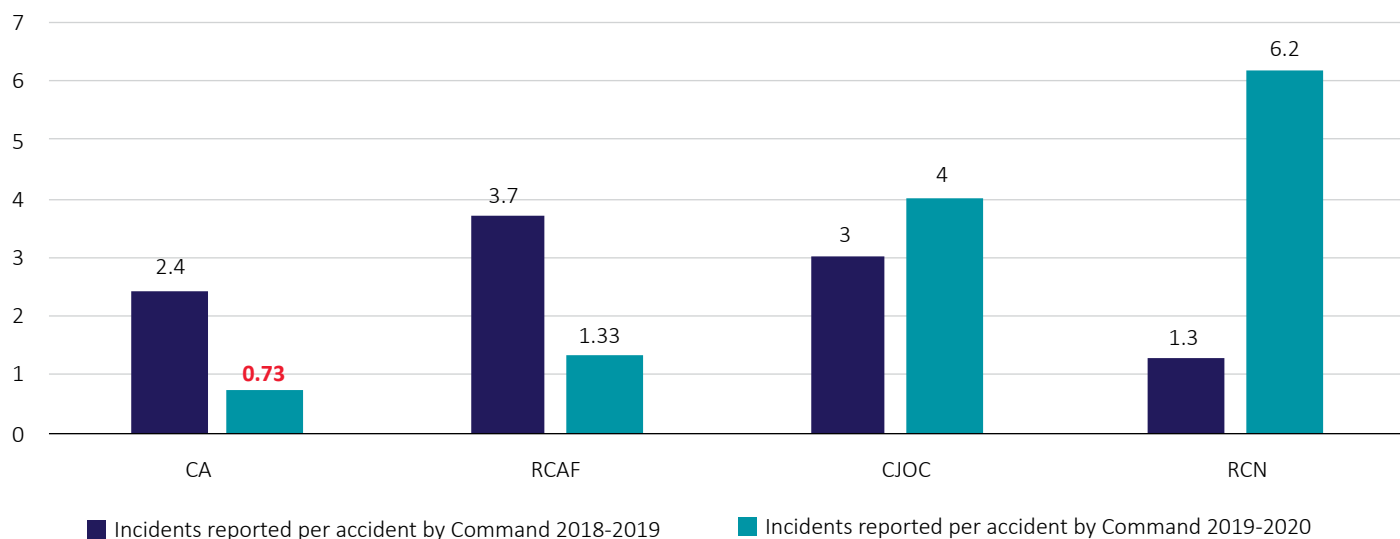


Figure 8 – Safety Margin per Command

With relatively consistent training and operational tempos over recent years, a 26% increase in accidents and the four-year downward trend in safety margin are cause for concern and will require a concerted departmental effort to address.

Safety Margin per Command

Despite environmental differences, Command safety margins should be similar and indicative of the departmental incident to accident ratio. Figure 8 depicts the safety margin for each Command over the last two years. While the ratios for the RCN and CJOC have increased, those of the RCAF and the CA have dropped significantly, with the CA reporting more accidents than incidents.

Cause Factor Trends and Analysis

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 25% of all occurrences were recurring occurrences, indicating an organizational challenge to capture and apply lessons related to ammunition and explosives safety.

There were 14 injuries in 10 separate accidents throughout the year. While this represents an 11% reduction in the number of injuries over the last reporting period, of the 14 injuries, seven were attributable to a human cause factor and were therefore preventable.

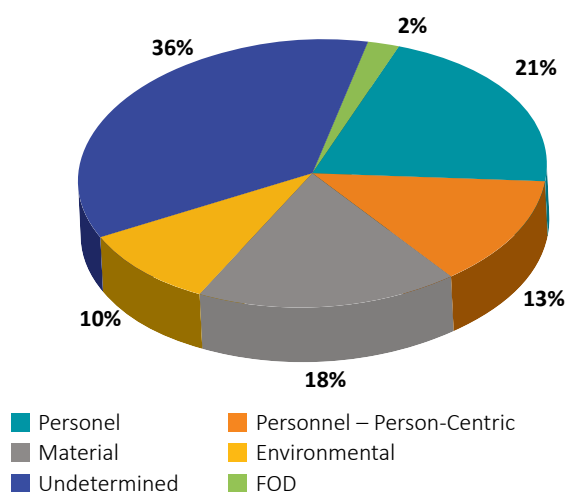


Figure 9a – Initial cause factors

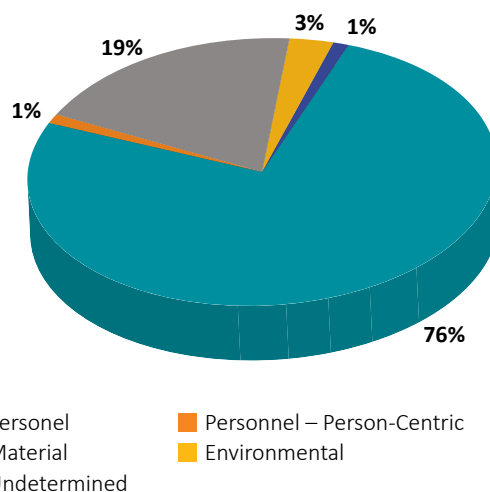


Figure 9b – Revised cause factors



Air Weapons Systems Technicians from 401 Tactical Fighter Squadron load an AIM-9 Captive Air Training Missile (CATM) on a Royal Canadian Air Force CF-188 Hornet during Operation REASSURANCE–Air Task Force Romania at the Mihail Kogălniceanu Air Base, Romania on September 5, 2019.

Symptomatic of the challenges associated with investigating and reporting within DND and the CAF, a detailed review of all AESIMS reports indicated that 36% of all Group- and Command-assigned cause factors were labelled as “Undetermined” or “Not yet determined”. Whereas figure 9a illustrates the cause factors as initially assigned by Groups and Commands, figure 9b illustrates the re-assignment of more than 50% of the cause factors following a careful review by DAER. **A repeat observation**, the departmental challenges in identifying and assigning appropriate cause factors are adversely affecting the organization’s ability to capture lessons learned and mitigate recurrence. There is a 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.

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

- Person-Centric Cause Factor. Seventeen (17) cases (13%) of all cause factors were assigned with the "Person-Centric" cause factor, a cause factor 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, only one case had been correctly identified as “Person-Centric”. There is a requirement for a better understanding of the Human Factors and Analysis Classification System (HFACS) methodology by departmental A&E investigators;
- Distribution of occurrences. 66% of all occurrences involved the operator while the remaining 34% involved personnel from the A&E practitioner community. In this reporting period, 40 cases (31% of all occurrences) were related to the use of pyrotechnics and SAA. Out of this number, 30 cases were directly linked to the failure to follow established directives and/or procedures (poor control of ammunition, mixing live or dud ammunition with salvage, poor usage and handling of A&E, etc.). In most circumstances, post-occurrence review and preventive measures were not comprehensively considered and/or implemented, resulting in a high percentage of recurrence;

- Storage. Out of 131 occurrence reports, 22 cases (17%) were related to the storage of A&E where:

- 1) Six (6) cases relate to issues involving fire suppression systems aboard RCN ships resulting in 5 flooding occurrences inside A&E magazines/lockers; and
- 2) Sixteen (16) cases were attributed to personnel cause factors (A&E improperly packaged or stored, entering a magazine with handheld radio, fire protection removed, unlicensed lock-up, etc.).

Failure to follow established directives and procedures in the storage of A&E could result in injury and/or materiel damage/loss and could adversely impact operations/capabilities. Education and training are key to ensuring compliance; and

- Air weapon systems. There was an increase in occurrences in AESIMS related to weapon loading operations of the CF-188 and the use of weapon systems aboard the CH-146 compared to the previous reporting period. Seven (7) reported occurrences involved the loading of a CF-188 and six (6) involved the use of M134D and GAU-21 gun systems, including the loss of ammunition in flight. In the majority of these occurrences, human factors were a contributing factor. Eleven (11) of the thirteen (13) reports remained open at the end of the reporting period with no proposed preventive measures.

Many factors can influence a reporting culture, but as safety is a Command responsibility, there is a requirement for continued senior leadership engagement in advocating the importance of reporting, tracking occurrences and report closing. There is also a requirement for Groups and Commands to leverage AESIMS to foster a healthy departmental A&E safety program.

AESP Communication

Work towards establishing a departmental AESP communication strategy continued throughout the year while AESP safety briefs were provided to the RCN, the RCAF, the CA, MILPERSCOM and several A&E forums and briefs over the course of the year.

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 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.

While future regulatory efforts will 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 HMCS REGINA's Air Detachment, Master Corporal Jonathan Audet (left) and Corporal Shannon Clayton (right), mount a torpedo on to Bronco, the CH-148 Cyclone helicopter during Operation ARTEMIS, in the Pacific Ocean on April 7, 2019.

CONCLUSION



Ongoing efforts towards developing ammunition and explosives safety inspections for elements 2 (Ammunition and Explosives Equipment Program Management), 6 (Ammunition and Explosives Practitioner) and 7 (Ammunition and Explosives Infrastructure) of the Ammunition Program have continued over the reporting period and will contribute towards greater departmental ammunition and explosives safety oversight. Collectively, the department witnessed some progress in its efforts towards reducing its stockpile of surplus, obsolete, deteriorated, and time-expired munitions in addition to the Assistant Deputy Minister (Materiel)'s initiative to secure a disposal capability for munition scrap and spent brass/steel cartridge cases.

There is a heightened level of concern around the continued downward trend in the department's ammunition and explosives safety margin from previous reporting periods. Many of the observations in this report have appeared in previous reports and have not been adequately addressed. 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 capturing lessons learned and is a critical component for institutionalizing safety and creating a healthy safety culture. 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 competency of and employment model for the practitioner community, more specifically the ammunition technician trade and the ammunition technical officer qualification, have been identified as a concern. The appointment of experienced and resourced Group/Command ammunition technical authorities would significantly improve the department's performance in many areas.

The complexities around the observations identified within this report are strategic in nature and require investment/resources as well as a concerted effort and whole-of-Ammunition Program approach to resolve. **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 absence of a responsible and accountable champion at the Strategic/National level to provide the necessary impetus to address observations raised within this report represents a significant challenge for the Department of National Defence and Canadian Armed Forces.

In the spirit of continuous improvement, a program of this complexity would benefit from enhanced leadership, commitment, communications, awareness, and a strong collaboration between Groups, Commands and the Director Ammunition and Explosives Regulation.



Leading Seaman Blake Verhaeghe, Sub-Lieutenant Graeme Stout, Master Seaman John Lang, Chief Petty Officer 2nd class Ian Burke, Petty Officer second class Clayton Kihn, Petty Officer second class Matthew Dykstra, HMCS REGINA's crewmembers, unload the 57mm Bofors canon during Operation PROJECTION on June 30, 2019.

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Acronyms

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(S&T)	Assistant Deputy Minister (Science and Technology)
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
ALP	Allied logistic publication
ASAWD	accidental small arms weapon discharges
ATA	ammunition technical authority
ATO	ammunition technical officer
CA	Canadian Army
CAF	Canadian Armed Forces
CANSOFCOM	Canadian 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	Director 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
ESAF	explosives safety assessment framework
ESMRM	explosives safety and munitions risk management
FY	fiscal year
HERO	hazards of electromagnetic radiation to ordnance
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	offices 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
TRB	Technical Review Board
UN	United Nations
VCDS	Vice Chief of the Defence Staff

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**BECAUSE MOST
ACCIDENTS
CAN BE
PREVENTED...**

REPORTING is essential
to prevent recurrence.

And may even
SAVE YOUR LIFE!