National Defence | Défense nationale

DIRECTOR AMMUNITION AND EXPLOSIVES REGULATION

Annual Report

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

A Review from 1 April 2017 to 31 March 2018

Canada

Cover Photo

A pilot inspects his CF-18 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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NDID: A-JS-040-000/JP-001

Print – English
Government of Canada Catalogue Number: D3-27E
ISSN: 1929-4719

Print – French
Government of Canada Catalogue Number: D3-27F
ISSN: 2561-3480

Electronic English
Government of Canada Catalogue Number: D3-27E
ISSN: 1929-4727

Electronic French
Government of Canada Catalogue Number: D3-27F
ISSN: 1929-4735

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

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EXECUTIVE SUMMARY

As the functional authority for ammunition and explosives regulation and safety, the Director Ammunition and Explosives Regulation is responsible to the Deputy Minister and Chief of the Defence Staff for:

- issuing policies, orders and directives for, and providing advice regarding the acquisition, storage, transportation, inspection, maintenance, authorized modifications, issue, use and disposal of all ammunition and explosives under the direction or control of the Department of National Defence and the Canadian Armed Forces, including ammunition and explosives for research and development;
- overseeing compliance with policies, orders and directives for ammunition and explosives; and
- overseeing the management of the Department of National Defence Ammunition and Explosives Safety Program.

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;
- Prologue;
- Policy Review;
- Ammunition and Explosives Safety Compliance;
- Ammunition and Explosives Safety Program Review; and
- Conclusion.

Whereas the Ammunition Program consists of nine elements, element 3 is not subject to ammunition and explosives safety compliance activities. Section 3 of this report addresses safety compliance activities for elements 1, 2, 4 and 7. Elements 5, 6, 8 and 9 will appear in subsequent annual reports as their respective ammunition and explosives safety inspections are developed and incorporated into the risk-informed compliance program.

The following paragraphs provide an overview of key observations made during the course of the year.

KEY OBSERVATION – POLICY REVIEW

- Canadian long span earth-covered magazines. The Assistant Deputy Minister (Infrastructure and Environment) was able to close out a long-standing significant issue related to the Canadian long span earth-covered magazines allowing equivalent NATO designations to be assigned to the magazines. The affected facilities are now correctly classified; confirming their licensing and storage capacities.

KEY OBSERVATIONS – AMMUNITION AND EXPLOSIVES SAFETY COMPLIANCE

Element 1 – Ammunition and Explosives Regulation.

Results of the 2017 Assistant Deputy Minister (Review Services)-led evaluation of the Director Ammunition and Explosives Regulation indicated that the department had addressed the majority of observations raised in 2005 by the then Chief Review Services. Major contributors to the success of the department were the establishment of an arms-length regulatory organization with a clear mandate and several key organizational accomplishments. Notwithstanding, there remained some areas for improvement centered around three specific themes: regulatory framework; program instruments and alternatives; and communications. The Director Ammunition and Explosives Regulation will continue to address the outstanding observations during fiscal year 2018/2019. The report's findings concluded that an evaluation of the Director Ammunition and Explosives Regulation should be considered as part of a cyclical evaluation of the Ammunition Program, with the next Assistant Deputy Minister (Review Services)-led evaluation tentatively scheduled for fiscal year 2022/2023.

Following an observation made during the 2017 Assistant Deputy Minister (Review Services)-led evaluation of Ammunition and Explosives Management within the Department of National Defence, the Director Ammunition and Explosives Regulation will amend the inspection criterion for assessing the safety conditions for ammunition and explosives-related activities and infrastructure by adopting a "three strikes" approach to compliance observations against level one organizations[1]. The target date for completion of this management action plan is April 2020.

Element 2 – Ammunition and Explosives Equipment Program Management

- Ammunition and explosives safety inspection. The Assistant Deputy Minister (Materiel) and the Director Ammunition and Explosives Regulation dedicated significant effort towards collaboratively developing an ammunition and explosives safety inspection for element 2 of the Ammunition Program, focusing on three distinct functions: safety and suitability for service assessment; life cycle materiel management; and demilitarization and disposal of surplus, obsolete and end-of-life cycle ammunition and explosives inventory. The initiative progressed well and is expected to continue throughout fiscal year 2018/2019 with the intent of implementing a first ammunition and explosives safety inspection in fiscal year 2019/2020.

- Demilitarization and disposal. A repeat observation, the Department of National Defence's stockpile of surplus, obsolete, deteriorated and time-expired ammunition and explosives awaiting disposal is well documented. While there has been progress through the Assistant Deputy Minister (Materiel) initiative of establishing a departmental disposal capability, the current limited institutional capability for large-scale demilitarization and disposal continues to pose a significant safety concern, of particular note are the more than 80 000 155mm M119 red bag propelling charges awaiting disposal.

- Safety and suitability for service assessments. The introduction of new equipment could affect the operational envelope of ammunition and explosives currently in service (temperature cycling, vibration profiles, hazard of electromagnetic radiation, etc.). This information must be considered when assessing or reviewing the safety and suitability for service of ammunition and explosives to mitigate potential safety risk to members, employees and equipment. There is a requirement for better coordination between project offices, the equipment management teams and the technical authority for ammunition and explosives when changes to equipment, weapons systems or a platform have the potential of impacting the operational envelope of ammunition and explosives.

[1] Automatic failure where a specific AESI observation is noted on three consecutive occasions.

Element 4 – Ammunition and Explosives Operations Support and Readiness

All level one or Command safety compliance observations are the result of:

- a level one self-assessment through the execution of an ammunition and explosives safety inspection by their respective level one ammunition technical authority; or
- strategic observations made by the Director Ammunition and Explosives Regulation.

The following paragraphs highlight observations raised by level ones, Commanders or the regulator that will require increased attention throughout the next reporting year.

AMMUNITION AND EXPLOSIVES SAFETY INSPECTIONS

Results for element 4 led to an acceptable self-assessment rating for most level one advisors or Commanders. However, while assessing the Canadian Joint Operations Command expeditionary operations, an inability to site explosives workshops within explosives storage areas and the absence of standard operating procedures for ammunition and explosives-related work were observed at multiple deployed Canadian Armed Forces mission locations, representing an unnecessary increase in safety risk.

AMMUNITION AND EXPLOSIVES STORAGE LICENCES

- Ammunition Information Maintenance System – Data integrity. A repeat observation. There is a lack of awareness over the safety hazards associated with inconsistencies between the approved storage licences and the licensing information recorded within the Ammunition Information Maintenance System. Information in the Ammunition Information Maintenance System must mirror that of the approved licences to ensure consistency of data being used, so that explosives storage limits are appropriately and correctly enforced. Continued level one oversight during the level one ammunition and explosives safety inspections is essential to ensuring safe storage practices.
- Currency. A key observation in last year's annual report stated that a number of ammunition facilities were operating with expired explosives storage licences. Licence renewals have improved notably and all units were observed as having accurate storage licences.

PERIODIC INSPECTIONS

This is a repeat observation. 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 additional deterioration due to storage conditions while ensuring stock serviceability. As part of observations made in relation to overdue periodic inspections, four important safety concerns were identified:

- most periodic inspections for ammunition and explosives that have been condemned or are awaiting disposal (through demilitarization or sale) were not done by the Canadian Army, the Royal Canadian Air Force and the Canadian Joint Operations Command. As the rate of degradation of these items represents a safety concern, it is important to ensure that they continue to be inspected to ensure they remain safe for storage, transportation or sale;
- some ammunition and explosives issued in support to operations did not receive periodic inspections. While this action impacts safety and in-theatre workload, it also has the potential of impacting deployed operations and the Canadian Armed Forces' capabilities in theatre;
- some ammunition and explosives issued within theatres of operations did not receive periodic inspections. With deployed ammunition and explosives storage conditions being far from ideal, a heightened level of scrutiny is required to ensure the safety and serviceability of stored ammunition and explosives; and
- the Ammunition Information Maintenance System is not being leveraged by the Canadian Army, the Royal Canadian Air Force and the Canadian Joint Operations Command to identify requisite intervals between periodic inspections nor to monitor inspection results. Consequently, 57 percent of overdue inspections were between 3 and 10 years

overdue, including items associated with aircraft safety systems.

Element 7 – Ammunition and Explosives Infrastructure

- Ammunition and explosives safety inspection. During the reporting period, the Assistant Deputy Minister (Infrastructure and Environment) and the Director Ammunition and Explosives Regulation worked collaboratively to establish initial metrics and criteria to support the development of an ammunition and explosives safety inspection for ammunition and explosives-related infrastructure. This initiative will continue throughout fiscal year 2018/2019, with the intent of implementing a first ammunition and explosives safety inspection in fiscal year 2019/2020.
- Facility condition assessments. While 78 percent of the ammunition and explosives assets are in good to fair condition, the remaining 22 percent are in poor to critical condition and approaching the end of their economic life cycle. Through the Assistant Deputy Minister (Infrastructure and Environment)'s continuous efforts towards characterizing the ammunition and explosives infrastructure portfolio, the condition of the majority of ammunition and explosives second and third line storage and processing facilities has been captured. Approximately 200 ammunition and explosives facilities were not captured in the first round of the facility condition assessments and will be evaluated in fiscal year 2018/2019.
- Missile Maintenance Facilities. Concerns were raised over infrastructure modifications to the missile maintenance facilities at both 3 Wing Bagotville and 4 Wing Cold Lake, impacting the functionality of the blow out panels and facility safety. Temporary corrective measures were implemented while the Assistant Deputy Minister (Infrastructure and Environment) is investigating long-term solutions.
- 8 Wing Trenton earth covered magazines. Within the context of an ammunition and explosives safety inspection, it was noted that two earth-covered magazines did not have a lightning protection system. As a result and until corrective measures are implemented, the facilities are no longer licensed for the storage of ammunition and explosives and remain empty.

KEY OBSERVATIONS – AMMUNITION AND EXPLOSIVES SAFETY PROGRAM REVIEW

The implementation of the Ammunition and Explosives Safety Information Management System has given the Department of National Defence and the Canadian Armed Forces a software driven tool to record ammunition and explosives incidents and accidents. Notwithstanding and despite initial direction and training, it is not being consistently and effectively used by members of the Canadian Armed Forces or employees of the Department of National Defence. There has been a significant decline in reports from previous years which, combined with the poor quality and belated submission of these reports, indicates a weakness in the department's reporting culture that I am drawing to the attention of senior leadership.

Accurate and timely reporting will grant level one advisors and Commanders alike the ability to gain real-time appreciation of ammunition and explosives safety risks; draw lessons learned and initiate appropriate mitigating measures; and work towards ensuring the safety of members, employees and equipment. While a capability exists within the Director Ammunition and Explosives Regulation to analyze reports generated by the Ammunition and Explosives Safety Information Management System, its effectiveness is undermined by the poor quality of the limited and belated reports recorded by investigators.

EXECUTIVE CONCLUSION

Progress has been observed on many issues while departmental regulatory oversight over ammunition and explosives safety continues to increase. Where the ammunition and explosives safety compliance self-assessment of level one advisors and Commanders indicate an overall acceptable rating, repeat strategic observations as observed by the Director Ammunition and Explosives Regulation are concerning and will require increased attention throughout the next reporting year.

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. The Department of National Defence and Canadian Armed Forces' lapse in and quality of reporting ammunition and explosives safety occurrences are concerning as they adversely impact the organization's ammunition and explosives safety program and risk placing members and employees in harm's way.

PROLOGUE

It is a distinct pleasure to present the Director Ammunition and Explosives Regulation's tenth annual report to the Deputy Minister and Chief of the Defence Staff. 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 program; and
- safety through the oversight and management of the Ammunition and Explosives Safety Program.

AMMUNITION AND EXPLOSIVES SAFETY COMPLIANCE

As presented in the ninth annual report, the Director Ammunition and Explosives Regulation adopted an Ammunition Program-based, risk-informed compliance model to assess safety throughout the Department of National Defence and the Canadian Armed Forces (figure 1).

While Offices of Primary Interest have been identified for each element of the Ammunition Program, ammunition and explosives safety compliance activities within the Department of National Defence and the Canadian Armed Forces are applied against the elements of the Ammunition Program and can be categorized into three distinct levels (figure 2):

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				

A&E SAFETY COMPLIANCE

Figure 1: Ammunition Program

- Level 1 – compliance through effective execution and self-assessment by local ammunition and explosives practitioners at wings and bases (monthly/ quarterly inspections);
- Level 2 – compliance verification through ammunition and explosives specialists outside the immediate line management chain but within the Command; and
- Level 3 – compliance assurance by the regulator that is fully independent of line management or the Command.

The Director Ammunition and Explosives Regulation conducts compliance assurance against the elements of the Ammunition Program through the following two activities:

- audits: a comprehensive assessment of organizational operations, activities, and practices that verify compliance with ammunition and explosives safety orders and directives through the establishment of processes and procedures; and
- evaluations: a review of organizational activities and practices to determine whether they meet the desired regulatory outcome – focusing on process outputs and examining questions pertaining to relevance, effectiveness and efficiency as they relate to safety.

Compliance audits and evaluations inform decision-making, improvements, innovations and accountabilities. Compliance evaluations determine whether the systems and processes, as identified through compliance audits, meet the desired safety objectives and identify the need for any change to comply with safety policies. Both are concerned with ensuring that the Department of

National Defence and Canadian Armed Forces' systems and processes are in line with ammunition and explosives safety policies and both will form part of the regulatory compliance model.

AMMUNITION AND EXPLOSIVES SAFETY PROGRAM

The importance of broadening and deepening the knowledge of the Ammunition and Explosives Safety Program within the Department of National Defence and Canadian Armed Forces cannot be overstated. Through the implementation of a strategic communication strategy together with an in-house capability to conduct meaningful data analysis against safety information gleaned from the Ammunition and Explosives Safety Information Management System, the Director Ammunition and Explosives Regulation strives to institutionalize ammunition and explosives safety within the department and contribute towards a stronger overall safety culture.

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.

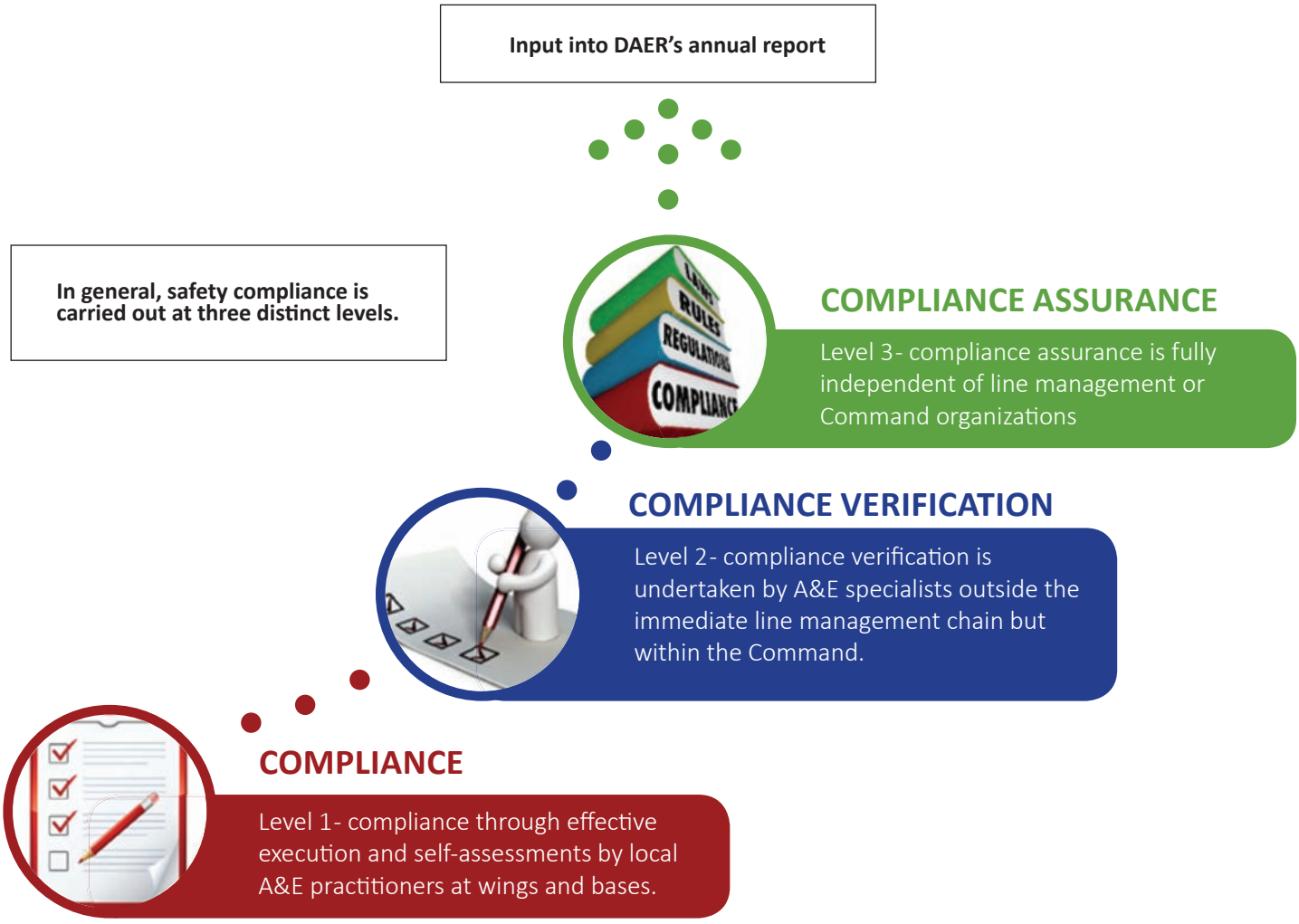


Figure 2: Levels of Compliance

PICTURE ON THE RIGHT: *Exercise COLLABORATIVE SPIRIT 17, which took place at 4th Canadian Division Support Base Petawawa from 19 to 22 September, provided an opportunity for Canadian Army stakeholders and civilian leaders to experience a personal and in-depth understanding of Canadian Army capabilities and equipment, as well as the professionalism and skill of Canadian soldiers.*

POLICY

INTRODUCTION

This section highlights important ammunition and explosives (A&E) safety policy amendments and findings. Supporting information and documents can be found on the Director Ammunition and Explosives Regulation (DAER) intranet site http://materiel.mil.ca/en/joint-common-ammo-explosives/controlled-documents.page.

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), DAER is the functional authority for A&E regulation and safety. DAER meets his mandate in part through the 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 other functional and technical authorities for areas that affect A&E are distributed across several level one (L1) organizations, DAER is responsible, through stakeholder engagement, for ensuring that A&E safety policies remain accurate, relevant and current. This is achieved through a three-fiscal year (FY) policy review cycle (table 1).

KEY POLICY CHANGES

An amendment to C-09-005-002/TS-001, Ammunition and Explosives Safety Manual – Volume 2 Storage and Facility Operations was published in 2017 with an updated unit lock-up policy. This policy grants flexibility to L1 ammunition technical authorities (L1 ATA) in approving lock-ups to meet both the operational and training needs of the unit.

C-09-005-004/TS-000, Ammunition and Explosives Safety Manual – Volume 4 Demilitarization and Disposal has been promulgated, superseding C-09-008-001/FP-000, Destruction of Surplus, Obsolete and Deteriorated Ammunition and C-09-008-003/FP-000, Ammunition and Explosives Procedural Manual – Explosive Ordnance Disposal – Disposal of Stray Ammunition. Volume 4 also incorporates the detail from Ammunition and Explosives Instruction (A&EI) 11, Disposal of Ammunition and Explosives at the End of Life Cycle. This A&E safety manual contains both policy direction and procedural instruction. Future amendments will be made through the policy

DOCUMENT	TITLE	FY 18/19	FY 19/20	FY 20/21
DAOD[2] 3002-0	Ammunition and Explosives	X		
DAOD 3002-1	Certification of Ammunition and Explosives	X		
DAOD 3002-2	Insensitive Munitions		X	
DAOD 3002-3	Ammunition and Explosives Safety Program	X		
DAOD 3002-4	Ammunition and Explosives Accident, Incident, Defect or Malfunction Reporting	X		
DAOD 3002-5	Use of Firearms, Ammunition and Explosives	X		
DAOD 3002-6	Display Fireworks		X	
DAOD 3002-7	Ammunition and Explosives Risk Management			X
C-09-005-001/TS-000	Program Management and Life Cycle Safety		X	
C-09-005-002/TS-001	Storage and Facility Operations			X
C-09-005-003/TS-000	Transportation		X	
C-09-005-004/TS-000	Demilitarization and Disposal			X
C-09-005-005/TS-000	Deployed Operations	X		
C-09-005-006/TS-001	Naval Vessels	X		
C-09-005-007/TS-000	Certification of Ammunition, Explosives and Accessories for Service Use		X	
C-09-005-008/TS-001	Design and Construction Standards	X		
C-09-005-009/TS-001	Hazards of Electromagnetic Radiation to Ordnance (HERO)			X
A-GG-040-006/ AG-001	Explosives Safety Program		X	
A-GG-040-006/ AG-002	Ammunition or Explosives Accident/Incident/Defect/Malfunction Reporting		X	

Table 1 – A&E safety policy publication review cycle

review cycle, when procedural content will be removed and transferred to the appropriate technical or functional authority.

The review of C-09-005-005/TS-000, Ammunition and Explosives Safety Manual – Volume 5 Deployed Operations has been delayed to FY 2018/2019 to allow it to incorporate upcoming changes to one of its source documents, North

[2] DAOD: Defence Administrative Orders and Directives.

Atlantic Treaty Organization (NATO) Allied Ammunition Storage and Transportation Publication 5 (AASTP-5) – NATO Guidelines for the Storage, Maintenance and Transport of Ammunition on Deployed Missions or Operations.

C-09-005-009/TS-001, Ammunition and Explosives Safety Manual – Volume 9 Hazards of Electromagnetic Radiation to Ordnance (HERO) was published during the reporting period. This policy document supersedes part 10 of C-09-005-001/TS-000, Ammunition and Explosives Safety Manual – Volume 1 Program Management and Life Cycle Safety and supports the policy requirement of DAOD 3026-0 to prevent accidents and losses that may result when A&E are exposed to radio frequency (RF) environments by planning, implementing and managing activities within a safety management framework.

CANADIAN LONG SPAN EARTH-COVERED MAGAZINE (CLSECM)

During this reporting period, the Assistant Deputy Minister (Infrastructure and Environment) (ADM(IE)) was able to close out a long-standing, significant issue related to the equivalent NATO designation of the CLSECMs (small and large variants).

ADM(IE) commissioned an engineering study to validate the designs of existing small and large-variant CLSECMs using plans from Canadian Forces Ammunition Depot (CFAD) Bedford (small-variant) and CFAD Angus (large-variant). The study was completed in March 2017 and the results were presented to DAER and ADM(IE). The assessment supported a 7-bar rating for the small variant and a 3-bar rating for the large variant. The Director Architecture and Engineering Services (DAES), the DND technical authority for infrastructure, accepted the results of the study and approved the classification of all existing small- and large-variant CLSECMs in accordance with the findings of the study. A&EI 63 (Canadian Long Span Earth Covered Magazines – Bar Ratings) will be the authority for this policy until such time as amendments can be made to the appropriate publications. The moratorium[3] on the construction of new CLSECMs was subsequently rescinded by DAER[4].

INTERNATIONAL ENGAGEMENT

To ensure Canadian policies reflect international best practices, DAER maintains global engagement with the military and civilian A&E community through participation in international forums, including NATO committees, as well as through meetings with Canada's allies.

In addition to being an active member of NATO's Allied Committee 326 Main Group (AC/326), Conference of National Armaments Directors – Ammunition Safety Group, DAER provides the chair for the NATO Allied Committee 326 Sub Group C (AC/326 SG C), in-service and operational safety management. Recent work in the committee has focused on revising quantity-distances for fragmentation and debris and updating the criteria for military airfields. Results of this work will be incorporated into the next edition of AASTP-1, which is the foundation document for DND's and the CAF's A&E storage safety policies.

United Nations General Assembly resolution 72/55 was adopted on December 4, 2017, encouraging states to identify and dispose of surplus A&E stocks and to support the UN by providing experts to assist other states in implementing explosives safety programs. The resolution also specifies through the Troop Contributing Country agreements that UN Peacekeeping operations comply with International Ammunition Technical Guidelines (IATG). DAER provides a representative on the technical review board for the UN IATG to ensure commonality with NATO and Canadian policies. The next edition of the IATG is scheduled to be published in 2020.

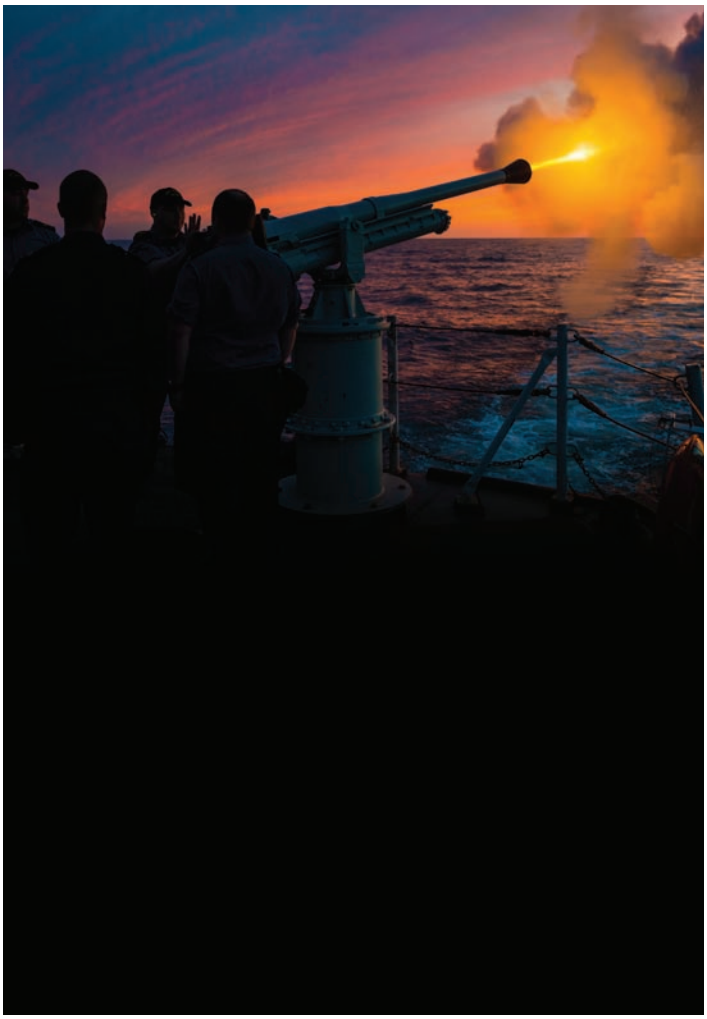
CONCLUSION

The introduction of a three-year review cycle for A&E policy documents has brought this component of DAER activities in line with the compliance program. Work throughout the year, both within Canada and with international bodies, remained critical to ensuring safety policy relevance, accuracy and alignment with NATO policies.

[3] 11300-23 (DAER 2-6, OTT_LSTL RDIMS# 3788293), December 2, 2014.
[4] 11300-23 (DAER 2-3,OTT_LSTL RDIMS# 4715169), September 28, 2017.

PICTURE ON THE RIGHT: *Crew members onboard Her Majesty's Canadian Ship Vancouver fire at their respective targets during the Sig Sauer and C-8 dual shoot during Operation PROJECTION Indo-Asia Pacific.*

AMMUNITION AND EXPLOSIVES SAFETY COMPLIANCE



INTRODUCTION

A&E safety compliance is accomplished through the execution of an Ammunition Program-based compliance verification program and a careful review and consideration of organizational practices around the Ammunition and Explosives Safety Program. Level one self-assessment compliance verification activities for element 4 were executed throughout the reporting period while substantial effort went into furthering the Ammunition Program-based compliance program through engagement with the ADM(Mat) and the ADM(IE) over the development of an ammunition and explosives safety inspection (AESI) for elements 2 and 7, respectively. Two notices of non-compliance were issued by DAER during the reporting period covering periodic inspections of A&E and the absence of lightning protection systems (LPS). The notices were addressed to the affected L1 organizations, the details of which are described in the following paragraphs under element 4 below.

COMPLIANCE BY AMMUNITION PROGRAM ELEMENT

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

ELEMENT 1 – A&E REGULATION

Assistant Deputy Minister (Review Services) (ADM(RS)) Follow-Up Evaluation – DND and the CAF Ammunition Safety Program. In 2005, DND and the CAF underwent an evaluation of the DND and the CAF Ammunition Safety Program by the then Chief of Review Services (CRS). In 2017, DAER underwent a follow-up validation built on the eight themes that had been identified in the original 2005 CRS report (table 2).

Results of the 2017 follow-up evaluation indicated that the department had rectified the majority of the observations raised in 2005 through the establishment of DAER and the mandate assigned to the director. There were however some areas for improvement centred around three specific themes:

- 1 – Regulatory Framework, where the regulator's authority and freedom of access were identified as challenging, particularly with level zero and L1s;

SERIAL	THEME	DESCRIPTION
1	Regulatory Framework	Evidence of a coherent regulatory framework for ammunition safety founded on regulatory principles, including: creation of an independent corporate regulator; clear and documented roles and responsibilities.
2	Policies and Standards	Evidence of a comprehensive review of existing ammunition safety policies and standards and associated documentation and corrective actions. Upon completion, establish a process for the development and on-going review of ammunition safety policies and standards, including a consultation process with stakeholders.
3	Program Management	Evidence of the establishment of ammunition safety as a distinct corporate program with a corresponding OPI, business plan and resource allocation; a business case should be undertaken to justify a baseline resource allocation for regulatory function.
4	Information for Decision-Making	Evidence of the establishment and maintenance of a comprehensive departmental system for the collection, analysis, and dissemination of ammunition safety information; institute measures to improve completeness and timeliness of occurrence reporting; streamline processes and develop automated tools for data collection and analysis; implement management reporting.
5	Risk Management	Evidence of a risk-based approach to ammunition safety management and regulation and development of risk policies and procedures for ammunition safety assessments.
6	Program Instruments and Alternatives	Evidence of a broad regulatory "tool kit" to address safety issues; monitor and assess effectiveness of action taken (program interventions); explore opportunities to leverage e-solutions across all ammunition safety activities.
7	Communications	Evidence of the development and implementation of an ammunition safety communications strategy and plan; establish mechanisms to promote dialogue and information sharing across DND/CAF ammunition safety community and with key external organizations.
8	People	Evidence of the establishment of competency profiles and terms of reference for ammunition positions; assess adequacy of training programs and skills for positions performing or managing ammunition activities and take action as required; establish ammunition support for planning of deployed operations.

Table 2: 2005 CRS Evaluation – Evaluation Themes

- 6 – Program Instruments and Alternatives, where recognition programs were lacking both in terms of ability to motivate stakeholders and in resource allocation; and
- 7 – Communications, where no department-wide Ammunition and Explosives Safety Program (AESP) communication strategy and plan had been established.

The report's findings concluded that an evaluation of DAER should be considered as part of a cyclical evaluation of the Ammunition Program, with the next ADM(RS)-led evaluation tentatively scheduled for FY 2022/2023.

ADM(RS) Evaluation – A&E Management. ADM(RS) further conducted an evaluation of A&E management within the department in 2017 with the resulting report released in November of 2017. Highlighted within the report was a requirement for DAER to establish 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 accurately reflects the safety conditions at A&E facilities.

In response and by leveraging the AESI recording and tracking functions within the recently implemented Ammunition and Explosives Safety Information Management System (AESIMS), DAER will amend the inspection criterion for assessing the safety conditions for A&E related activities and infrastructure by adopting a "three strikes" approach to compliance observations against L1 organizations[5]. The target date for completion of this management action plan (MAP) is April 2020. DAER will continue to monitor and report on its progress in meeting the MAPs for both evaluations through its annual reports.

ELEMENT 2 – A&E EQUIPMENT PROGRAM MANAGEMENT

Throughout the reporting period, ADM(Mat) and DAER dedicated substantial effort towards developing a collaborative AESI for element 2 of the Ammunition Program, focusing on three distinct functions: ammunition safety and suitability for service (S^3) assessment; life cycle materiel management; and demilitarization and disposal of surplus, obsolete and end-of-life cycle A&E inventory. Significant progress was made in addressing compliance assurance requirements for the first two functions, resulting in the successful execution of a focused[6] AESI dry run for element 2. Lessons learned were captured and will be considered throughout FY 2018/2019 while DAER and ADM(Mat) continue to evolve the AESI. Efforts towards addressing the demilitarization and disposal function are being postponed until the third quarter of FY 2018/2019 and will resume within the context of a spiral growth approach towards developing the assessment tool. Once both organizations are satisfied that the assessment tool is comprehensive and inclusive of all A&E safety functions under element 2, the intent will be to execute a first AESI with ADM(Mat) in FY 2019/2020. DAER will subsequently work with Canadian Special Operations Forces Command (CANSOFCOM) to ensure its incorporation, as an office of primary interest (OPI), within the Ammunition Program compliance assurance program.

While not yet observed within the context of a comprehensive AESI for element 2, some observations were raised throughout the reporting period, the results of which are presented in the following paragraphs.

DEMILITARIZATION AND DISPOSAL

The DND stockpile of surplus, obsolete, deteriorated and time-expired A&E awaiting disposal has been well documented in previous annual reports. A repeat observation, the department's limited institutional capability for large-scale demilitarization and disposal continues to pose significant challenges to inventory holdings optimization and is a high visibility safety concern; this observation is echoed in the 2017 ADM(RS) evaluation of A&E management within the department. Of specific safety concern are the more than 80 000 155mm M119 red bag propelling charges which, following an unsuccessful attempt to sell as surplus inventory, continue to await disposal.

In response, ADM(Mat) initiated and developed a plan to acquire and commission equipment for the disposal of small arms ammunition, spent brass, aids to production and munition scrap. Four projects are planned to be delivered to establish these capabilities by December 2019. In FY 2017/2018, three of the four projects were launched and a tender notice for a mutilation capability was posted on the Government Electronic Tendering Service. In parallel and as part of ongoing policy review, a rationalization analysis of thermal treatment temperature and duration thresholds, as well as a series of technical studies with respect to A&E incinerators, flashing furnaces and brass certification technologies, are being conducted.

While the Canadian Materiel Support Group's annual A&E disposal exercise, Exercise DUSTY THUNDER, continues to play an important role in reducing the current stockpile and successfully disposed of 35 tonnes (net explosive quantity) of A&E awaiting disposal, the absence of an institutional disposal capability continues to represent a significant concern given the ongoing requirement to store time-expired, deteriorated, obsolete and/or surplus A&E.

[5] Automatic failure where a specific observation is noted in three consecutive annual reports.

[6] Initial application of the AESI against the life cycle management function focused solely on organizations within the Director General Land Equipment Program Management. Future revisions of the AESI will incorporate the Director General Maritime Equipment Program Management, the Director General Air Equipment Program Management and the Major Project Delivery organizations within ADM(Mat).

Air Weapons Systems Technicians unload a CF-188 Hornet after a training mission during Exercise CHUMEX at Homestead AFB, Florida.

Finally, the technical study on environmental considerations and mitigations for the disposal of the Canadian rocket vehicle-7 stockpile was completed, permitting the commencement of options analysis for a disposal methodology.

Where DAER was previously able to report on departmental trends and the total volume of ammunition and explosives awaiting disposal through information provided by ADM(Mat), this was not possible for the current reporting period as the information was not captured. ADM(Mat) acknowledged the shortfall and will work to re-establish a capability.

PROCESS CONTROL – INFORMAL ENGINEERING ASSESSMENTS

S^3 assessments are critical to the safe in-service use, storage, handling and transportation of A&E. During the reporting period, it was observed that an internal engineering assessment tool known as an "Informal Engineering Assessment" had been inappropriately used and referenced within ADM(Mat) as a formal Ammunition Safety and Suitability Board (ASSB) decision[7]. The ASSB Chair has since directed that the practice of using the title, "Informal Engineering Assessment" and of performing informal assessments be ceased to mitigate potential confusion over official engineering assessment decisions/ documents and supporting internal processes/tools.

A&E S^3 ASSESSMENTS

S^3 assessments. The ASSB is mandated to assess the S3 of A&E and is guided by an environmental questionnaire[8] defining the operational envelope within which A&E is expected to function as designed. Changes to a weapon system or platform could adversely impact safety by exposing A&E to temperatures, pressures and/or vibration profiles that exceed its design limits, potentially causing the A&E to: function outside its design parameters (prematurely, deflagrate or detonate); or fail to function (having an operational impact and potentially creating an unexploded explosive ordnance (UXO) hazard). A change in operational envelope could also affect the planned shelf or installed life of A&E. As such, there is a requirement to capture and assess changes to the operational envelope of A&E so that it continues to function as designed and does not pose a potential safety risk.

As the technical authority[9] for A&E, ADM(Mat)'s Director Ammunition and Explosives Management and Engineering (DAEME) chairs the ASSB and provides engineering services and advice to operational and project staff, equipment management teams and A&E item managers to ensure A&E remains safe and suitable for service within its defined operational envelope. The following observations support the requirement for better project office and equipment management team coordination with DAEME:

[7] C-09-005-007/TS-001 – Volume 7 – Certification of Ammunition, Explosives and Accessories for Service Use identifies accepted A&E engineering S^3 assessment processes and tools.

[8] Guidance on the Assessment of the S^3 of Non-Nuclear Munitions for NATO Armed Forces, AOP-15, reflected in D-09-002-010/SG-000, Standard – Assessment of the Safety and Suitability for Service of Ammunition and Explosives.

[9] C-09-005-001/TS-000, Ammunition and Explosives Safety Manual, Volume 1 – Program Management and Life Cycle Safety, Part 2.

- Hazards of Electromagnetic Radiation to Ordnance (HERO) and Platform Integration. As part of its maritime role, the Cyclone helicopter will deploy on the Royal Canadian Navy's HALIFAX Class ships. A review of the Sikorsky white paper[10] revealed that the helicopter's high power surveillance radar design posed a potential HERO threat when in close proximity to exposed rounds from the ship's 20mm close-in weapon system. While the issue had been identified by the project team and was being addressed from a platform integration perspective, the information had not been communicated to the A&E technical authority; and

- Safe Storage of Pyrotechnic items in Search and Rescue (SAR) Helicopters. Within the context of discussions over operational requirements of the Cormorant SAR aircraft, it was noted that the introduction of the new aircraft had not triggered a review of the S3 assessment for the pyrotechnic items stored on and used by the aircraft. Once advised, ADM(Mat) Director Technical Airworthiness & Engineering Support acted appropriately and amended the Airworthiness Design Standards Manual to include a requirement to engage DAEME where a change in platform could impact the S3 of A&E.

TECHNICAL INVESTIGATION RESULTS – 5.56MM

In 2015 and 2016, the Canadian Army (CA) experienced twelve ammunition accidents involving C7A2 rifles and C77 cartridges[11]. All accidents occurred during training that involved high rates of fire and resulted in over-pressure events causing rupture of the cartridge cases and damaging rifles. In response, DAEME tasked the Quality Engineering Test Establishment (QETE) to investigate the accidents, identify the cause(s) and provide recommendations. Through a multi-disciplinary investigation team led by Munitions and Experimental Test Centre (METC) ammunition and weapons specialists, QETE determined that the C7A2s performed as designed and focused on the C77 cartridges and the propellant production lots.

Small arms ammunition cartridge that ruptured when R22eR soldiers were on a range in Santa Margarida Army Base, Portugal October 2015

Is was determined that rifle chambers reached temperatures between 130°C to 145°C after firing five magazines, and that propellant from different lots behaved differently when exposed to that temperature range. In May 2017, the technical team was able to replicate the accident and demonstrate that a cartridge case ruptured from overpressure after residing 15 seconds in a 137°C chamber. Having identified the root cause, QETE/METC instrumented a C7A2 rifle and tested six lots of C77 cartridges in the fall of 2017. Test results identified one production year of C77 Cartridges with affected propellant as susceptible to high temperature.

Consequently, the results of the technical investigation allowed ADM(Mat) to lift all restrictions save those against affected lots manufactured in 2011.

ELEMENT 4 – A&E OPERATIONS SUPPORT AND READINESS

Safety compliance activities under element 4 are executed:

- as L1 self-assessments at second or third line storage facilities by L1 ATAs on behalf of their respective level one advisor or Commander through the execution of AESIs; and

- by DAER through a review of information generated by the Ammunition Information Maintenance System (AIMS) database.

L1s with a responsibility for the safe storage, handling and management of A&E facilities are subject to AESIs. As a result, several L1 organizations and Commands[12] were subject to compliance activities during the reporting period while DAER worked with the ADM(IE) UXO, Contaminated and Legacy Sites Program to incorporate that unique domestic operation as part of element 4.

[10] CMHP APS-143B(V)3 Radar/IFFI Effects of RF Transmissions White Paper, 14 Nov 2014.

[11] Featured on the cover page and discussed within DAER's eighth annual report to the DM/CDS.

[12] The Assistant Deputy Minister (Materiel) (ADM(Mat)), Royal Canadian Navy (RCN), Canadian Army (CA), Royal Canadian Air Force (RCAF), Canadian Joint Operations Command (CJOC), Canadian Special Operations Forces Command (CANSOFCOM), and the Assistant Deputy Minister (Science and Technology) (ADM(S&T)).

L1 ORGANIZATION	AGGREGATE AESP HEALTH SUMMARY
RCN	Acceptable
CA	Acceptable
RCAF	Acceptable
CJOC Domestic	Acceptable
CJOC Expeditionary	Improvement Required
CANSOFCOM	Acceptable
ADM(S&T)	Acceptable

Legend

Acceptable	Aggregate L1 average score is over 75 percent for all pillars.
Improvement Required	Aggregate L1 average score is between 60 percent and 75 percent for at least one pillar.
Attention Required	Aggregate L1 average score is below 60 percent for at least one pillar.

Table 3: Aggregate Element 4 AESI Results

The following paragraphs outline the AESI results for the reporting period that will require increased attention throughout the next reporting year.

AMMUNITION AND EXPLOSIVES SAFETY INSPECTION

The AESI self-assessment summary depicts the results within respective L1 organizations across the seven pillars of the inspection tool (table 3). Interpreting these aggregated results; A&E safety remained strong at second and third line A&E-related facilities. There were, however, two areas assessed under CJOC expeditionary operations that required improvement.

While assessing CJOC expeditionary operations, an inability to site explosives workshops within the explosives storage areas was observed at multiple mission locations, requiring personnel to work near or around the storage magazines, leading to non-compliant and unsafe conditions. Explosives workshops are a key component supporting day-to-day A&E activities and enable the breakdown and build-up of ammunition for shipment, use or return. It was also observed that standard operating procedures were not available for A&E operations at various deployed locations. While it is recognized that it may not always be possible to fully meet A&E safety policies within a deployed environment, elevated safety risks must be identified, assessed, accepted and mitigated where feasible. While conducting expeditionary operations with other partner nations, the co-ordination and/or acknowledgement of all A&E safety policies is paramount in establishing an appropriate standard of A&E safety within deployed locations[13].

A&E STORAGE LICENCES – AIMS DATA INTEGRITY

This is a repeat observation. The warehousing of ammunition (including licensing of storage facilities) is managed through AIMS. A first compliance evaluation of L1 A&E storage facilities conducted in October 2016 revealed that no unit was found to be 100 percent accurate in matching their A&E storage licences to the information found in AIMS. Following engagement with affected L1 organizations, a second evaluation was again conducted in March 2018 and revealed that while improvements had been observed, no L1 organization was 100 percent accurate. The findings were promptly re-communicated to L1 organizations for corrective action.

There is a lack of awareness over the safety hazards associated with inconsistencies between the approved storage licences and the licensing information stored in AIMS. It is imperative that the information within AIMS mirrors that of the approved licences to ensure explosives storage limits are not exceeded and safe storage policies are not circumvented. Continued L1 oversight during the L1 AESIs is essential to ensuring safe storage practices.

A&E STORAGE LICENCES – CURRENCY

A key observation in last year's annual report stated that a number of ammunition facilities were operating with expired explosives storage licences. Licence renewals have improved notably and all units currently have accurate and authorized quantity-distance licences. L1 ATAs are using the annual AESI as an opportunity to ensure licence accuracy and currency.

[13] On NATO operations, Allied Logistics Publication 16 (ALP-16) Explosives Safety and Munitions Risk Management (ESMRM) details a systematic approach to be used for identifying potential consequences associated with munitions operations, risk reduction alternatives, and risk decision criteria for key decision makers.

PERIODIC INSPECTIONS

This is a repeat observation supported by a Notice of Non-Compliance to affected L1 organizations. Ammunition practitioners carry out periodic inspections at second and third line A&E storage facilities at prescribed intervals throughout the life of the A&E to safeguard against degradation and additional deterioration due to storage conditions while ensuring stock serviceability. In September 2016, DAER conducted a 100 percent safety compliance audit of the periodic inspections recorded in AIMS and noted 3,105 overdue periodic inspections (cumulative). The lapse in inspections places the safety and serviceability of the A&E in question. On behalf of the functional authority for materiel and inventory management (ADM(Mat)) and under its authority as the technical authority for A&E, DAEME published A&EI 62 providing clear direction to L1 organizations to take corrective action and ensure inspections are completed in accordance with departmental policy. By June 2017, a follow-up audit by DAER showed progress with an overall decrease of 26 percent in the total quantity of overdue periodic inspections. However, despite the initial impetus to resolve the issue, a March 2018 audit revealed that the overall number of overdue periodic inspections had increased by 13.7 percent since the June 2017 audit (figures 3 and 4).

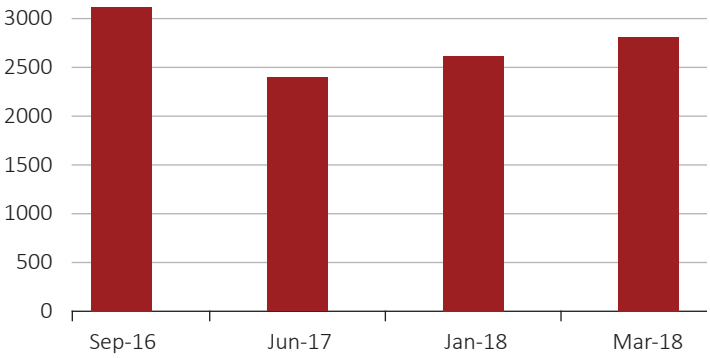


Figure 3: Total Number of Lots Awaiting Periodic Inspection

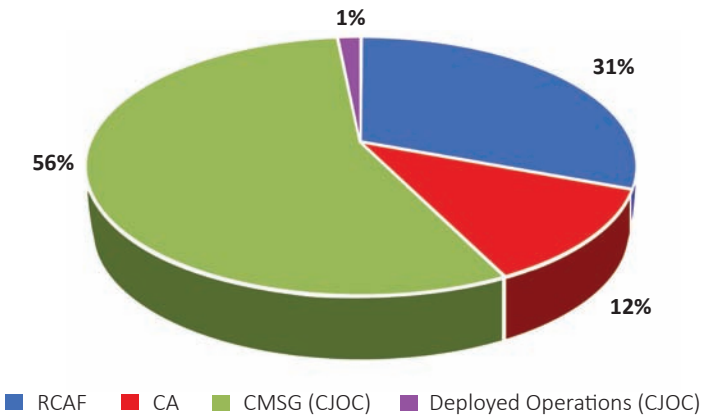


Figure 4: Breakdown of Lots Awaiting Periodic Inspection

As part of the observations made in relation to overdue periodic inspections, four important safety concerns were identified:

- most periodic inspections for A&E that have been condemned or are awaiting disposal (through demilitarization or sale) were not done by the CA, the RCAF and CJOC. As the rate of degradation of these items represents a safety concern, it is important to ensure that they continue to be inspected to ensure they remain safe for storage, transportation or sale;
- some A&E issued in support to operations did not receive periodic inspections. While this action impacts safety and in-theatre workload, it also has the potential of impacting deployed operations and the CAFs' capabilities in theatre;
- some A&E issued within theatres of operations did not receive periodic inspections. With deployed A&E storage conditions being far from ideal, a heightened level of scrutiny is required to ensure the safety and serviceability of stored A&E; and
- the AIMS is not being leveraged by the CA, the RCAF and CJOC to identify requisite intervals between periodic inspections nor to monitor inspection results. Consequently, 57 percent of overdue inspections were between 3 and 10 years overdue, including items associated with aircraft safety systems.

The safety and serviceability of A&E is dependent upon the application of correct surveillance policy by responsible custodians. A lapse in A&E maintenance and surveillance contributes towards an unacceptable level of risk to military members and civilian employees. A robust and regimented surveillance program remains paramount in ensuring safety at all times within the life cycle of A&E. The current situation requires continued senior leadership engagement in order to mitigate safety risks to CAF members, DND employees, and infrastructure and equipment.

ASSESSMENT OF L1 ATAs

During the reporting period and as part of DAER's compliance assurance activities, L1 ATAs were assessed against criteria evaluating their effectiveness in conducting

AESIs under element 4 on behalf of their respective L1 advisor or Commander. Compliance assurance focused primarily on the ATA team composition and AESI execution, resulting in performance evaluations being staffed to L1 organizations indicating areas of strength and areas for improvement. While L1 ATAs were able to successfully execute their respective compliance verification activities, there remains a continued focus of observations applicable to most L1 ATAs associated with:

- Team Conduct: ensuring adequate personnel to complete a detailed AESI based upon the size of the unit; and
- Inspection Execution: lack of experienced personnel to extensively apply and assess detailed elements of the AESI.

Of note, the RCN has established a Fleet Ammunition Technical Authority on each coast to directly support the RCN ATA in the execution of his/her compliance verification activities. Unique to the RCN, this approach supports inspector continuity and training, and caters to the requirement to conduct AESIs onboard ships and submarines.

ELEMENT 7 – A&E INFRASTRUCTURE

During the reporting period, ADM(IE) and DAER worked collaboratively to establish initial metrics and criteria to support the development of an AESI for A&E safety as applicable to infrastructure. This initiative will continue throughout FY 2018/2019 with the intent of executing a first AESI against element 7 in FY 2019/2020.

While not yet observed within the context of a comprehensive AESI, some observations were raised throughout the reporting period, the results of which are presented in the following paragraphs.

REAL PROPERTY SPATIAL DATA WAREHOUSE – A&E INFRASTRUCTURE

To assist with A&E infrastructure planning and licensing, ADM(IE) implemented the Real Property Spatial Data Warehouse (RPSDW). This innovative online tool integrates land, site and infrastructure, building, and equipment data into an accessible platform to optimize the management of the DND real property portfolio. The tool will also allow ammunition practitioners to validate, visualize and populate information on explosives storage facilities and surrounding exposed sites. The RPSDW will significantly reduce the potential for error in the submission of explosives storage licences, contributing to a safer A&E environment.

PORTFOLIO CHARACTERIZATION

ADM(IE)'s efforts towards characterizing the A&E infrastructure portfolio progressed through the Ammunition Program Study. A collaborative effort between ADM(IE) and Strategic Joint Staff J4 Ammunition (J4 Ammo), the goal of the study is to assess the current state of the A&E infrastructure assets and determine the medium to long term operational infrastructure requirements in support of the Ammunition Program.

While the study consists of three distinct parts, DAER's main focus is on Part 1, Portfolio Analysis, which defines the condition of the existing A&E infrastructure through facility condition assessments (FCAs) of A&E-related infrastructure. To date, ADM(IE) has captured the condition of the majority of A&E second and third line storage and processing facilities. Approximately 200 A&E facilities were not captured in the first round of the FCAs and will be evaluated in FY 2018/2019.

The A&E real property portfolio composes approximately one percent of the overall defence portfolio based on the real property replacement cost. Buildings alone, such as storage magazines and ammunition transit or maintenance facilities, have an assessed replacement value of approximately $400M, while the combined value of buildings and works (hardstands, jetties, vehicle marshalling areas) is estimated to exceed $1B.

The physical and functional suitability of A&E infrastructure assessed to date varies greatly across the country. Within the A&E portfolio, 78 percent of the currently assessed assets are in good to fair structural condition (fair equating to "adequate for now/requires attention") and 22 percent are in poor to critical condition (poor equating to "at risk of affecting service/functionality" and critical equating to "unfit for sustained service") (figure 5).

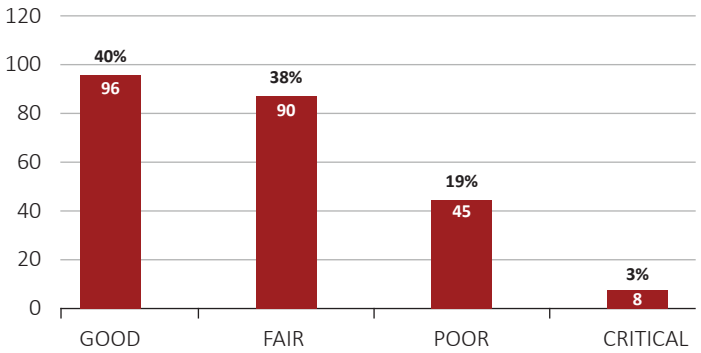


Figure 5: Condition of Currently Assessed Ammunition Infrastructure Assets

[13] The RCN has established a Fleet Ammunition Technical Authority on each coast to directly support the RCN ATA in the execution of his/her compliance verification activities. Unique to the RCN, this approach supports inspector continuity and training, and caters to the requirement to conduct AESIs onboard ships, boats and submarines.

Figure 6 depicts the age of the ammunition storage and processing facilities where 286 of the facilities were built in or prior to 1969. The aging and degrading infrastructure along with encroachment issues expose DND and the CAF to potential safety risks.

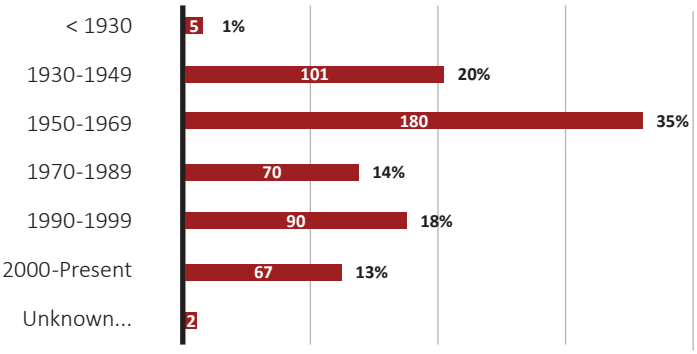


Figure 6: Construction dates of Ammunition Infrastructure Assets

MISSILE MAINTENANCE FACILITIES (MMF)

Missile maintenance facilities (MMF) were purposely designed to vent rocket motor pressures in the event of unintended initiation during testing. At 4 Wing Cold Lake, the 1 Air Maintenance Squadron Safety Manager noted that the MMF functionality had been compromised during a minor security upgrade. Rather than an obviously frangible surface or louvered arrangement (blow out), the vent was found to be weather sealed with layers of plywood attached to two-inch lumber and Hilti/Ramset anchored to the concrete vent port walls. Additionally, the metal siding on the exterior of the building covered the vent, preventing easy identification of a hazard area. Concerns were subsequently raised over the blow out properties of the infrastructure modifications in the event of an accidental rocket motor ignition, and the consequent hazard to a maximum of 25 related personnel working in the attached workshop. In response, ADM(IE) Real Property Operations completed a temporary modification by replacing the plywood with a thin metal sheet held lightly in place in the vent opening, and trimmed away the metal siding. A comparable modification is proposed for the similar 3 Wing Bagotville MMF. This issue will require ADM(IE) follow up action to validate the test cell designs for both facilities.

CANADIAN LONG SPAN EARTH-COVERED MAGAZINE (CLSECM)

An observation by CFAD Bedford personnel raised concerns over the construction standards of the newly built CLSECMs. In February 2017, a technical report confirmed that the depth and quality of earth cover on the newly constructed A&E storage facilities did not meet departmental design criteria for an earth-covered magazine. In addition to posing a potential safety risk, the shortfall drastically reduced the explosives storage capacity of the facilities and depot. As an interim measure and pending an ADM(IE)-led investigation, the Canadian Joint Operations Command (CJOC) amended the licences of the seven magazines and reduced the storage capacity of the affected facilities by redistributing the stores in compliance with departmental policies. In December 2017 and as a result of ADM(IE)'s efforts, the issue was addressed and corrective measures implemented, allowing the A&E storage facilities to be licensed as 7-bar earth-covered magazines.

8 WING TRENTON EARTH-COVERED MAGAZINES (ECMS)

This observation resulted in a Notice of Non-Compliance. The RCAF conducted the annual AESI of its ECM facilities over 18-21 July 2017 and observed that buildings 115 and 116 were without a lightning protection system (LPS). Built in 1952/53, the facilities had received regular AESIs where the grounding bars inside the magazines had been mistakenly referred to as a LPS. Upon noticing the discrepancy, the RCAF took appropriate action and rescinded the storage licences for the facilities and relocated the A&E to other storage facilities. A recapitalization project has been expanded to include the installation of LPS that will allow the ECMs to be re-licensed for the safe storage of A&E.

CONCLUSION

There has been significant progress in expanding the compliance assurance program to address elements 2 and 7 of the Ammunition Program. Concurrently, progress was also observed through the demilitarization and disposal projects for small arms ammunition, spent brass, aids to production and munition scrap. Notwithstanding, there are some areas where improvement is required, notably where repeat observations were recorded.

Where a Notice of Non-Compliance has been issued, there is an expectation that L1 advisors and Commanders will ensure corrective actions have been initiated over the course of the next reporting period.

L1 ATA INPUT

L1 ATAs were requested to report on systemic issues, recurring AESI safety observations, critical safety issues and any other issues of note affecting their respective organizations. The following is a synopsis of returns received that should be considered as supporting or additional observations.

RCAF ATA

AESI for first line workshops. The AESP results highlighted the requirement for changes to the AESI to account for the existence of first line ammunition workshops.

Vegetation control. A significant trend was observed with respect to maintaining the vegetation control within explosives storage areas (ESA). The root cause of the trend was identified by the RCAF as the prioritization of ESA contracts resulting in overgrown vegetation within the ESAs.

Deteriorated infrastructure. The current state of deteriorated A&E infrastructure in the RCAF continues to negatively affect AESP compliance and mission success. Three critical safety observations were recorded during the year: lightning protection systems were noted as being absent at 8 Wing Trenton; and missile maintenance facility blow out panels were observed as being obstructed at both 3 Wing Bagotville and 4 Wing Cold Lake.

CJOC ATA

Recurring observations. Recurring observations were noted under the storage pillar of the AESI with five out of seven facilities observed with multiple fraction tags, incorrect condition codes and mixed lots.

Vegetation control. A lack of vegetation control was recorded during the inspection of all the CFADs. CJOC attributes the challenge to awarding contracts to companies with the appropriate security clearance.

Critical safety issues. Three critical safety issues were observed on OP REASSURANCE: mixing of compatibility groups on the same pad, no workshop and the lack of lightning protection.

VCDS ATA

Deteriorating infrastructure. The annual AESI revealed that the Canadian Forces Support Unit (Ottawa) (CFSU(O)) ammunition facility does not have the capability to conduct receipt and issue of HD 1.1 & 1.2 stores without a risk-based licence, due to limitations of the approved quantity-distance licence. 2 Service Battalion will provide these services on behalf of CFSU(O) under a service level agreement for the foreseeable future. The facility's infrastructure is aging, requires repairs and maintenance and, ultimately, does not meet the requirements for performing all of CFSU(O)'s A&E operations for National Capital Region (NCR) clients. Other locations within the NCR should be considered for construction of a new facility.

BOTTOM PICTURE: *Royal Canadian Air Force weapons systems specialists from 401 Tactical Fighter Squadron load an air-to-air missle on a CF-188 Hornet at Tyndall Air Force Base, Florida, January. 31, 2017. as part of Exercises COMBAT ARCHER and COMBAT HAMMER.*

AMMUNITION AND EXPLOSIVES SAFETY PROGRAM REVIEW

INTRODUCTION

The aim of the DND and the CAF AESP is to prevent accidental bodily harm, as well as damage to materiel, facilities, infrastructure and the environment. It ensures personnel have safe and effective means to either execute or support a mission. The success of the AESP is predicated on top-down engagement by leadership, bottom-up execution by CAF members and DND employees, and an overall institutional awareness of A&E safety.

Annual reports have historically provided corporate statistics on A&E occurrences measuring departmental performance in its execution of safe A&E practices and gauging the overall health of the AESP. The identification and subsequent analysis of departmental safety trends enables the determination of root causes, informed decision-making and potential avoidance of future occurrences. With the advent of AESIMS, there is an opportunity to capitalize on real-time, structured data and consequently conduct comprehensive data analysis, leading to meaningful conclusions and results.

Last year I indicated that the introduction of AESIMS would trigger a strategic pause in statistical reporting over the next two years while DAER resets its reporting schema and develops a statistical reporting capability through AESIMS. While that statement holds true as we enter the second year of AESIMS implementation, there are some significant takeaways that can be garnered at this early stage and which speak to the overall A&E reporting and safety cultures within DND and the CAF.

THE HEINRICH MODEL

The Heinrich 300-29-1 model[14] suggests that for every 300 near misses there will be 29 minor injuries and 1 major injury (figure 7). The resulting incident to accident ratio is therefore approximately 10:1.

While the methods used to determine the relationship between near-miss events, accidents, serious accidents and fatalities may vary depending on the model used, the triangle theory does help to correlate the number of accidents to incidents and, more importantly, to understand that major accidents and fatalities may be avoided by making a practice of investigating all near misses and

[14] 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".

accidents. Whatever the precise ratio in any given field of work, the key point is to capture and understand incidents before they recur to cause an accident. Focusing on near misses and trends will help provide forewarning before an incident or accident occurs, changing the fundamental approach of hazard management from reactive to proactive.

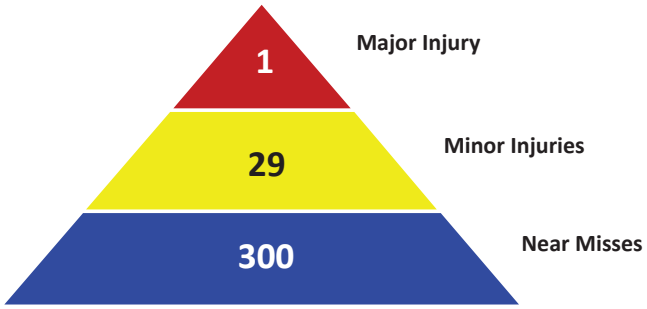


Figure 7: The Heinrich Model

DND AND THE CAF – OCCURRENCE REPORTING

AESIMS Release 1 (R1) was fielded to the A&E practitioner community[15] on 1 April 2017 and became the system of record for reporting and staffing of all A&E safety occurrences. The following top three AESIMS implementation observations represent critical opportunities for improvement for DND and the CAF at large:

- Reporting culture. Accidents result in personal injury or damage to equipment or infrastructure and, as a result, are likely to be reported. Incidents, on the other hand, are near misses and are less likely to be reported due to circumstances (field environment, reporting tools, training, awareness, etc.), operational tempo or unfamiliarity with reporting requirements and policies. Last year's A&E incident to accident ratio is indicative of that for the past ten years and was reported as 3.65:1. This reporting year witnessed a reduction in ratio to 2.7:1 (figure 8). Recognizing DND and the CAF transition from a paper-based reporting methodology to one that is fully automated, the marked decrease in occurrence reporting witnessed during this reporting period[16] (figure 9) remains alarming. Organizational reporting is an essential part of a successful AESP and has a direct impact on personnel safety, readiness and capabilities. As directed[17], AESIMS is the departmental system of record for all A&E safety reporting and must be used accordingly. A&E occurrences that are reportable through other safety programs must also be reported in AESIMS. There is a requirement for a dedicated and sustained effort in growing the A&E reporting culture within the department;

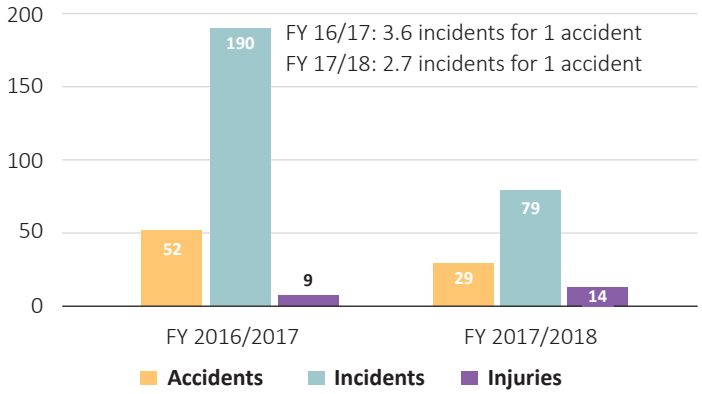


Figure 8– Accident/Incident Ratio & Injuries

- Quality of reporting. Whereas in the past, the message-reporting format sought brevity, AESIMS allows case reporters and investigators to provide more detail through a far greater scope of investigative narrative. An analysis of all occurrence reports for this reporting period shows substantial deficiencies in reporting through: poor quality of the description narrative; incomplete reports; inaccurate cause factor identification; and incongruent corrective and preventative measures. It was also noted that some reports were closed without attributed cause factors or preventative measures. While DAER will continue to monitor and work with L1 organizations to increase the quality of reporting, it is the responsibility of the investigator, supported by the L1 ATA and chain of command, to determine primary and contributory causes, and make recommendations to bring about corrective action to prevent similar occurrences from recurring; and

[15] Ammunition technical authorities, ammunition technicians, air weapons systems technicians, weapons engineering technicians and life cycle materiel managers for A&E.
[16] From 242 occurrences reported in FY 2016/2017 down to 108 reported in FY 2017/2018.
[17] Canadian Forces General Order 23/17.

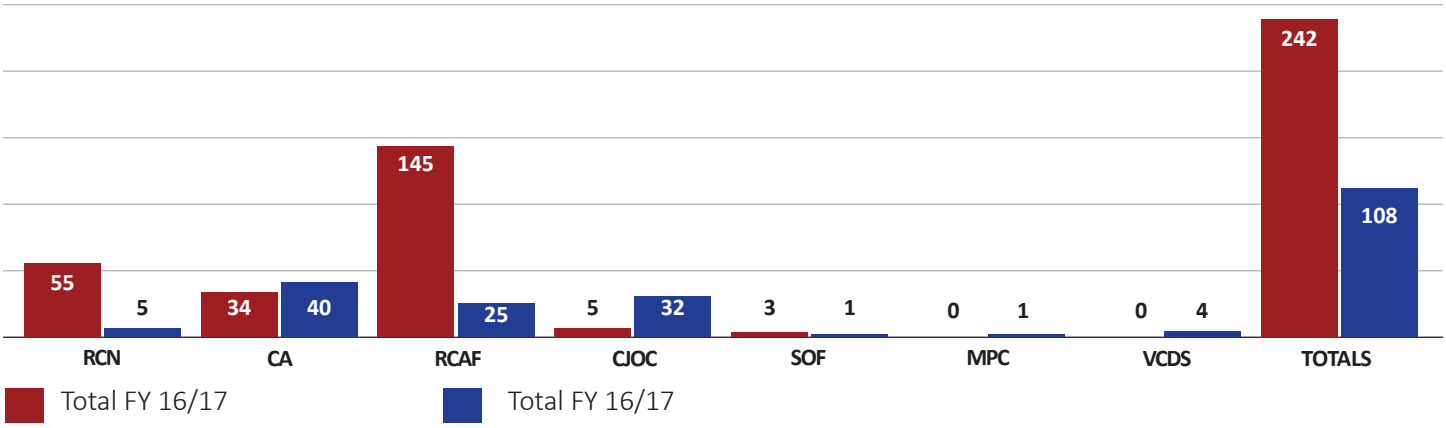


Figure 9– Occurrence Reporting: FY 2017/2018 vs FY 2016/2017

- Reporting timeliness. It is DND and the CAF policy that all occurrences be investigated in a timely manner to determine causes and make recommendations to prevent recurrences. All A&E-related incidents and accidents must be reported within 12 hours of occurrence, with detailed reports provided to higher headquarters within seven days. Information gleaned from AESIMS revealed that only 10 percent of the occurrences were reported within the 12-hour period and 28 percent of the cases had a completed detailed report within seven days (figure 10). Considering that the majority of the cases were minor incidents, the average number of days for each step in the production of the reports received from the event to its conclusion was extremely protracted (figure 11). Consideration is being given to extend the reporting timeline from seven to 30 days to allow for a thorough investigation and to mirror the timeline of similar safety programs within the department. Nonetheless, timely reporting and dissemination of investigation findings form the center of gravity of the DND and the CAF AESP and are critical to preventing similar occurrences with the potential of resulting in more severe consequences. Without the timely dissemination of accurate information, CAF members and DND employees are exposed to an increased safety risk. As a means to raise awareness over organizational occurrence reporting performance, DAER will be tracking and reporting on departmental progress on the use of AESIMS as the system of record during FY 2018/2019.

Despite the overall decrease in occurrence reporting, CJOC is to be commended for its effort and net increase in reporting since the implementation of AESIMS.

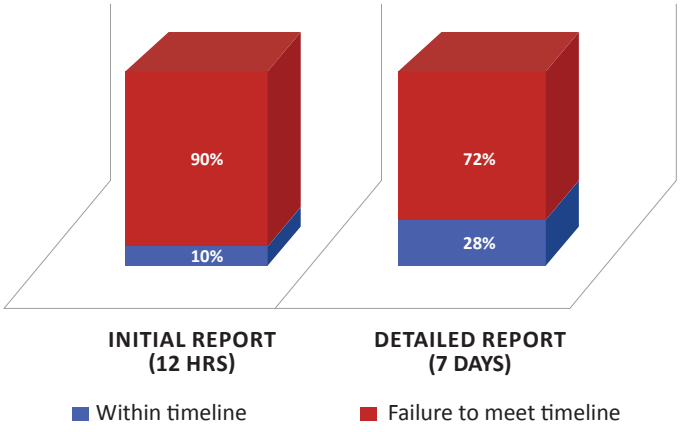


Figure 10 – AESIMS Reports Completion Timelines

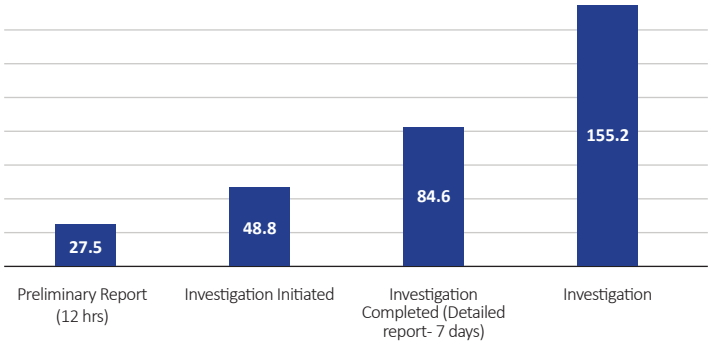


Figure 11 – Average Days from Occurrences to Closure

OCCURRENCE ANALYSIS

A cause factor is defined as the presence or absence of an action, condition or circumstance that leads to an A&E occurrence. The process of identifying the reasons for an occurrence allows for the implementation of preventive measures that will lead to a safer A&E environment. Cause factors associated with FY 2017/2018 occurrences have been grouped under four categories: personnel, materiel,

environmental and undetermined. As depicted in figure 10, cause category attribution for the reporting year shows 78 percent of all reported A&E occurrences were related to personnel, more specifically: carelessness, poor judgement, errors in drill, and deliberate deviations. While this is in line with other safety programs across the department and internationally, it remains concerning when recognizing the current lapse in overall reporting within the department. The high percentage associated with human error emphasizes the importance of increasing A&E safety awareness throughout DND and the CAF by strengthening the department's A&E safety program.

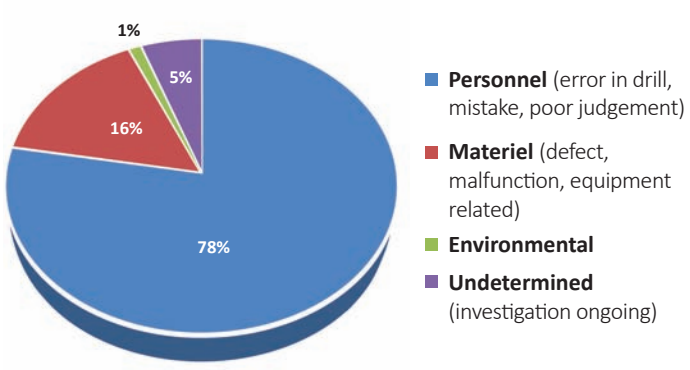


Figure 12– 2017/2018 Cause Factors

Notwithstanding the very low levels of reporting, an analysis of occurrences has led to the following main observations:

- Deaths, injuries, near misses. There were no deaths reported through the AESP during the reporting period. There were, however, 14 injuries resulting from nine separate occurrences: 13 injuries to CAF members and one to a DND civilian employee. Despite these relatively small values, an analysis of recorded near misses that could have led to catastrophic consequences is alarming and warrants engagement at the highest levels;
- Common User natures. A recurring observation, common user natures such as small arms ammunition and pyrotechnics were involved in the majority of occurrences. While it is difficult to attribute the cause to a lack of training or complacency, an increase in supervision and additional emphasis on safety awareness during training remain important mitigating factors; and
- Infrastructure. While the majority of reported occurrences were directly linked to the in-service use of A&E, it is encouraging to note that there were A&E infrastructure-related observations reported through AESIMS. This provides ADM(IE), as the department's custodian, an opportunity to gain insight into A&E infrastructure safety concerns and identify potential mitigating measures.

AESIMS TRAINING

While the rollout of the AESIMS training curriculum was accomplished under less than ideal circumstances, training was made available in advance of AESIMS R1 implementation. Mandatory AESIMS training remains available on the Defence Learning Network in support of the requirement for unit explosives safety officers and unit ammunition representatives to be qualified by 1 April 2018.

Some improvements in reporting is expected for FY 2018/2019 as organizations become more familiar with AESIMS and its reporting capabilities. Nonetheless, there remains a requirement for a dedicated and sustained effort in growing the A&E reporting culture within the department. L1 ATAs will need to play an even more pivotal role as they continue to review reports for their respective L1 advisors or Commanders.

COMMUNICATIONS

AESIMS provides the added capability of communicating using a bulletin board approach. Consequently, DAER will be able to reach out to the A&E community on an as-required basis to communicate important safety messages or provide feedback on reporting trends.

In an effort to build an A&E safety outreach program, DAER staff accompanied the Director Flight Safety (DFS) during one of his Flight Safety briefings in December 2017. DAER hopes to build upon the knowledge and experience gained and apply DFS best practices towards the A&E safety briefings it plans to start delivering to wings and bases in FY 2018/2019.

While DAER had planned to establish a communications strategy during the reporting period, this milestone was not achieved and has been set for the upcoming reporting period.

CONCLUSION

While the implementation of AESIMS has given DND and the CAF the necessary tools and training to recognize the strengths and weaknesses of the AESP, it is currently not being consistently and effectively used by L1 organizations and Commands. Only through accurate and timely reporting, can L1 advisors and Commanders alike expect to gain a better real-time appreciation of A&E safety risks, initiate appropriate mitigating measures and work towards ensuring the safety of their members, employees and equipment. While a capability exists within DAER to analyze reports within AESIMS, its effectiveness is undermined by the poor quality of the belated reports recorded.

REPORT CONCLUSION

Progress has been observed on many issues while the Director Ammunition and Explosives Regulation continues to expand regulatory oversight to address all elements of the Ammunition Program. The execution of and associated results for level one advisor or Commander self-assessed ammunition and explosives safety inspections under element 4 can be characterized as healthy. On the other hand, repeat strategic observations as observed by the Director Ammunition and Explosives Regulation are concerning and will require increased attention throughout the next reporting year.

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. The Director Ammunition and Explosives Regulation will eventually expand the regulatory program and work with Strategic Joint Staff, Military Personnel Command and the Assistant Deputy Minister (Human Resources – Civilian) towards defining metrics to assess safety within the context of element 6 (Ammunition and Explosives Practitioner and Professionalization).

The implementation of the Ammunition and Explosives Safety Information Management System, a tool designed to strengthen the regulatory safety framework and decrease safety risks to personnel, employees and, where applicable, the civilian population, has given the Department of National Defence and the Canadian Armed Forces the necessary tool to record ammunition and explosives incidents and accidents. Notwithstanding, the unit- and command-level implementation of the Ammunition and Explosives Safety Information Management System has been challenging.

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. The Department of National Defence and Canadian Armed Forces' lapse in effective and timely reporting of ammunition and explosives safety occurrences are causes for concern and adversely impact the Ammunition and Explosives Safety Program, and risk placing members and employees in harm's way. Recognizing that challenges in implementation of a new system are to be expected, the underlying weak ammunition and explosives safety reporting culture within the department is cause for concern. A healthier reporting and safety culture can be achieved through increased communications, increased awareness and continued collaboration.

Maritime Tactical Operations Group Tiger Team and Royal Canadian Navy Ship's Boarding Party members conduct pistol training on the flight deck of Her Majesty's Canadian Ship St. John's during Operation REASSURANCE, off the Norwegian coast.

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RESOURCES

Ammunition & Explosives Orders and Directives and related publications
http://materiel.mil.ca/en/joint-common-ammo-explosives/policies-directives.page

NATO Munitions Safety Information Analysis Centre (MSIAC) Tools and Resources
http://www.msiac.nato.int/

The Defence Terminology Bank (DTB) Definitive A&E related definitions
http://terminology.mil.ca/index-eng.asp

NATO Standardization Document Database (NSDD)
http://nso.nato.int/nso/nsdd/listpromulg.html

Allied Logistics Publication (ALP) 16 – Explosives Safety and Munitions Risk Management (ESMRM) in NATO Planning, Training and Operations
http://nso.nato.int/nso/nsdd/APdetails.html?APNo=1592

NATO Allied Ammunition Storage and Transportation Publication 1 (AASTP-1) – NATO Guidelines for the Storage of Military Ammunition and Explosives
http://nso.nato.int/nso/nsdd/apdetails.html?APNo=1981

Landing page for information related to ammunition and explosives (A&E)
http://materiel.mil.ca/en/joint-common-ammo-explosives/index.page

Various analysis products related to A&E
http://materiel.mil.ca/en/joint-common-ammo-explosives/analysis.page

Articles related to explosives safety
http://materiel.mil.ca/en/joint-common-ammo-explosives/articles.page

Briefings and presentations
http://materiel.mil.ca/en/joint-common-ammo-explosives/briefings-presentations.page

DVDs related to explosives safety
http://materiel.mil.ca/en/joint-common-ammo-explosives/dvds.page

Explosives safety posters
http://materiel.mil.ca/en/joint-common-ammo-explosives/posters.page

Licences and Waivers
http://materiel.mil.ca/en/joint-common-ammo-explosives/licences-waivers.page

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