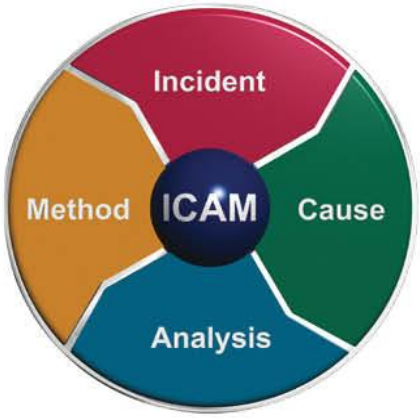
INCIDENT INVESTIGATION REPORT

UNCONTROLLED RELEASE OF NITROGEN DURING AIRCRAFT MAINTENANCE

Prepared by
Safety Wise Solutions Pty Ltd

SWS 14 Ver 2 (Final) 30 November 2017



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1.0 Investigation Team

Name	Position	Company
[Name]	ICAM Lead Facilitator (independent)	Safety Wise Solutions
[Name]	Mechanical Aircraft Maintenance Engineer	Aussiecorp Pty. Ltd.
[Name]	Health and Safety Advisor	Aussiecorp Pty. Ltd.

2.0 Incident Description

2.1 Incident

Brief Description: During maintenance activities being performed on a Bell 412 helicopter, registration VH-BBB, in the hangar at Middleton Airport, Victoria, an Aircraft Maintenance Engineer inadvertently initiated an uncontrolled release of nitrogen into the atmosphere. The force, created by the sudden release of nitrogen, resulted in significant injuries to the Aircraft Maintenance Engineer and damage to the aircraft.	
Location: Middleton Airport, Victoria	**Area:** Aircraft Hangar
Incident Date: Thursday, 16 November 2017	**Time:** 1555 hrs (approx.)
Reported Date: Thursday, 16 November 2017	**Time:** 1615 hrs (approx.)
Aussiecorp Pty. Ltd. Reference - Incident Number: 012	
Incident Type: Injury - uncontrolled release of gas.	

Details of Entities Involved

Contractor: Aussiecorp Pty. Ltd. - provision of aircraft maintenance services.

Details of Person/s Involved and Injuries Sustained

Employer: Auussiecorp Pty. Ltd.	
Name: [Name]	**Role:** Avionics Aircraft Maintenance Engineer (AME#1)
Injuries: Nil	
Name: [Name]	**Role:** Mechanical Aircraft Maintenance Engineer (AME#2)
Injuries: Serious injuries to abdomen, groin & upper leg area requiring hospitalisation.	
Name: [Name]	**Role:** Avionics Aircraft Maintenance Engineer (AME#3)
Injuries: Minor bruising to lower legs.	

Details of Equipment and Damage

Equipment:	Bell 412 Helicopter, registration VH-BBB
Owner of Equipment:	ACME Helicopters Pty Ltd
Damage to Equipment:	Damage to the left side of the aircraft structure and components in the nose section of the aircraft and in the vicinity of the emergency floatation system nitrogen cylinder.

Environmental Impact:

Nil

Risk Rating

Actual Consequence Level:	Moderate (moderate irreversible disability or impairment)
Potential Consequence Level:	Extreme (multiple fatalities and/or severe irreversible disability or impairment to one or more directly involved persons)

The risk rating was assessed using the Australian Standard AS/NZS ISO 31000:2009 and based upon Aussiecorp Pty. Ltd. Risk Matrix Classifications from Procedure “Risk Management” Doc. No. AV-HS-PRO-01.

2.2 Events Leading up to the Incident

a) During the month of October 2017, and the time leading up to the incident on 16 November 2017, there was a high volume of maintenance activity being conducted in the Aussiecorp Pty. Ltd. **(Aussiecorp)** aircraft hangar. These activities included maintenance and specialised modifications to a Bell 205 helicopter, registration VH-AAA, which was being prepared for firefighting activities, and two Bell 412 helicopters, registration VH-LLL and VH-BBB, being prepared for a start-up contract in the Pacific Islands.

The Bell 412 helicopters were to undergo scheduled maintenance inspections, rectification, modification and installation of specialised role equipment for the upcoming assignments.

This maintenance work was contracted to Aussiecorp. For Aussiecorp to complete this high volume of work, and in the allotted time required of the contract, they engaged the services of a labour hire company, Avionics 2000, to supplement their work team with contract labour on an ‘as required’ basis.

b) On Thursday, 16 November 2017 (the day of the incident), both Bell 412 helicopters were scheduled for maintenance.

c) That same day, at 0700 hrs, the Chief Engineer commenced the morning pre-start meeting. During the meeting he assigned duties, to carry out the maintenance for that day, to the relevant maintenance personnel, which included the Aussiecorp and Avionics 2000 Aircraft Maintenance Engineers.

d) The Bell 412 helicopter, registration VH-BBB, was having specialised avionics equipment installed in the nose section of the aircraft, in addition to the scheduled maintenance, which required Avionics Aircraft Maintenance Engineers from Aussiecorp to carry out this work.

e) At approximately 1400 hrs, on Thursday 16 November 2017, while performing this work on helicopter VH-BBB, an Aussiecorp Avionics Aircraft Maintenance Engineer **(AME#1)** informed the Aussiecorp Chief Engineer **(Chief Engineer)** that the emergency floatation system nitrogen cylinder **(cylinder)** would have to be removed from the aircraft to gain access to the intended work area. Refer to Figure 1 and 2 showing the location of the cylinder in the nose section of the aircraft.

f) This work, to remove the cylinder, had not been previously identified nor planned as part of the day's maintenance activities.

g) The Chief Engineer instructed AME#1 to obtain the assistance of the Mechanical Aircraft Maintenance Engineer **(AME#2)**, who was working on helicopter VH-LLL in the adjacent work bay, to remove the cylinder.

h) AME#1 requested the assistance of AME#2, and AME#2 immediately stopped his work and went to his newly allocated job on helicopter VH-BBB. With the assistance of AME#1, he commenced the process to prepare for the removal of the cylinder from the nose section of helicopter VH-BBB.

i) AME#1 removed an electrical box and then disconnected the electrical connector from the cylinder initiating squib. The cylinder restraining straps were released by AME#2 and the stainless-steel discharge pipe was disconnected at the manifold end. The connection at the cylinder was partially loosened, and the discharge pipe was rotated in line with the cylinder, and at 90 degrees to its initial position, to facilitate removal. Refer to Figure 3 showing the cylinder and discharge pipe.

j) AME#1 then noticed a warning placard and informed AME#2 about the placard (refer to Figure 4) which stated; "release air pressure before servicing." After a discussion between AME#1 and AME#2 about this warning instruction, they both agreed to seek guidance from the Chief Engineer.

k) AME#2 approached the Chief Engineer to inform him of the instructions on the placard and sought his guidance on a method for discharging the nitrogen from the cylinder. The Chief Engineer agreed that the nitrogen should be discharged prior to removal of the cylinder; however, he did not provide any guidance on the method of discharge, or where the Original Equipment Manufacturer **(OEM)** Manual or other relevant instructions for this process could be found or accessed.

l) AME#2 returned to the task on helicopter VH-BBB and prepared to discharge the cylinder. He was still uncertain on a safe method of discharge; so, he went and requested further advice from the Chief Engineer. AME#2 asked the Chief Engineer, who was busy with workers from Avionics 2000 who were working on the other helicopter at this time, if he should manually discharge the cylinder. The Chief Engineer did not hesitate to respond with; "discharge the nitrogen manually from the cylinder." No specific guidance or instruction was given by the Chief Engineer on a method to manually discharge the cylinder. The Chief Engineer remained working with the Avionics Aircraft Maintenance Engineers from Avionics 2000.

m) AME#2 returned to the task on helicopter VH-BBB and prepared to manually discharge the cylinder.

n) Whilst preparing for the manual discharge of the cylinder, another Aussiecorp Avionics Aircraft Maintenance Engineer **(AME#3),** whilst on his break, approached both AME#1 and AME#2 and engaged in conversation.

o) AME#2 mentioned, during the conversation, his reluctance to manually discharge the cylinder as he had never done this before and was not completely confident of the method to perform this task. AME#3 was also unsure about the method to manually discharge the cylinder.

p) AME#2 requested other maintenance personnel, who were also working on helicopter VH-BBB, to vacate the area around the nose section and to remain clear.

q) AME#1, AME#2 and AME#3 donned their hearing protection while AME#2 prepared to discharge the cylinder by removing the cylinder safety discharge pin.

2.3 Incident Description

a) At approximately 1555 hrs, AME#2 began to manually discharge the cylinder. A sudden release of pressure occurred initiating an uncontrolled release of the approximate 3500 psi contents of nitrogen from the cylinder. The force created, by this sudden release of pressure, bent the discharge pipe and dislodged it from its fitting. This force also pushed AME#2 approximately two meters away; upon which he made impact with the hangar floor and collided into the legs of AME#3.

b) AME#2 suffered serious injuries to his abdomen, groin & upper leg area, while AME#3 sustained only minor bruising to his legs.

2.4 Events Post Incident

a) AME#1 immediately gave assistance to the injured persons while another worker in the hangar, who heard the event, called Emergency Services.

b) The Chief Engineer contacted the Aussiecorp General Manager and advised him of the incident.

c) At approximately 1625 hrs, Emergency Services arrived and both AME#2 and AME#3 were transported to hospital.

d) At approximately 1715 hrs, the Aussiecorp General Manager advised WorkSafe Victoria of the incident by telephone.

e) At 1825 hrs, WorkSafe Victoria attended the incident scene.

f) A Non-disturbance Notice was issued by the attending Inspector which was valid for 24 hours.

g) On 19 November 2009, an entry report and four Improvement Notices were issued to the General Manager of Aussiecorp.

Note: The nature of the Improvement Notices and Aussiecorp's response do not form part of this report.

2.5 Photographs

Fig. 1: Bell 412 helicopter, registration VH-BBB, showing the position of the cylinder in the nose section of the aircraft.

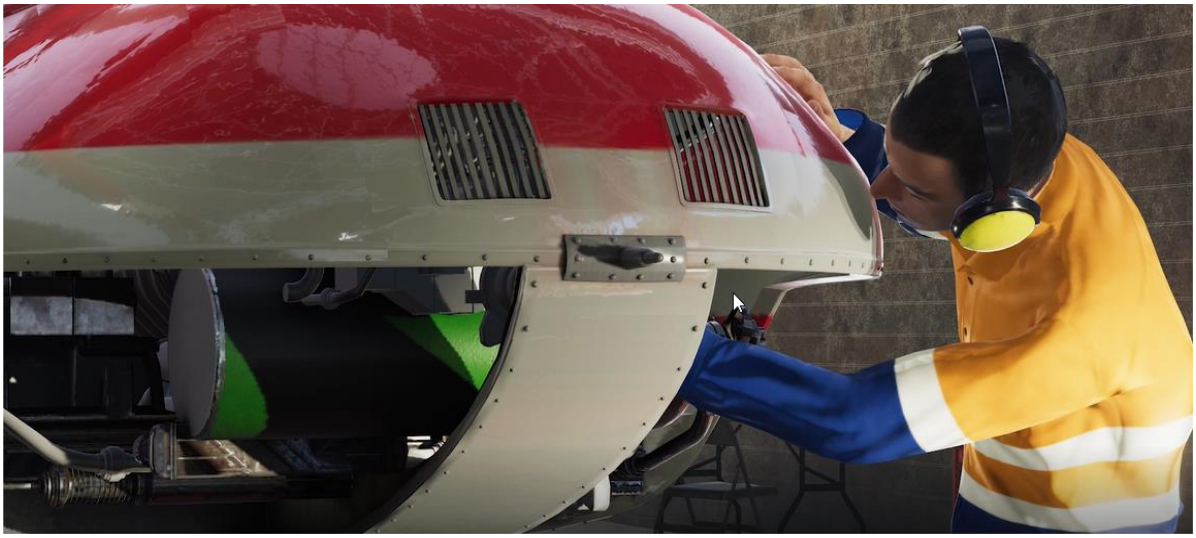


Fig. 2: View showing cylinder in the nose section of the Bell 412 helicopter, registration VH-BBB.

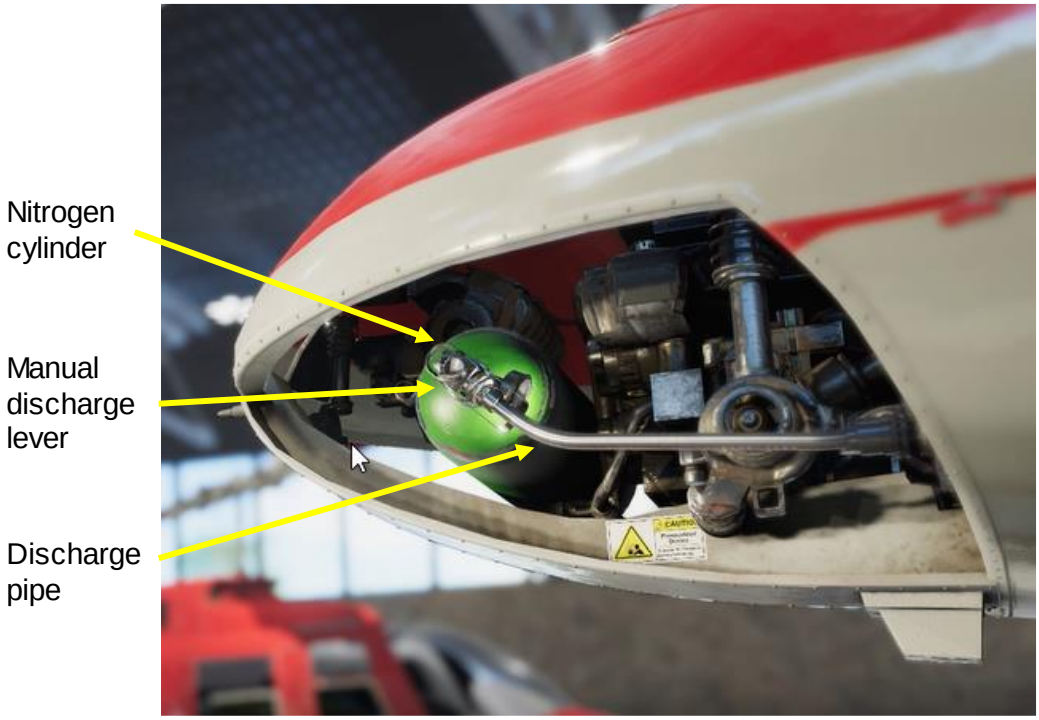


Fig. 3: View showing the cylinder and discharge components in the nose section of the helicopter.

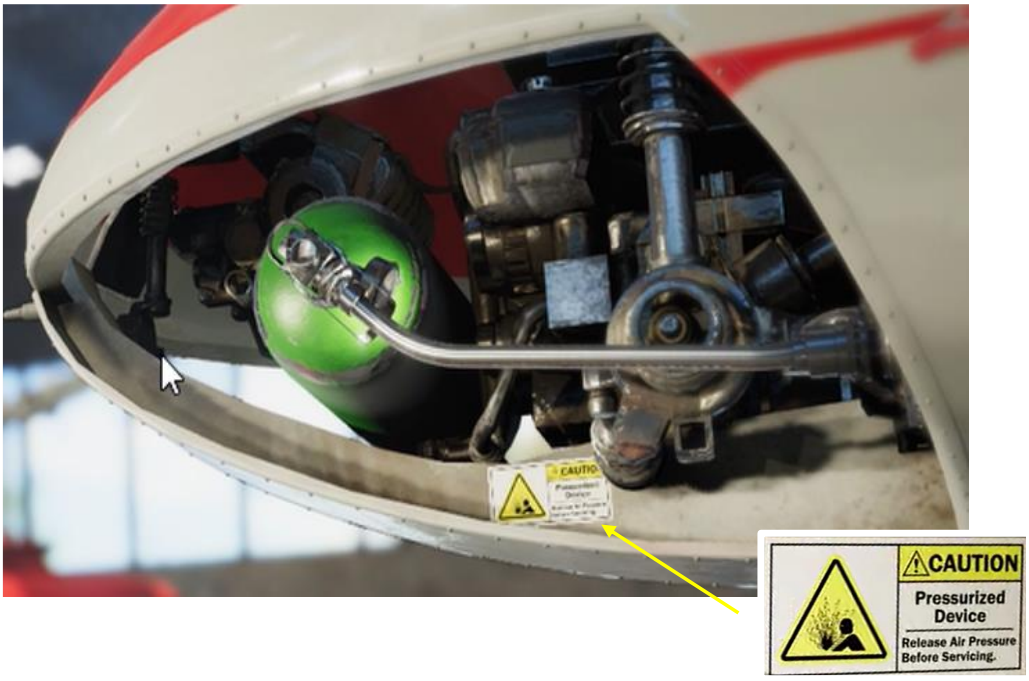


Fig. 4: Placard warning and its location in nose section of the helicopter.

2.6 Time Line

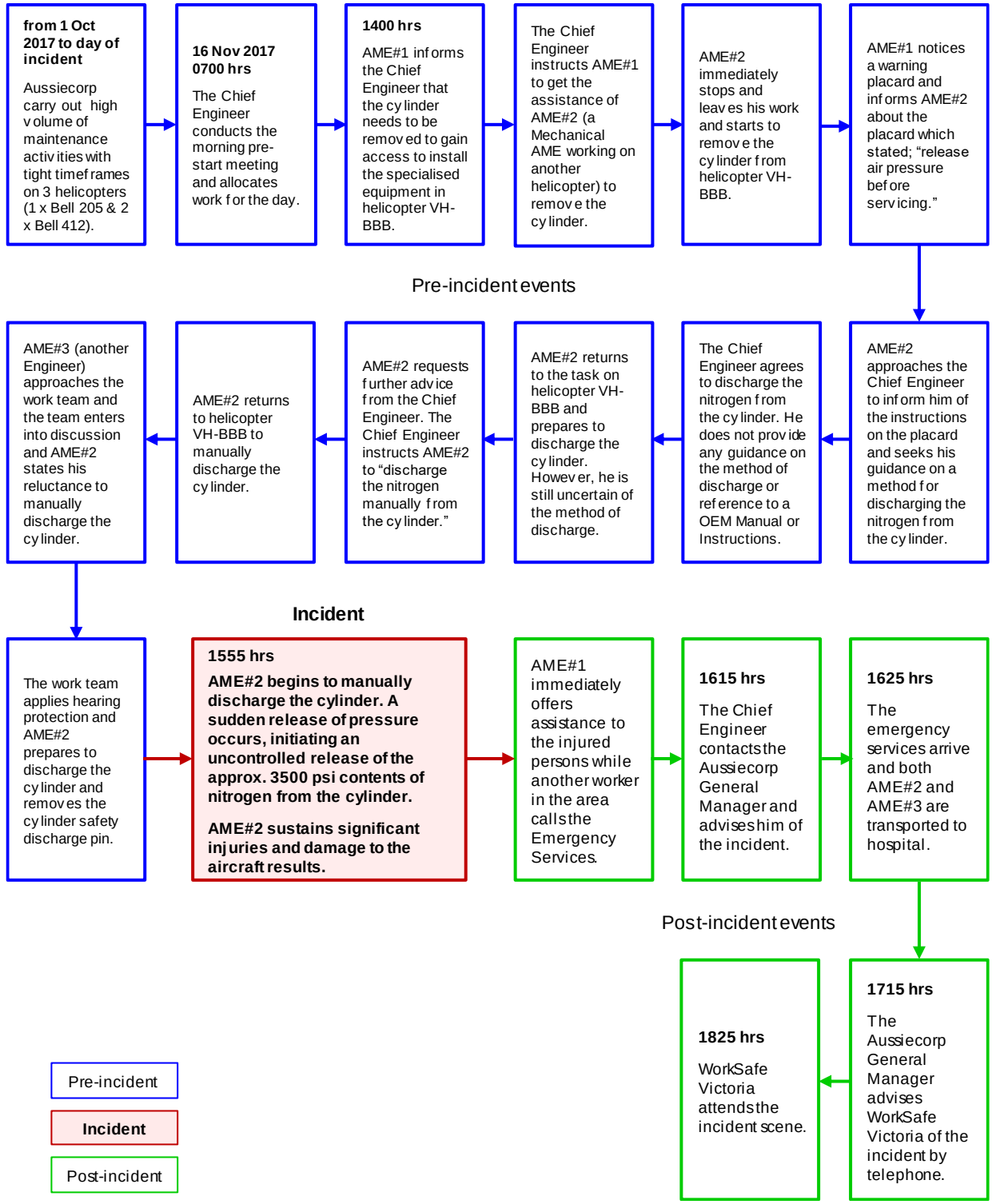


Fig. 5: Time line summary of events

3.0 Data Collection

Data was gathered to identify the relevant facts surrounding the incident using the principles, techniques, and methodology of the ICAM Data Collection process focusing on the five data categories known as the “PEEPO” process. These five data categories are:

- People;
- Environment;
- Equipment;
- Procedures; and
- Organisation

The basis of the data collection is to establish details of the incident and determine the contributing and non-contributing factors to the incident.

3.1 People

The personnel associated with the incident and/or activities and process impacting on the incident occurring on 16 November 2017 were interviewed providing statements and/or were subject to discussions. These personnel are detailed in Table 3.1.

Name	Position	Company
[Name]	Avionics Aircraft Maintenance Engineer (AME#1)	Aussiecorp Pty. Ltd.
[Name]	Mechanical Aircraft Maintenance Engineer (AME#2)	Aussiecorp Pty. Ltd.
[Name]	Avionics Aircraft Maintenance Engineer (AME#3)	Aussiecorp Pty. Ltd.
[Name]	Chief Engineer	Aussiecorp Pty. Ltd.
[Name]	Safety Advisor	Aussiecorp Pty. Ltd.
[Name]	Mechanical Aircraft Maintenance Engineer	Aussiecorp Pty. Ltd.

Table 3.1 - Personnel interviewed and/or subject to discussions

Supervision and Work Instructions

- On the day of the incident and at the morning pre-start meeting, commencing at 0700hrs, the Chief Engineer assigned duties to carry out the maintenance for that day. These duties were assigned to the relevant maintenance personnel from Aussiecorp and the labour hire company, Avionics 2000, who provide additional labour on an ‘as required’ basis. All persons involved in the incident attended the morning pre-start meeting.
- Additional labour resources were required because of the high workload, involving scheduled maintenance activities and specialised modifications, to be carried out on the Bell 205

helicopter, registration VH-AAA, which was being prepared for firefighting activities, and two Bell 412 helicopters, registration VH-LLL and VH-BBB, being prepared for a start-up contract in the Pacific Islands.

- Leading up to, and at the time of the incident, the Chief Engineer was focused on the work being carried out, on the Bell 205 helicopter, by the Avionics Aircraft Maintenance Engineers from Avionics 2000. The Chief Engineer elected to prioritise his time by providing direct supervision with the recently engaged labour hire Aircraft Maintenance Engineers from Avionics 2000 because they were less familiar with the activities and aircraft as opposed to the Aussiecorp maintenance engineers.
- The Aircraft Maintenance Engineers, AME#1 and AME#2, were assigned specific tasks at the commencement of the day to install specialised equipment in the nose section of the aircraft. Later, during the day, their tasks changed to include the removal of a nitrogen cylinder because the access to the work area in the nose section of the aircraft, to install the specialised equipment, was obstructed. To gain clear and unrestricted access to the work area, the nitrogen cylinder which was obstructing their access required to be discharged and removed. This work was unplanned.
- Minimal instructions were given for this task by the Chief Engineer and both AME#2 and AME#1 relied upon the general and limited instructions on the placard located in the nose section of the aircraft. No OEM Manual or other specific instructions were sourced for confirmation of the method to manually discharge the cylinder safely.
- No risk assessment was completed prior to the start of this newly allocated work, as well as no specific procedure followed, to perform the task. Reliance was upon the workers limited knowledge and experience on this type of work.
- The hazard that could have resulted in a fatal consequence was undetected by the members of the work team and the Chief Engineer prior to the incident and, subsequently, was not adequately controlled within the scope of work.

Training and Experience

The Mechanical Aircraft Maintenance Engineer (AME#2) is:

- engaged by Aussiecorp and been employed in his current position for two years;
- trained and competent in general aircraft maintenance; however, he is not familiar with the Bell 412 helicopter, as this is his first time working on this type of aircraft;
- inducted into Aussiecorp and completed his induction on 11 December 2015; and
- not formally trained in the Aussiecorp risk assessment process using the Job Safety Environmental Analysis **(JSEA)** and Take 5.

The Avionics Aircraft Maintenance Engineer (AME#1) is:

- engaged by Aussiecorp and been employed in his current position for five years;
- inducted into Aussiecorp and completed his induction on 11 June 2013;

- trained and competent in general avionics aircraft maintenance and he has previous experience with work on Bell 412 helicopters; and
- trained, during his induction, in the Aussiecorp risk assessment process using the JSEA and Take 5.

The Chief Engineer is:

- engaged by Aussiecorp and he has been in his current role for six months. He has over ten years of experience in aircraft maintenance including helicopters; and
- responsible for the maintenance work being conducted in the hangar and has roving responsibilities for several tasks and work teams in the hangar.

Other Factors

- No fatigue or other fitness for duty issues were identified of those persons directly involved.
- The Chief Engineer allowed the maintenance work team to work on the 412 helicopter, registration VH-BBB, without direct supervision.
- All members of the work team were wearing hearing protection at the time of the incident.
- AME#2 carried out the task of discharging the cylinder under his self-imposed time pressure to complete the task, as he assumed AME#1 was requiring this work done urgently so he could carry on with his assigned tasks.

Conclusions

- There was ineffective and inadequate supervision with respect to the practical application of the work being undertaken because of no documented process, together with limited instruction and lack of adequate control measures provided by the Chief Engineer. There was poor coordination of work that involved unplanned work, which did not account for safely conducting a manual discharge of nitrogen from the cylinder.
- Competing tasks for the Chief Engineer was evident with his focus being the provision of direct supervision for the labour hire maintenance personnel.
- No OEM Manual or other specific procedures were available. These could not be located or accessed to assist the workers in applying correct work methods.
- AME#2 was unfamiliar with this work, to discharge and remove the cylinder, as it was his first time working on a Bell 412 helicopter.

3.2 Environment

The conditions in the hangar and in the vicinity of the Bell 412 helicopter, and on the day of the incident, are summarised as follows:

- Good lighting in the hangar.
- The emergency floatation system nitrogen cylinder was in a location in the nose section of the helicopter obstructing the work area for the installation of specialised role equipment. This cylinder had to be removed for the installation of the equipment to occur.

- The warning placard, in the nose of the helicopter, was in a position which was not prominent; being away from the cylinder when working around the cylinder. Refer to Figure 4 detailing the placard and its location.
- Time pressure was identified as a perceived pressure incurred by AME#2 to complete the task of discharging the cylinder. This perceived pressure was influenced by the overall working conditions, in the hangar, of the high volume of work and tight timeframes to complete the helicopter maintenance.
- During the manual discharge of nitrogen from the cylinder, AME#2 was in the direct line of the high-pressure uncontrolled release of nitrogen.

Conclusions

The environmental issues were:

- the limited work area in the nose section of the helicopter required the removal of the emergency floatation system nitrogen cylinder before work to install specialised equipment could commence;
- the perceived pressure maintenance personnel were under due to the high volume of maintenance work to be completed in a tight timeframe; and
- the unsafe location and proximity to the cylinder of AME#2 while manually discharging the nitrogen.

3.3 Equipment

The equipment at the time of the incident included:

- Bell 412 helicopter, registration VH-BBB:
  - No OEM Manual or other instructions were available to the work team.
  - The emergency floatation system nitrogen cylinder is located in the nose section of the helicopter.
  - The placard stating “Pressurised device. Release air pressure before servicing” is located in the nose section of the helicopter; however, is not in a prominent position and was initially missed by AME#2.
- PPE:
  - Hearing protection.

Conclusions

- Aussiecorp did not have, or have access to, an OEM Manual or instructions to detail the safe method to manually discharge the nitrogen from the cylinder.
- The location of the cylinder warning placard in the nose section of the helicopter, and having limited information, was ineffective in providing adequate instructions and warning of the hazard.

3.4 Procedures

Aussiecorp processes and procedures were reviewed to establish any aspects that may have contributed to the incident. The following information was obtained:

- The morning Pre-start Meeting, conducted on the 16 November 2017 by the Chief Engineer for Aussiecorp, focused primarily of the allocation of duties for the maintenance tasks to be carried out for that day. Avionics Aircraft Maintenance Engineers from the labour hire company, Avionics 2000, also attended this meeting.
- Aussiecorp use the risk assessment tools, JSEA and Take 5, to identify hazards and assess the associated risks. However, following discussions with several Aussiecorp personnel, it is common within Aussiecorp that a risk assessment is not always completed prior to undertaking scheduled maintenance. No formal documented risk assessment was carried out for the unplanned work to remove the cylinder and manually discharge the nitrogen from the cylinder.
- No OEM Manual or other documented procedure was located, accessed, or used prior to discharging the nitrogen from the cylinder. The only instructions were taken from the warning placard in the nose section of the helicopter and the limited instruction from the Chief Engineer.
- The Aussiecorp Safety Management Plan, Doc. No. HS-SMP-001, was reviewed specific to responsibilities, application of risk management and applicable procedures, and training requirements for maintenance on aircraft. There is a disconnect from this document and the application of maintenance activities specific to:
  - responsibilities and application to perform risk assessments;
  - the absence of procedures in the hangar for personnel to access and follow; and
  - ineffective process and/or the absence of application for the verification of competency of personnel to perform certain tasks.

Conclusions

The documentation register and hierarchy, as detailed in the Safety Management Plan, is deficient and incomplete for the standard required to complete a task safely and efficiently within the maintenance activities performed. There exists a lack of knowledge, within the work teams, about the documentation available and its application.

There is no Aussiecorp standard operating procedure for manually discharging the nitrogen cylinder, as well as other maintenance instructions required on the helicopter emergency floatation system.

There is inadequate operational discipline in following and applying the formal documented processes such as completing a risk assessment and application of, although limited, procedures.

3.5 Organisation

Aussiecorp systems and processes impacting on the task being carried out at the time of the incident included:

Procedures

- There is no OEM Manual and very limited procedures and/or instructions in the Aussiecorp document register for the Bell 412 helicopter.
- Procedures and work instructions are not always utilised, and it is common practice for maintenance personnel to rely on previous knowledge and experience to carry out their tasks.

Risk Management

- Where different tasks were initiated and/or assigned throughout the day, no risk assessment/s were carried out to identify potential hazards for the new scope of work. Management of change processes applied for the scope of work were ineffective with hazards and risks not being identified and/or not addressed.
- From reviewing past practices, it was found to be common practice to not always complete a Take 5 or JSEA prior to commencing a task.

Training and Communication

- Training on the use of risk assessments for a task is provided in the induction and the induction was completed by those personnel involved in the incident. The risk management training within the induction is very limited and general without any verification of competency. There is no indication of follow up on site to determine conformance to process. There is a diminished operational discipline to following and applying this process.
- Communication is generally via morning pre-start Meetings covering work activities for the day.

Roles and Responsibilities

- There is inadequate application of responsibilities with respect to work planning, supervision, work instruction, communication, and application to process.
- There is ineffective work planning and coordination between the Chief Engineer and Aircraft Maintenance Engineers.
- There exist multiple work activities being performed simultaneously, and workers are regularly being re-assigned to other tasks before the task they are working on is completed. This is evident with AME#2 taken from his unfinished work on one helicopter to remove the cylinder from another helicopter.
- There exists an organisational tolerance which allows non-conforming practices, to that of documented process, to go unaddressed. This is evident by (i) inaction to address issues identified where risk assessments, such as the JSEA and Take 5, are not always completed; and (ii) inconsistent application of OEM instructions and Aussiecorp procedures.

Maintenance Capability

The work plan adopted by Aussiecorp to address the requirements of the maintenance contract, and complete the work in the agreed timeframe, was ambitious. The Aussiecorp contingency, if time became a pressing issue, was to engage additional labour from the labour hire company, Avionics 2000, on an ‘as required’ basis.

This work plan put additional pressure on the Chief Engineer and, at times, other aircraft maintenance engineers to complete the work.

Conclusions

The planning and application of the work where the incident occurred, demonstrated ineffective working arrangements between the work group due to:

- ineffective supervision through inadequate lines of communication between the Chief Engineer and Aircraft Maintenance Engineers with re-assigning of work, limited instruction for the unfamiliar task of manually discharging the cylinder and no follow up on the work;
- work was allowed to proceed without accessing the OEM instructions and completing a risk assessment that should have identified the hazards and addressed the associated risks; and
- unnecessary pressure placed on supervisory requirements to meet unrealistic timeframes.

While the investigation did identify that errors were committed by directly involved persons carrying out their work; they are considered “system induced errors” whereby they were assigned the duties without adequate instruction and supervision. This investigation found that there exists a tolerance across the maintenance activities, allowing non-conformance to procedures to become repeated behaviours.

The organisation has systems and processes in place; however, the application of process is inadequate and ineffective. This is supported by:

- inadequate documentation to safely and efficiently carry out maintenance activities on the Bell 412 helicopters;
- inadequate supervision tolerating non-compliance behaviour;
- a largely ad-hoc and informal process used by the workers to carry out the maintenance activities; and
- poor application of work planning, supervision, work instruction, communication, and application to process.

4.0 Key Findings

The key findings outline why the incident occurred and the contributing factors identified from the investigation have been categorised using the Incident Cause Analysis Method **(ICAM)**. The ICAM analysis chart is shown as an Appendix in Section 8.1 of this report.

4.1 Basic Cause

While attempting to manually discharge the nitrogen from the emergency floatation system nitrogen cylinder, a sudden release of pressure occurred initiating an uncontrolled release of the approximate 3500 psi contents of nitrogen from the cylinder. The force created from this uncontrolled release of gas caused injuries to two workers and damage to the aircraft.

This basic cause combining with the following contributing factors led to the incident.

4.2 Contributing Factors

Based on the evidence to hand, the Investigation Team consider the following were the main contributing factors to the incident:

Note: All codes assigned to the contributing factors are detailed in the Safety Wise Solutions Pocket Investigation Guide; pages 70 to 74.

4.2.1 Absent or Failed Defences

- **DF1** Awareness - Hazard identification: No risk assessment (Take 5 or JSEA) was conducted prior to the task being performed, resulting in hazards and hazard mitigation strategies not identified.
- **DF3** Awareness - Competence/knowledge**:** A knowledge gap was present with the safe system of work needed for this task to discharge the nitrogen from the cylinder.
- **DF4** Awareness - Supervision: There was inadequate supervision in place to ensure the relevant work instructions and risk assessment for the task were applied to an acceptable standard.
- **DF5** Awareness - Work instruction/procedures: The Original Equipment Manufacturer's instructions or other specific procedures for this task were unavailable to the work team.
- **DF6** Detection - Visual warning systems: The warning placard was not in a prominent location and provided unclear instructions reducing its effectiveness.
- **DF17** Protection and Containment - Barricading/exclusion zones: The nitrogen cylinder discharge safety pin was not in place.

4.2.2 Individual or Team Actions

- **IT7** - Change management error: Both AME#1 and AME#2 did not complete a risk assessment, either Take 5 nor JSEA, for the new work to discharge the cylinder. (Routine Violation[1])
- **IT10** - Hazard recognition/perception: AME#2 removed the manual discharge safety pin prior to discharge of the cylinder, without understanding the risk that this action posed. (Knowledge Based Mistake[2])
- **IT12** - Work method error or violation: AME#2 initiated an uncontrolled discharge of the high-pressure nitrogen contained in the cylinder. (Knowledge Based Mistake)
- **IT1** - Supervisory error or violation: The Chief Engineer did not provide adequate instruction and allowed the work to commence without a risk assessment being conducted. (Situational Violation[3])

[1] Safety Wise Solutions Pocket Investigation Guide
s05 - Routine violation - habitual corner cutting / implicitly accepted.
[2] Safety Wise Solutions Pocket Investigation Guide
s05 - Knowledge based mistake - poor decisions due to inadequate knowledge or lack of experience
[3] Safety Wise Solutions Pocket Investigation Guide
S05 - Situational violation - time or resource pressures

- **IT6** - Procedural compliance: The work team did not refer to the OEM Manual and applied an undocumented work method to release gas from the nitrogen cylinder. (Organisational Optimising Violation[4])

4.2.3 Task or Environmental Condition

- **TE1** - Task planning/preparation/manning: There was a high workload in the time available for the maintenance activities in the hangar, requiring the engagement of labour hire engineers on an 'as required' basis.
- **TE1** - Task planning/preparation/manning: There were multiple, and parallel, work activities placing high demands on supervision.
- **TE2** - Hazard analysis/job safety analysis/take 5: There was inadequate awareness of hazards associated with the task of discharging the nitrogen from the cylinder.
- **TE3** - Work procedures availability and suitability: The OEM Manual and instructions were not readily accessible and not commonly known to the work teams.
- **HF22** - Passive tolerance of violations: There was no accountability to follow up when Aussiecorp workers did not use the JSEA or Take 5, which had developed into a standard work practice.
- **HF16** - Experience/knowledge/skills for task: The method of discharging and removing the cylinder were ad-hoc with limited instructions from the Chief Engineer and the warning placard being ambiguous and open to mis-interpretation.
- **TE12** - Routine / non-routine task: The task to discharge the nitrogen cylinder was unplanned and unfamiliar to the work team.

4.2.4 Organisational Factors

- **PR** - Procedure: There was no Aussiecorp standard operating procedure, or OEM instructions accessible, for discharging the nitrogen from the cylinder or removal of the cylinder.
- **IG** - Incompatible Goals: There was limited capability for supervisors to supervise work activities and manage risk due to multiple responsibilities covering multiple activities.
- **OR** - Organisation: There was ineffective work planning, co-ordination and lines of communication for the task due to unclear responsibilities and ineffective attention paid to active supervision.
- **TR** - Training: There was no verification of competency for the maintenance personnel to ascertain their knowledge and understanding of the task on the specific aircraft.
- **RM** - Risk Management: There was no risk assessment conducted prior to the allocation of new work; being an unplanned task to discharge and remove the cylinder, resulting in ineffective risk management.

[4] Safety Wise Solutions Pocket Investigation Guide
s05 - Organisational optimising violation - commercial or production goals override safety goals.

- **DE** - Design: The cylinder warning placard information and position was ineffective in providing adequate instructions and warning of the hazard.
- **MC** - Management of Change: There was an ineffective process applied by the maintenance personnel to manage the change in the scope of work for removal of the cylinder.
- **OC** - Organisational Culture: There was management tolerance to 'get the job done' without procedural compliance and/or utilising a robust risk management process prior to carrying out the work.

5.0 Recommendations

The following recommended corrective actions are proposed for consideration. The recommendations address the **Absent or Failed Defences** and **Organisational Factors** identified as key findings of the investigation. These recommendations are applicable to Business Group or site and could benefit other Company group operations.

5.1 Communication via Safety Alert (Administration)

Issue and communicate a Safety Alert (or other suitable communication method) to all personnel, including labour hire personnel, explaining what occurred, the basic cause, and the actions that have been taken, as well as those that are to be taken.

Emphasise the importance of (i) conducting risk assessments (ii) understanding the risks around uncontrolled release of gas and applying the appropriate documented control measures; (iii) having good operational discipline to follow documented process (iv) knowing your responsibilities (e.g. supervision and accountability to follow process); (v) situational awareness and interaction with other work groups; and (vi) a good monitoring and review program across all activities to maintain the integrity of the safe system of work.

5.2 Risk Management and Training (Administration)

Introduce a training program to address deficiencies in the application of the Take 5 and JSEA risk assessments including identification of hazards and associated risks, risk mitigation and application. The focus of this training should include the specific triggers (change, etc) for when a risk assessment should be completed, updated and/or refreshed. Introduce a monitoring or safety observation program to ensure application and quality of the risk assessments is maintained to a high standard.

5.3 Procedures and Training (Administration)

Develop a procedure/s for the installation and removal of the emergency floatation system nitrogen cylinder and include a detailed method, with the appropriate control measures, to manually discharge the cylinder in a safe manner. The procedure must align to the requirements of the OEM Manual and/or instructions.

This information must cascade through the Document Hierarchy where relevant; i.e. Safety Management Plan, Risk Register, Procedures, JSEA, Take 5, and other relevant documents.

Initiate and carry out an implementation program across Aussiecorp for all personnel. Include a training program to verify competency with the application of procedures and ensure any associated documents are readily accessible by employees, labour hire personnel, and contractors.

5.4 Document Register (Administration)

Review and modify the documentation hierarchy and register for recording Aussiecorp documents and other associated documents, such as OEM Manuals and instructions, to ensure all necessary documentation is available and easily assessed by all relevant personnel.

This documentation be managed through a consultation and feedback process to ensure the integrity and currency of documents is maintained.

5.5 Responsibilities (Administration)

Review and modify Supervisor, and Aircraft Maintenance Engineer position descriptions regarding responsibilities and accountabilities, specific to work planning and communication, such as provision of work instructions and ensuring the instructions are understood and applied accordingly, and participation in risk assessments with sign-off.

Ensure responsibilities are clearly defined and provide support with targeted coaching / training in these areas.

5.6 Maintenance Management (Administration)

Review and modify the work plan for the contracted helicopter maintenance activities to include clear, defined and assigned responsibilities and accountabilities to ensure the safe, effective and efficient execution of tasks to complete the scope of work. The capability of Aussiecorp must be recognized and work allocated to maintenance personnel be aligned with that person's knowledge and competence to carry out the work. Additionally, the work team must be provided with adequate resources, such as procedures and instructions, as well as given a realistic time frame to complete the task.

To ensure adherence to the work plan, and the application of a safe system of work to complete tasks, as per requirements of the scope of work and Safety Management Plan, a comprehensive monitoring and review program must be formalised and applied at a defined frequency across the work.

5.7 Warning Placards (Administration)

Consult with the Original Equipment Manufacturer and request modifications to the warning placard in respect to: (i) provision of more detailed and specific instructions; and (ii) increased awareness of the placard by positioning it in a prominent and more visible location closer to the cylinder, to improve the effectiveness of the placard.

5.8 Intervening in Safety

Develop and implement a program which empowers personnel to intervene in safety, by taking "time out" to assess the risk, if they consider the work being undertaken is unsafe, or too high a risk. This program is to be incorporated into the training program covering risk assessment (see recommendation 5.2) and included in role responsibilities (see recommendation 5.5).

5.9 Fair and Just Culture (Administration)

Review and modify fair and just culture behavioural markers to ensure that employees, labour hire personnel, and contractors are fully aware of the safe behavioural requirements of Aussiecorp.

Additionally, all employees, labour hire personnel, and contractors must be fully aware of their responsibilities and accountabilities in their role to meet the organisation's management protocols and standards. These protocols and standards include:

- clearly defined expectations of behaviour
- effective communication of safety related information
- guidance on risk assessment and acceptance
- the right and duty to intervene on unsafe acts and conditions
- personal accountability for safe behaviours
- process to develop, encourage and sustain safe behaviours

6.0 Management Review of the Investigation Report

6.1 Management Review

The management of Business Group, site and Project should formally review the investigation report for completeness, quality of the investigation and to endorse the recommendations with aligned corrective actions. It is recommended that the following action plan is implemented:

6.1.1 Distribution

To maximise the preventative potential of the investigation report, the findings and conclusions of the report should be distributed as widely as practicable internally within Company Business Groups and externally to industry bodies.

6.1.2 Implementation of Corrective Actions

Corrective actions addressing the recommendations shall be formally presented to the Responsible Line Manager for implementation. An action plan and timeframe shall be agreed and endorsed by the appropriate level of management. An action plan is attached in section 8.2 of this report.

6.1.3 Implementation Monitoring

The completion of corrective actions must be documented and communicated by the Responsible Line Manager to the Site Senior Executive, and in turn to the Safety Manager. Where corrective actions have not been fully implemented, ongoing monitoring should be maintained until implementation is complete.

6.1.4 Analyse Effectiveness

The effectiveness of the corrective actions should be evaluated by a review of safety performance and through an audit within the next six months whereby a report will be prepared for management to detail compliance and progress achieved.

6.1.5 Document Archival

Investigative data and reports shall be archived in accordance with site and regulatory requirements.

7.0 Significant Learnings

The investigation has raised several key learnings which are covered in the body of the report. The significant learnings for the Company are:

7.1 Incompatible Goals

The presence of conflicts between production, planning, safety and economic goals can lead to risk taking behaviours.

7.2 Production Pressures

If people are put under production pressures and time constraints, they are likely to ignore and circumvent the rules to achieve unrealistic goals.

7.3 Risk Management

All work must to be subject to hazard assessment and risk control processes, where the risk is assessed as low as reasonably practicable, to ensure safe and effective completion of task.

7.4 Capability of Personnel

Where a person may be qualified to perform certain work, it cannot be assumed they are competent. An organisation must have a robust verification of competency process to ensure competency prior to carrying out that work.

7.5 Responsibilities for Supervision of Work Groups

Direct and visual supervision, with good communication and instruction, effectively combines to ensure conformance to process, quality application and outcome of the task.

8.0 Appendices

8.1 ICAM Analysis

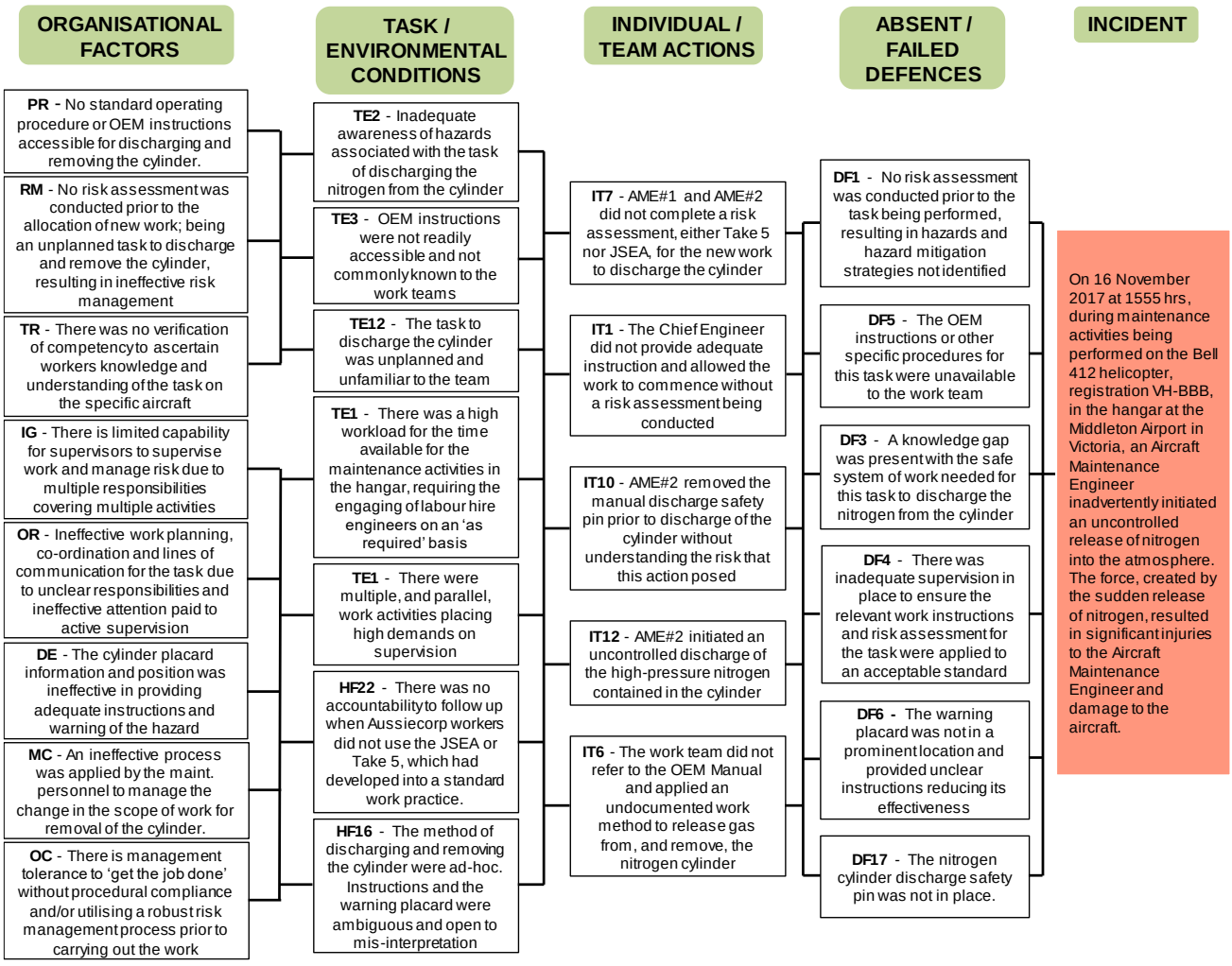
The features of the ICAM chart for the purposes of this Report are:

- It provides a graphical representation of all the key circumstances and factors relating to the incident; and
- It outlines the relationship of the various elements considered throughout this report.

In addition, ICAM is designed to:

- Provide a framework to organise the data collected;
- Assist in assuring the investigation follows a logical path;
- Aid in the resolution of conflicting information and the identification of missing data; and
- Provide a diagrammatical display of the investigative process for management briefing.

Accordingly, this ICAM table should not be considered in isolation and needs to be considered in the context of all the investigation findings and comments in this report.



Note: Refer to Section 4 of this Report for the description of the codes assigned to the contributing factors.

8.2 Corrective Action Plan

To be completed in consultation with Aussiecorp line management and approved by management.

Item Ref	Recommendation	Responsible Department	Responsible Person	Completion Date	Sign off
5.1	Communication via Safety Alert				
5.2	Risk Management and Training				
5.3	Procedures and Training				
5.4	Document Register				
5.5	Responsibilities				
5.6	Maintenance Management				
5.7	Warning Placards				
5.8	Intervening in Safety				
5.9	Fair and Just Culture				
General Manager's Close out of Incident - All corrective actions have been completed, where corrective actions have not been fully implemented, the following measures have been put in place to ensure ongoing monitoring until implementation is complete.					
Name:		Signature:		Date:	

9.0 Report Sign-off

To maximise the preventative potential of the investigation report, the findings and conclusions of the report should be distributed to the various people involved in the incident and as widely as practicable.

The completion of corrective actions must be documented and communicated by the Responsible Line Manager to the Site Senior Executive, and in turn to the Safety Manager. Where corrective actions have not been fully implemented, ongoing monitoring should be maintained until implementation is complete.

Feedback to the Involved Person(s) and comments:		
Name:	Signature:	Date:

Feedback to the Involved Person(s) Supervisor(s) and comments:		
Name:	Signature:	Date:

Department Manager's acceptance of findings and comments:		
Name:	Signature:	Date:

Safety Manager's acceptance of findings and comments:		
Name:	Signature:	Date:

Site Senior Executive's acceptance of findings and comments:		
Name:	Signature:	Date: