Aircraft Accident Site Hazards

AIRCRAFT ACCIDENT INVESTIGATION AUTHORITY
2nd Floor, Manx Corporate Center, #45 West Bay Street, Nassau, N. P., Bahamas

Knowing and Managing Hazards at an Aircraft Accident Site

FORWARD

This manual has been constructed to assist all first responders and accident investigators on the methods to utilize to protect themselves during response to aircraft accidents.

Too often we are overwhelmed by the occurrence of an accident and therefore personal safety measures are not paramount. This manual aims to highlight and inform all first responders as well as accident investigators on the need to consider safety measures that will protect you from injury to yourself as well as to family members.

With the high incidence of air transportation, the chances of injury to one's self increases with such dangers as blood-borne pathogens, dangerous goods and explosive devices among other dangers that are normal components built on new age aircraft and a host of other potentially dangerous situations that are usually present at an accident site.

It is the hope that this manual will open first responders as well as accident investigators' eyes and make them more aware of their surrounding and take precautions to avoid self-injury.

This manual is constructed primarily for first responders, especially those on the family islands. Whatever standard procedures and protocols have been developed for Lynden Pindling Int'l Airport and Freeport International Airport will remain in force and shall be followed.

Any suggestions or comments are welcomed. As this is a training manual it is a living document and will be amended and updated as more information becomes available.

Contents

RECORD OF REVISIONS

- ⇆ Insert and remove pages as indicated on the revision cover letter.
- ⇆ For missing pages, contact the Chief Investigator of Air Accidents.

Rev. No.	Revision Date	Initials	Investigator
1	May 18, 2018	DRM	Delvin Major
2	January 1, 2020	DRM	Delvin Major
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COMMENT REPORT

Please complete this form to transmit your comments, questions, or suggestions concerning this Manual. Attach any reference pages, marking area where changes or questions apply.

Name: _____Position: _____
Dept.:_____
Date Submitted: _____
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Material Unclear
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RECORD OF BULLETINS

- Insert Bulletins in chronological order as directed by the Bulletin.
- For missing Bulletins, contact the Chief Investigator of Air Accidents.

Bulletin	Date Posted	Subject (Remarks)	Date Removed

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1	Rev: 2	Jan. 1, 2020	24	Rev: 2	Jan. 1, 2020
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3	Rev: 2	Jan. 1, 2020	26	Rev: 2	Jan. 1, 2020
4	Rev: 2	Jan. 1, 2020	27	Rev: 2	Jan. 1, 2020
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AIRCRAFT ACCIDENT SITE HAZARDS

CHAPTER 1
INTRODUCTION

1.1 OBJECTIVE;

In accordance with the Aircraft Accident Investigation Authority Act, 2019, Part I, Section 4 –

(1) The sole objective of the investigation of an aircraft accident or incident conducted under this Act shall be the prevention of accidents and incidents.

(2) Investigations by the Authority shall be conducted separate from investigations conducted for the purposes of establishing blame, civil or criminal liability.

(3) Any investigations conducted under the provisions of this Act shall have unrestricted access to all evidential material without delay and shall not be impeded by administrative or judicial investigations or proceedings.

1.1.1 INVESTIGATION COORDINATION

In accordance with the Aircraft Accident Investigation Authority Regulations, 2019, Subpart C, Section 1.140

(a) The Authority shall take all reasonable measures to ensure that the investigation procedures and practices that it follows in relation to aircraft accidents and incidents are compatible to the degree possible with investigation requirements, procedures and practices followed by other departments, regulatory authorities, police forces and coroners.

(b) The Authority shall make all reasonable efforts to enter into agreements to provide for the coordination of activities between the Authority and the entities noted in (a), with respect to—

(1) investigation procedures and practices;

(2) requirements for reporting aircraft accidents and incidents;

(3) procedures to be followed in the event that conflicting interests arise during their activities with respect to aircraft accidents or incidents.

1.1.2 INVESTIGATION JURISDICTION

In accordance with the Aircraft Accident Investigation Authority Act 2019, Part IV, Section 12

(1) Notwithstanding any other Act, no department may commence an investigation under this Act if the accident or incident has been investigated, is being investigated, or is going to be investigated by the Authority.

(2) Nothing in subsection (1) shall prevent —

(a) the Authority from referring an accident or incident to another department or law enforcement department for the purposes provided in paragraphs (b) or (c);

(b) a department from commencing an investigation into or continuing to investigate an aircraft accident or incident for any purpose other than that of the Act; and

(c) any law enforcement department from investigating an aircraft accident or incident for any purpose for which it is empowered to conduct investigations.

(3) For any investigation conducted under the provisions of this Act, and in consideration of (2)(b), the Authority shall —

(a) have unhampered access to and unrestricted control over the scene of the accident or incident, including the wreckage and any material relevant to the investigation including statements taken from witnesses;
(b) have unhampered access to and control of the wreckage and all relevant material, including flight recorders and air traffic services recordings and records;
(c) have unrestricted control over wreckage and parts to ensure that detailed examinations can be made without delay;
(d) take all reasonable measures to protect the evidence and to maintain safe custody of the aircraft and its contents for such a period as may be necessary for the purposes of the investigation; and
(e) relinquish control of the accident or incident site(s) and release custody of the aircraft, its contents or any parts thereof as soon as they are no longer required for the investigation.

1.1.3 EXTENT OF INVESTIGATION

In accordance with the Aircraft Accident Investigation Act, 2019, Section 17(3) –;

(3) The Authority, on the advice of the Investigator-in-Charge shall have the authority to call on and receive the assistance of any government agency, service or department to assist in search and rescue operations for so long as is necessary to ensure the timely location of any crash site, wreckage and the rescue or recovery of any human beings.

1.2 EMERGENCY CALL LIST

In the event there is an accident or incident the below persons are to be contacted immediately.

TO REPORT AN ACCIDENT or SERIOUS INCIDENT

Telephone the Aircraft Accident Investigation Authority (AAIA)

(242) 376-1617 or (242) 376-8334 (24 hours)

Note: During normal working hours the below telephone numbers will be answered directly by personnel from the AAIA. Outside normal working hours the above telephone numbers will be answered directly by an on duty investigator who will record your information and advise the AAIA investigation staff.

(242) 397-5509, (242) 397-5513, (242) 397-5514 or (242) 397-5525

GENERAL INQUIRIES

Aircraft Accident Investigation Authority

#45 West Bay Street, 2nd Floor, Manx Corporate Center

P. O. Box CB-11702

Telephones: (242) 397-5509, (242) 397-5513, (242) 397-5514 or (242) 397-5525

Fax: (242) 327-2192

Email: baaid@bahamas.gov.bs

Website: www.baaid.org

Ministry of Transport & Local Government

1.3 DEFINITIONS

The following terms are used in this manual and have the following meanings;

1.3.1 Catastrophic Accident:
An accident that results in apparent complete destruction of the aircraft and any loss of life.

1.3.2 Major Accident:
An accident that results in substantial damage to the aircraft, or serious injury to one or more persons, or substantial damage to property caused by the aircraft.

1.3.3 Missing Aircraft:
An aircraft is considered to be missing when its position is unknown and, with the supply of fuel carried, or normally carried, can no longer be airborne; or is completely inaccessible.

1.3.4 Airborne or Circumstances of a Potentially Hazardous Nature:
An emergency condition reported by the flight crew (during flight) necessitating assistance or guidance.

1.3.5 Bomb Threat:
A bomb threat directed against an aircraft or company facility that meets the requirements of positive target identification (P. T. I.)

1.3.6 Ground Accident/Incident
An accident/incident that results in damage to company property, loss of life or serious injury to personnel caused by natural disaster, fire, explosion or mishap.

1.3.7 Apparent Complete Destruction Of An Aircraft:
Means that the damage sustained by the aircraft has caused severe structural break-up of the major components by impact, explosion or fire; or the aircraft is apparently beyond restoration (e.g. aircraft completely gutted by fire, or wreckage spread over a wide area, or if there is complete is integration).

1.3.8 Substantial Damage To Aircraft:
Means damage to an aircraft that necessitates major repairs, or the replacement of, or repairs to any major component or combination of components of the aircraft. (Damage such as scraped wing tips, bent fairing or cowling, small puncture holes in skin, dented skin, repairable damage to tires excluded).

1.3.9 Serious Injury:
Means an injury which is sustained by a person in an accident and which —
(a) requires hospitalization for more than forty-eight hours, commencing within seven days from the date the injury was received;
(b) results in a fracture of any bone (except simple fractures of fingers, toes or nose);
(c) involves lacerations which cause severe hemorrhaging, nerve, muscle or tendon damage;
(d) involves injury to any internal organ;
(e) involves second or third degree burns, or any burns affecting more than five per cent of the body surface; or
(f) involves verified exposure to infectious substances or injurious radiation;

1.3.10 Serious Incident
Means an incident involving circumstances indicating that there was a high probability of an accident and associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to

move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down;

1.3.11 Fatal Injury:
Means an injury which is sustained by a person in an accident and which results in his death within thirty days of the date of the accident;

1.4 ACRONYMS & ABBREVIATIONS

(a) The following acronyms and abbreviations are used in this appendix—

(1) AAIA – Air Accident Investigation Authority
(2) ACCID – Accident
(3) AIP – Aeronautical Information Publication
(4) AOC - Air Operator Certificate
(5) ICAO – International Civil Aviation Organization
(6) INCID – Incident
(7) IIC – Investigator-in-Charge
(8) PSE – Principal Structural Element
(9) UTC – Universal Coordinated Time

CHAPTER 2

2.1 PRESERVATION & PROTECTION OF WRECKAGE & ACCIDENT SITE.

(a) The operator and pilot-in-command shall ensure as much as is practical that the wreckage and accident site is protected and preserved in accordance with the requirements of this subpart.

(b) An operator shall ensure, to the extent possible, in the event the aircraft becomes involved in an accident or incident, the preservation of all related flight recorder records and, if necessary, the associated flight recorders, and their retention in safe custody pending their disposition as determined in accordance with this Regulation.

(c) All persons involved in the rescue, search and investigation of an accident shall take all reasonable measures to protect the evidence and to maintain safe custody of the aircraft and its contents for such a period as may be necessary for the purposes of an investigation —

(1) protection of evidence shall include the preservation, by photographic or other means of any evidence which might be removed, effaced, lost or destroyed.

(2) safe custody shall include protection against further damage, access by unauthorized persons, pilfering and deterioration.

(d) The operator of an aircraft involved in an accident or incident for which notification must be given is responsible for preserving to the extent possible any wreckage, cargo, and mail aboard the aircraft, and all records, including all recording mediums of flight, maintenance, and voice recorders, pertaining to the operation and maintenance of the aircraft and to the airman until the AAIA takes custody thereof or a release is granted.

(e) The operator of an aircraft involved in an accident or incident shall retain all records, reports, internal documents, and memoranda dealing with the accident or incident, until authorized by the AAIA to the contrary.

2.2 MOVING THE WRECKAGE.

(a) Prior to the time the AAIA or its authorized representative takes custody of the aircraft wreckage, mail, or cargo, such wreckage, mail, or cargo may not be disturbed or moved except to the extent necessary to —

(1) Remove persons injured or trapped;
(2) Protect the wreckage from further damage; or
(3) Protect the public from injury.

(b) Where it is necessary to move the aircraft wreckage, mail, or cargo, sketches, descriptive notes, and photographs shall be made, if possible, of the original positions and condition of the wreckage and any significant impact marks.

(c) If a request is received from the State of Registry, the State of the Operator, the State of Design or the State of Manufacture that the aircraft, its contents, and any other evidence remain undisturbed pending inspection by an accredited representative of the requesting State, the investigator-in-charge shall take all necessary steps to comply with such request, so far as this is reasonably practicable and compatible with the proper conduct of the investigation; provided that the aircraft may be moved —

(1) To the extent necessary to extricate persons, animals, mail and valuables;
(2) To prevent destruction by fire or other causes; or
(3) To eliminate any danger or obstruction to air navigation, to other transport or to the public; and
(4) Provided that it does not result in undue delay in returning the aircraft to service

CHAPTER 3
EMERGENCY RESPONSE PLAN CHECKLIST

3.1 OBJECTIVES
The following actions are involved in handling an aircraft accident…immediate on-scene action objectives are to:

a) care for the injured and non-injured passengers; (in most cases…this will be already taken care of by accident medical teams dispatched to the site)
b) secure the scene of the accident;
c) protect and to the extent possible preserve the aircraft, mail/cargo, passenger belongings, and company equipment, etc.;
d) maintain orderly traffic, crowd control, etc., so as to provide for prompt rescue, identification, and investigation.
e) establish liaison with law enforcement agencies to accomplish (c) and (d) above until arrival of the AAIA.

3.2 PRIORITY LIST FOR AIRCRAFT CRASH
Do not allow access of media to the crash site. Under no circumstances should you talk with media in order to release information until the Investigator in Charge or a Department Media Person has been appointed and a common Media News Release has been prepared.

This is extremely important in order to protect yourself, pending any future litigations or lawsuits.

1. Rescue
   a) Assist survivors and render first aid at the earliest and have medical personnel called and dispatched immediately.
   b) If there is danger of post-crash fire, move survivors a safe distance away. **(Be especially aware of anyone with indications of spinal injury and give consideration to this prior to moving anyone, unless it is obvious that fire is perhaps imminent.)**
   c) Keep bystanders and unauthorized personnel out of the crash area.
   d) Establish a **"No Smoking Rule"** immediately.

2. Search the wreckage and surrounding area carefully for other survivors.

3. Notify or arrange to notify:
   a) Medical Aid and Air Ambulance
   b) Local police
   c) Aircraft Accident Investigation Authority
   d) Police or Spill Response if hazardous materials involved

4. Preserve the accident site. Every piece of the aircraft and its location is important to investigators. Nothing should be disturbed or taken. Use local police and/or Departmental personnel to secure site.

5. *** IDENTIFY WITNESSES - THIS IS A VERY CRITICAL ELEMENT ***
   a) Obtain written statements, if possible, and/or record comments on tape recorder. Any pictures taken?
   b) Have witnesses' names, addresses and phone numbers.

3.3 ACCIDENT SCENE TEAM (ON-SITE) PROCEDURES & RESPONSIBILITIES
Notify (if not already accomplished) local authorities, as necessary, of the approximate scene of the accident:

- The fire department for assistance in rescue operations
- Ambulance/Hospital
- The police for assistance in security and coroner's duties
- Nassau Air Traffic Control
- Aircraft Accident Investigation Authority

Inform local authorities whether hazardous materials are being carried on the aircraft and where they may be found if applicable.

DO NOT discuss the accident with any person including company employees not officially connected with the investigation.

Proceed to the scene of the accident by whatever the most expeditious method to assist the police and rescue teams.

Rescue and assist the injured. Administer aid as necessary and obtain medical assistance as required. Relieve crewmembers of the responsibility for uninjured passengers.

Secure the accident scene for the protection of personnel and property. The police may be able to offer temporary assistance until the Investigator in Charge is able to arrange for longer term help. The best source of reliable help may be obtained by recruiting company personnel.

Assist the coroner or police in identifying victims if possible. Notify the police or the appropriate embassy if known of the outcome of this identification procedure so that notification of next of kin can proceed.

Provide accurate and factual information to the police or other authority as this information is put together. Upon arrival of an AAIA representative, relinquish control of the accident site.

Do not permit relatives entry to the "Crash-Defined Scene".

The Accident Scene Team will, as soon as possible, begin to obtain information necessary to complete applicable documentation.

Document observations, facts, and actions taken through detailed notes.

Record extent of any property damage, name of witnesses, etc.

Obtain photographs *(including negatives)* when available.

The only persons with whom any conversations should be held regarding the accident are:

- Individuals properly identifying themselves as bona fide members of the official investigative authority's team or the police.

3.4 HANDLING INJURED PERSONS

If the accident occurs in an area where rescue and medical assistance is available, company employees, (if an airline involved in the accident) will assist such agencies. If company employees are first on the scene, they will summon such agencies as is necessary.
Accurate records must be maintained containing the name of each injured person, general nature of his injuries, and the hospital to which he was dispatched, along with the name of the next of kin, if known.

As the rescue phase of operations is completed, it is important that accurate records be maintained on passengers dispatched to particular hospitals and what is known of their present condition. It is important to note and record non-accident related injuries, disabilities, physical handicaps, or the apparent absence of injury.

Do not delay any urgently needed treatment on this account.

3.5 EVIDENCE PROTECTION

If possible the entire accident site should be photographed. It is imperative that fleeting evidence such as contents of fuel tanks, any ice adhering to parts of the aircraft, skid marks, tree slashes, etc., be documented as accurately as possible to assist the investigator during the investigation. Company representatives should also record the names of witnesses and note any property damage done by the aircraft, plus any other relevant facts.

The Aircraft Accident Investigation Authority Regulations also state that:

Where an accident occurs involving an aircraft, the pilot-in-command, operator, owner, and any crew member of the aircraft shall, as far as possible, preserve and protect:

- the occurrence site including the aircraft and its component parts and contents until such time as an investigator otherwise directs all other records, documents and evidence of any kind pertaining to the flight during which the accident occurred;

- the crew members of the aircraft, and the aircraft, its component parts, and contents, and shall surrender the records, information, records, documents and evidence referred to in paragraphs (b) and to an investigator on demand.

3.6 POST ACCIDENT SCENE TEAM (ON-SITE) PROCEDURES & RESPONSIBILITIES

The first responsibility in any aircraft accident is the rescue and immediate care of the survivors. The coroner and the police will be responsible for the recovery of bodies.

Upon arrival at the scene, check immediately on the welfare of the flight crew members involved.

- If the crewmembers are uninjured, ensure that they have been medically examined.
- If the crewmembers are injured, ensure that they have adequate medical attention and that they are kept under medical observation.
- Whether injured or uninjured, the crew will probably be suffering from considerable mental and physical strain. It is important that you continually monitor their welfare and ensure that they are not disturbed and that they are getting proper rest and food.

The crew will be moved from the site of the accident to a specified location and the AAIA will be advised. If company personnel are involved, it is important that the positions of the bodies in the wreckage be documented. Documentation and preservation of evidence aid in the identification process, record facts which may be utilized for improved safety of equipment or procedures, which may be utilized for improved safety of equipment or procedures, and assist the company in meeting its responsibility for the handling of the deceased and personal effects.

Care must be taken in preserving wallets, handbags, jewelry and other easy to lose items, and correlating them with specific individuals. The use of heavy equipment (cranes, bulldozers, etc.) must be carefully controlled during the recovery phase and their use must be discontinued and

replaced with handwork when the first evidence of human remains or personal effects is discovered.

Information available at the field site includes that taken from wallets or other possessions of the passenger such as baggage, laundry marks, jewelry, etc.

Air accidents present a formidable range of challenges to organizations charged with providing a response. Such accidents can be hugely variable in scale and nature, occurring in almost any location at any time of day. On occasions, the accidents may involve a major international response. Organizations' attending the scene undertake a wide range of tasks including first responder activities, accident investigation, airport/regional emergency planning and response, aircraft recovery and transportation and environmental remediation.

The range of tasks in response to an aircraft accident are designed to rescue survivors, identify victims, protect the public and conduct appropriate investigations into the accident causes. Whilst conducting these tasks, all organizations are required to provide appropriate health and safety management arrangements for their own personnel, whilst also ensuring that they co-operate and co-ordinate operations with other organizations working at the scene.

Personnel responding to air accident sites can be exposed to a wide range of health and safety hazards. These hazards – physical, material, biological and psychological – have diverse characteristics and pose varying risks, depending on exposure. To manage these risks, organizations must ensure that they have installed proper safety management systems to identify these hazards, assess risks and implement appropriate control measures.

International investigative authorities are increasingly aware of the health and safety risks that accident site attendees are exposed to and are beginning to limit entry to hazardous sites to only those personnel who have completed hazard awareness training.

In addition to managing safety responses, organizations should give due consideration to the evidence that may exist at the scene of the accident and those tasked with collecting and analyzing it. This evidence may be required for a variety of purposes; most commonly for use in the identification of victims and in the determination of the reasons why the accident occurred.

CHAPTER 4

4.1 INFORMATION GATHERING

The need for accurate and readily available information is quite important as it is the most frequent inquiry made of the operator following a major accident and is essential in the process of aircraft accident investigation. The following are examples of information often requested:

A. Wreckage Location
B. Local law Enforcement agency and contact handling the accident
C. Information on Passengers (names, addresses, next of kin, present location, hospital, etc.)
D. Purpose of flight
E. Witness (names and addresses)
F. Aircraft/Engine Log Books and other maintenance records
G. Pilot Log Books or records

4.2 DISASTER PREPAREDNESS

The following items should be considered in preparing for major emergencies:

1. Communications: Battery-operated portable radio equipment.
2. Emergency power supply: Portable generator(s), flashlights and batteries, lanterns and fuel.
3. First aid medical equipment and supplies.
4. Water and emergency food rations.
5. Hazardous materials inventory: Location, spill control plan, special first aid/health protection requirements.

4.3 INTRODUCTION

A major aircraft disaster presents a scene where wreckage, bodies and survivors can be scattered over a wide area. It can be further complicated by hazardous cargo. If the accident occurs near a school, housing area, or traffic area, the results can be disastrous.

The purpose of this plan is to formulate a comprehensive action of rescue, medical and firefighting operations to combat the effects of a major air crash disaster that might occur within The Bahamas
This plan has been developed and coordinated with the cooperation of law enforcement, the fire service, EMS, NAD, Public Safety and Health Officials, 911, FAA and Coast Guard advisors.

The plan does not obligate any local community to a financial commitment. Based on that premise, the plan speaks to the Island(s) affected by the air crash, and to the supporting public resources which can provide assistance when called. Not knowing beforehand which Island(s) will be affected, and which will be supporting, each should be prepared to respond in either a primary or supporting role.

The jurisdictional autonomy of an island must be respected at all times. Local officials, unless otherwise advised are in command of disaster operations.

4.4 MISSION

To establish methods and procedures designed to protect life and property in the event of an aircraft disaster within The Bahamas, to render aid to The Island in which the accident occurred, and to protect the crash scene and preserve evidence for further investigation.

4.5 CONCEPT OF OPERATIONS

4.5.1 Preparedness

1. Preparedness involves action designed to save lives and minimize damage. It is planning and training prior to a major air crash for appropriate response when an emergency occurs.

2. All responders will:

A. Maintain a resource inventory of equipment and manpower which could be utilized.
B. Train personnel in the responsibilities and emergency duties required under this plan.
C. Conduct periodic exercises that will test the effectiveness of this plan.
D. Review and update the plan as needed based on exercises, emergency response or changes in policy.
E. Follow the established communications network identified in this plan.

4.5.2 Emergency Response

Emergency Response begins as soon as an aircraft is identified or reported. The numbering sequence is not meant to establish priority as all actions should be done as soon as possible.

1. When the Air Traffic Control Tower and Lynden Pindling International Airport is notified that an aircraft approaching the airport is having difficulty; they will immediately make notifications per Lynden Pindling International Airport/Airport Emergency Plan.

2. In the event of reported air crash off-site of the Lynden Pindling International Airport, the 911/Dispatcher / ATC / NAD will immediately notify agencies based on the information from the caller, and the Air Traffic Control Tower.

3. The first responder on scene will make a preliminary assessment and notify the 911 Dispatcher, giving all information available. The 911/Dispatcher will immediately notify agencies according to the established protocol based on the size of the aircraft.

4. The Senior Police Officer of The Island affected, upon arriving at the scene of the crash, becomes the Incident Commander and will command and direct all emergency response actions.

5. The Incident Commander will assess the need for additional resources.

6. The Incident Commander will appoint Command Staff as appropriate.

7. Law Enforcement will establish access and traffic control and assist the Medical Examiner in body recovery and identification, if necessary.

8. The first qualified EMS provider (if available) at the scene shall assume EMS command and set-up the EMS incident command structure. The EMS Branch Director (if available and applicable) shall appoint officers to the EMS incident command system, which shall include triage, treatment, transportation, communication, staging and resource officers.

9. The Incident Commander will instruct emergency response personnel to not move debris associated with the wreckage, i.e. Cargo, plane remnants, passenger belongings, unless there is imminent danger of items being destroyed, or unless they inhibit access to passenger rescue.

10. The Medical Examiner or his/her designee is responsible for the identification, movement and/or removal of the dead. Unauthorized personnel are not to move the dead without express approval of the Medical Examiner or his /her designee, except when there is a question of whether the person is deceased or if the body is in danger of being destroyed. In all cases involving the

movement of a body, personnel moving the body shall make careful note of the location and condition of the body for the Medical Examiner.

11. Town department heads, Fire, Law Enforcement, EMS or their designees will direct the activities of their respective emergency response forces from Command Post and/or the Operations Section. The Incident Commander may request other personnel to report directly to the Command Post.

12. Upon notification of an air disaster, the Air Traffic Control Tower will be responsible for air traffic in proximity to the scene, with immediate regulatory control of airspace around the area. They will keep the airspace clear of intrusive air traffic, to the limits of the regulations.

4.5.3 Recovery

1. Recovery immediately following emergency response. It can involve
   A. Diverting vehicular traffic (if applicable)
   B. Maintaining access control.
   C. Clearing debris.
   D. Restoring public utilities.
   E. Removing aircraft.
   F. Providing international services.
   G. Processing Insurance claims.
   H. Providing emergency social services (shelter, clothing, food, etc.).
   I. Rebuilding homes and buildings.
   J. Investigating the accident.
   K. Demobilizing Emergency personnel and resources, which may include emergency worker counseling.
   L. Adjusting traffic control perimeters.
   M. Continuing public information for general and health-related needs.
   N. Maintaining security in restricted areas.
   O. Providing for residents long-term counseling.
   P. Economics/Industry continuation.

4.5.4 Direction and Control

The incident Commander will control and direct all activities at the scene.
If a disaster is declared, The Commander post will be established at or near the scene. This is the center from which all emergency operations will be directed. Staffing for the Command Post, as directed by the Incident Commander, should be limited to primary responders: Fire, law enforcement, EMS, Communications, and others who may be appointed by the Incident Commander.
NOTE:

1. If an accident / incident occur in an Island, outside Nassau, Bahamas the police officer in charge or the designee will be the lead agent and will work in conjunction with other law enforcement agencies as appropriate.

2. If an accident / incident occur in Nassau, Bahamas the Chief of Police or his designee will be the lead agent and will work in conjunction with all other law agencies as appropriate.

4.6 MISSION ASSIGNMENTS

4.6.1 Incident Commander

Incident Commander (during Emergency Response) is responsible for, but not limited to performing the following functions:

1. Accessing the magnitude of the scene and reporting this to the 911/Dispatcher.
2. Directing and controlling all tactical operations.
3. Assigning Command and General Staff as required.
4. Assessing the need for additional resources.
5. Establishing and Staffing a Command Post/Operations Post as needed.
6. Designating the emergency site boundary.
7. Conferring with the Chief Investigator of the Aircraft Accident Investigation Authority as requested.
8. Evacuating the vulnerable population from the emergency site.
9. Requesting Utility shut-offs (if applicable).
10. Designating a staging area for media representatives.
11. Lighting the emergency scene in coordination with public utilities and Public Works.
12. Assessing the need to incorporate other response plans in the emergency response, i.e. Hazardous Materials, Marine Emergency Plan.

4.6.2 The Fire Service

The Fire Service is responsible for, but not limited to:

1. Establishing Initial Incident Command in accordance with Incident Command System.
2. Establishing operational control of Fire and operations.
3. Conducting Evacuations.
4. Conducting search and rescue operations.
5. Assuming responsibility for the safety and well-being of all firefighters involved with the incident.
6. Assisting in body recovery as needed or requested by the Medical Examiner or his /her designee.
7. Assisting in removing mail and cargo from the wreckage.
8. Staffing both the Command Post and the EOC.
9. Identifying, securing, and managing necessary resources.
10. Utilizing technical representatives and resources available from the Airport Fire Department, and other agencies.
11. Providing assistance and support services to applicable agencies for the duration of the incident.

4.6.3 Law Enforcement

Law Enforcement is responsible for, but not limited to

1. Limiting access of unauthorized persons to the emergency scene.
2. Activating traffic and crowd control systems.
3. Establishing an inner and outer perimeter for the emergency site boundary.
4. Establishing emergency vehicle ingress and egress.
5. Coordinating activities with Incident Commander at the Command Post (Senior Police Officer).
6. Maintaining law and order.
7. Assisting with evacuation.

8. Assisting with rescue operations.
9. If it is necessary to remove mail and cargo from the wreckage to protect it from further damage law enforcement will designate a secure area for these items which will later be examined by an Air Safety Investigator.
10. Assisting with body recovery and identification as needed or requested by the Medical Examiner.
11. Assuming incident Command, as appropriate, during the course of the incident.
12. Coordinating security of the emergency site with the Aircraft Accident Investigation Authority (AAIA).

4.6.4 Emergency Medical Services

Emergency Medical Services is responsible for but not limited to:

1. Responding to the scene and Establishing EMS Branch Operations in coordination with the Incident Commander.
2. Coordinating activities with the Incident Commander and staffing both the Command Post and the EOC (Senior EMS Official and designees).
3. Directing all Triage, Treatment and Transportation activities.
4. Establishing on-site Advanced Life Support consistent with regional EMS and hospital plans and protocols.
5. Establishing communication with hospitals regarding the number of incoming injured, severity of injuries estimated time of arrival, and termination of patient flow.
6. Keeping the Incident Commander informed of all operations.
7. Maintaining all medical supplies and re-supply.
8. Coordinating hospital destination for patients.
9. Communicating and coordinating with the Medical Examiner.
10. Coordinating with Health officials.
11. Assuming responsibility for the safety and well-being of all EMS providers involved with the incident.

4.6.5 The Emergency Manager

The Emergency Manager is responsible for, but not limited to:

1. Establishing an EOC, at the direction of the Chief Executive.
2. Coordinating staffing and functions of the EOC.
3. Alerting departments, agencies and individuals assigned responsibilities under this plan.
4. Coordinating communications with the Command Post.
5. Coordinating with the Emergency management Office regarding support from local Agencies.
6. Coordinating support from private agencies and volunteer groups.
7. Collecting, displaying, and disseminating emergency information from the EOC.
8. Directing volunteer civil preparedness forces.
9. Keeping the Chief Executive fully informed of all operations.
10. Supporting Emergency response forces to the fullest extent.
11. Designating an on-scene liaison to facilitate response (as necessary)

4.6.6 The Command Post

The Command Post will function as:

1. Direction and Control of all tactical operations at the scene of the emergency, under the supervision of the Incident Commander.
2. The on-site headquarters for the Incident Commander and other key personnel at the direction of the Incident Commander.
3. Site communications link with the EOC.
4. The central communications center within the crash scene perimeter.
5. Control for use of on-scene resources.

4.6.7 The Emergency Operations Center

The Emergency Operations Center is responsible for, but not limited to:

1. Maintaining communications with the Incident Commander at the scene for coordination and support.
2. Coordinating public information.
3. Coordinating Support through the Emergency Management Office.
4. Verifying Identification of appropriate EOC response personnel as required.
5. Collecting, analyzing and disseminating all emergency information.
6. Administering record keeping procedures required during the response and recovery phase.

4.6.8 The Red Cross

The Red Cross will provide:

1. Food, clothing shelters and other assistance as needed.
2. Assistance with rehabilitation of families.
3. Assistance as required in triage operations.
4. Assistance in handling inquiries from the public on where to contact missing or injured residents, shelters, or social services.
5. Operational bloodmobiles as required.
6. Assistance with Human Services (Social Services).

4.6.9 Aircraft Accident Investigation Authority

The Aircraft Accident Investigation Authority has mandated responsibilities and will:

1. Provide an Investigator-in-Charge (IIC).
2. Investigate such accidents and report the facts, conditions, and circumstances relating to each accident and the probable cause thereof.
3. Release the wreckage.
4. Release the remains of victims.
5. Provide the official “Aircraft Accident Report.”
6. Provide assistance to the local community as necessary.

4.6.10 The Airline / Carrier

The Airline/Carrier will

1. Report to the Lynden Pindling International Airport for a briefing on the incident, and
2. Be escorted to the scene from this location.
3. Designate a staging area for survivors and their families and provide for their needs and comforts.
4. Designate a spokesperson to coordinate with the AAIA.

Designate a telephone number as a point-of-contact for inquiries from the public and families, and communicate this number to the AAIA for dissemination to the media.

CHAPTER 5

HAZARDS

A hazard is something that has the potential to cause adverse consequences, and the degree of adverse consequences caused by specific exposures is important when determining the risk posed. A wide range of hazards may exist at aircraft accident sites, some of which may not be directly associated with the aircraft wreckage.

Hazards may be posed by pathogens (from human or animal remains), cargo, and the nature of the accident location, ground installations, and other factors. Given the wide range of potential hazards at an accident site, it can be helpful to categorize typical hazards, in order to better manage the accident site.

Hazards have been categorized as follows:

- Environment — location (both geographic and topographic), fatigue (effects of travel and transportation), insects/wildlife, climate, security and political situation;
- Biological — pathogens associated with human remains or cargo consignments and state of local hygiene;
- Physical — fire, stored energy, explosives, structures;
- Materials — exposure to and contact with materials and substances at the site; and
- Psychological — stress and traumatic pressures imposed by exposure to the aircraft accident, and interaction with those associated with the air carrier and related aviation activities.

When considering hazards, it is important to consider the manner in which they may be presented. Some hazards produced by acute events may result in a risk of short duration; these may be physically evident as, for example, fire, explosives, electrical discharges, lack of oxygen and chemicals. Other hazards may not be immediately observable but, through either single or multiple exposures, pose significant health risks over time.

It is not unusual for hazards posing more immediate threats to be prioritized ahead of hazards threatening delayed symptoms, yet the hazards threatening delayed symptoms may eventually present a much greater degree of risk.

5.1 ENVIRONMENTAL HAZARDS

The ***accident location*** frequently poses a range of hazards to first responders as well as investigators due to the geographic and topographic location of the site. On land, the site may be located in remote or built-up areas, at altitude or in very difficult terrain; each of these may pose particular hazards.

Marine situations can pose their own problems depending on whether the accident site is in shallow or deep water. Recovery issues pose great risk where divers need to be deployed. Just gaining access for preliminary investigation tasks may present personnel with complex decisions. During later investigation and recovery, the simple need for a continuing presence may pose a hazard and expose personnel to risk of injury.

5.1.1 Fatigue.

Extended journey times, circadian de-synchronization resulting from trans-meridian travel, lengthy working hours and demanding working conditions can result in reduced performance as an outcome of fatigue. These are significant issues about which individuals should be aware and for which they should be prepared.

Investigators should ensure they understand the physical and psychological demands of their work and when confronted with particularly demanding working conditions, seek medical advice at an early stage. It is recommended that investigators undergo a periodic medical examination to check their fitness for work at accident sites. Early provisions must be made for nourishment, rest and counseling of investigators both during and following their exposure to the accident site.

5.1.2 Insects/wildlife.

Some sites, particularly in remote areas, will introduce the prospect of exposure to or contact with wildlife. The many insects and larger animals that bite, sting, inject or secrete can cause immediate or long-term health problems, some of which can be life threatening.

5.1.3 Climate.

Extremes of climate are likely to pose problems, especially to unprepared investigators, as can locations where changes in weather can occur suddenly. Even relatively small temperature changes can pose problems where wind and rain may also be involved and work is extended throughout a long day.

5.1.4 Security.

Criminal and terrorist threats are a feature of the social situation in many regions, even in seemingly safe cities. The advice and support of local contacts should be sought to determine security measures that should be adopted. Other political and social advice should be requested in order to not violate local traditions or regulations.

The following scene photos are provided to illustrate the challenges faced by accident investigators and first responders alike. As portrayed, not all accidents occur on an airport or in locations that are accessible; therefore first responders as well as accident investigators need to take the appropriate precautions for self-preservation first and foremost.

Aircraft sites are dangerous places; many sites are not always on an airport

It would be ideal if all accidents were to occur on the airfield or in close proximity to one. However, as this is not always the case, investigators and first responders alike must adapt to the challenges as it presents depending on where the accident or incident occurs.

5.1.5 Accidents / incidents occurring in swamps or swampy areas

Accidents or incidents occurring in swampy areas present a difficult challenge as aircraft components and evidence can be lost to the mud and water of the swamp. Creatures and other swamp animals (alligators, snakes, leeches mosquitoes etc.) also present a hazard to investigators and responders alike. Some of these creatures can be a serious outright threat to life or many contain disease-carrying organisms that can pose a serious health risk to both responders and investigators alike. Proper attire, safety and defensive equipment and repellent must be considered when operating in such environments.

5.1.6 Underwater and deep water operations




Underwater rescue and recovery are in and of itself very dangerous and challenging for investigators as well as first responders. Some of the considerations that must be observed are;

1. Water depth
2. Water pressure
3. Water currents
4. Water temperature
5. Fuel spill
6. Sharks as well as other unknown water creatures


These rescue and investigative measures **should not** be attempted by persons not properly trained in underwater operations. The scene should be photographed, catalogued and documented as much as possible prior to recovery due to changing currents and weather conditions and the possibility of lost evidence.

Underwater recovery like underwater investigation present challenges for investigators more so than first responders. However, the same degree of caution must be taken as blood-borne pathogens as well as other disease causing agents can be present where a fatality occurred and blood and other body fluids are present.

Protective gear must be worn at all times when on scene or in contact with components during documentation and follow-up examinations.

5.1.7 Lakes and shallow water recovery

5.2 BIOLOGICAL HAZARDS

Accident investigators and first responders alike are at risk of exposure to many biological hazards. Biological hazards may exist in the cockpit, cabin, and cargo wreckage as well as on the ground where bodies and survivors have lain. Since it is not possible to readily identify contaminated blood and other bodily fluids, it is prudent to take precautions whenever working around and in wreckage, when handling wreckage and when performing off-site examinations and tests on wreckage parts.

Precautions must be taken to prevent viruses from entering mucous membranes (such as the eyes, nose and mouth) or non-intact skin such as open cuts or rashes. The accident site may be contaminated with liquid, semi-liquid and dried blood and other bodily fluids, fragmented bones, human or animal tissue and internal organs. In the dried state, there is a risk that particles of these substances may become airborne and come into contact with the unprotected eyes, nose and mouth.

As part of the investigation-planning process, appropriate precautionary measures should be taken against biological hazards. Investigators and others who work on-site, or who carry out off-site examinations and tests of wreckage, should take a biological hazard precaution-training course and be inoculated against the Hepatitis B virus. The following procedures should be developed and implemented:

- a system to maintain records of training and vaccinations;
- procedures to ensure that the biological hazard area is identified and that precautions are maintained throughout an investigation;
- procedures for the maintenance of a personal protective equipment inventory;
- proper methods for donning, removing and disposing of contaminated personal protective equipment;
- work practices to minimize exposure;
- procedures for decontaminating investigation equipment and wreckage parts;
- procedures for shipment of contaminated wreckage parts to off-site examination and test facilities; and
- procedures to follow when exposure to biological hazards has occurred.

A kit containing personal protective equipment should be made available to each investigator. The kit should include a full cover protective suit, several pairs of latex gloves, work gloves, face masks, goggles, shoe covers and protective boots, disinfection chemicals and a biological hazard disposal bag.

Procedures to be followed at the accident site should include an initial survey for biological hazards in the form of visible blood or other bodily fluids. When there are serious injuries or fatalities, there will often be bodily fluids remaining after the dead and injured are removed. Areas contaminated by spilled blood or bodily fluids should be identified and roped off and have only one point of entry/exit. Only persons using personal protective equipment should be allowed access to the contaminated areas. Any components that are removed from the accident site for examination and testing should be labeled as bio hazardous to ensure that they are treated with the same care as exercised at the accident site.

Investigators should always assume that human tissue and bodily fluids are contaminated and, as a minimum precaution, should don a face mask and wear latex gloves under their work gloves when examining wreckage known to contain blood or other fluids.

The most common contaminated items include all cabin interior materials, e.g. seat belts/shoulder harnesses, seat cushions, other upholstery and trim materials, and instrument panels. While wearing personal protective equipment in the biological hazard area, investigators should not eat, drink or smoke; apply cosmetics, lip balm or sun block; touch their or others' face, eyes, nose or mouth; neither should they handle contact lenses.

Biological-hazard waste such as clothing and contaminated personal protective equipment should be disposed of appropriately according to local requirements. Investigators should carefully pull off the outer work gloves first, then peel off the latex gloves and drop both pairs into a biological hazard disposal bag.

Contaminated personal protective equipment should never be reused. Exposed skin should be wiped immediately with moist towels, and then washed with soap and water or a solution of one part chlorine bleach to ten parts water. A new bottle of bleach solution should be mixed every day. Contaminated eyes should be flushed with fresh water. Special attention should be given to thorough hand washing after removing latex gloves and before eating, drinking, smoking, or handling contact lenses. Where an investigator or response person suffers an exposure incident involving biological hazards, appropriate and timely medical assessment should be undertaken and any measures indicated by that assessment be taken to ensure the health and well-being of the investigator involved.

Investigators should be aware that wearing personal protective equipment in hot and humid climates may result in heat stroke unless precautions are taken to minimize heat stress. Thus, before donning personal protective equipment, a liter or more of water should be consumed. Depending upon the heat and the humidity, and on the amount of physical exertion required, it may be necessary to limit the amount of time that investigators wear personal protective equipment. Once they have left the biological hazard area, removed and disposed of their personal protective equipment and disinfected their hands, investigators should rest in the shade and consume at least a liter of water. It may be necessary to have medical personnel assess the condition of investigators who have experienced heat stress.

Since it is important to minimize the number of investigators, tools and equipment that could come into direct contact with contaminated materials, a minimal number of investigators should be assigned to handle wreckage and disassemble components. Other investigators could be assigned to take notes, draw diagrams, take photographs or use the appropriate manuals and engineering drawings.

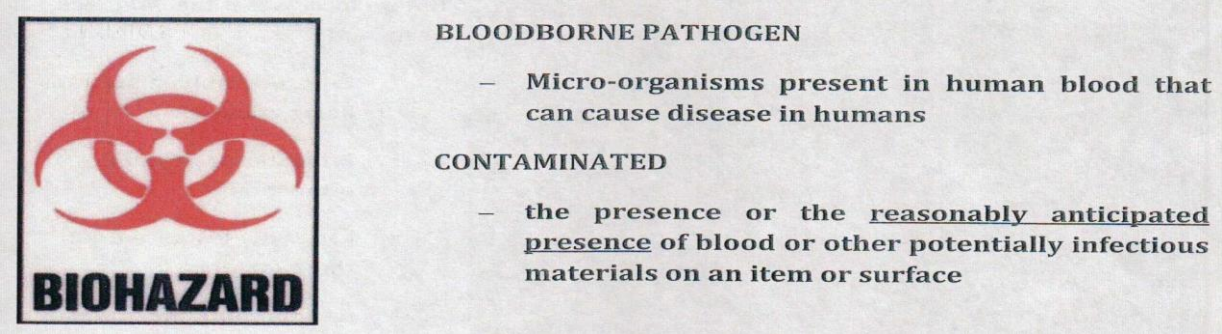
Contaminated investigation equipment, such as tools, flashlights and tape measures, should be cleaned with soap and water, disinfected and allowed to dry. Personnel, when leaving the area, should place in biological-hazard disposal bags any equipment that cannot be readily disinfected. On-site garments should be removed at a decontamination area and clean garments worn in transit to prevent biological hazards from being spread to clean areas off the accident site. The disposal bags and their contents are usually incinerated at appropriate facilities, such as hospitals.

5.2.1 Local state of hygiene.

Low levels of hygiene can pose health risks. Even relatively minor complaints can become serious when personnel cannot access medical treatment. Care should be taken when eating and drinking in remote locations or where hygiene levels are of concern. Guidance on essential hygiene should be sought from experts prior to undertaking foreign travel.

5.2.2 Blood-borne pathogens potential

The exposure to blood, blood products or other body fluids or parts from persons involved in accidents present a serious hazard to first responders as well as accident investigators. The urge to assist and help persons in need of rescue can cause first responders to forget precautionary methods in their rush to assist. However, care should be taken and everyone should be treated as if they can possibly infect you. Universal precautions must be worn at all times by first responders and accident investigators alike.



Each rescue agency usually has in place universal equipment and precautions that must be followed in a rescue operations. These procedures should be followed at all times when responding to an accident. All accident sites must be treated as a hazardous site when fatalities or blood or other body products / fluids are present.

Post site activities should also consider evidence retrieved as hazardous until such time as they can be decontaminated using universal procedures for decontamination.

Exposure Incident – a specific eye, mouth, mucous membrane, non-intact skin or parenteral (below skin) contact with blood or potentially infectious materials that result from the normal performance of duties.

Post site activities should also consider evidence retrieved as hazardous until such time as they can be decontaminated using universal procedures for decontamination.

Exposure Incident – a specific eye, mouth, mucous membrane, non-intact skin or parenteral (below skin) contact with blood or potentially infectious materials that result from the normal performance of duties.

5.3 PHYSICAL HAZARDS

5.3.1 Fire and flammable substances.

Fuel is likely to be one of the most common hazards encountered at a crash site. Fuel poses problems due to its flammability and its nature as a harmful substance. In practice, it is the flammable aspect that most needs to be guarded against. There are, however, other health hazards presented by inhalation of fumes and prolonged skin contact that should also be considered. Where available, the advice of an experienced fire officer attending the site should be sought in guarding against fire hazards and in securing fuel tanks and containers of other flammable liquids such as hydraulic fluids.

Fire may also be the result of aircraft batteries short circuiting; this may be caused by impact damage. Prolonged exposure to firefighting agents can also cause skin and respiratory injuries. These agents should be washed off skin and clothing as soon as possible.

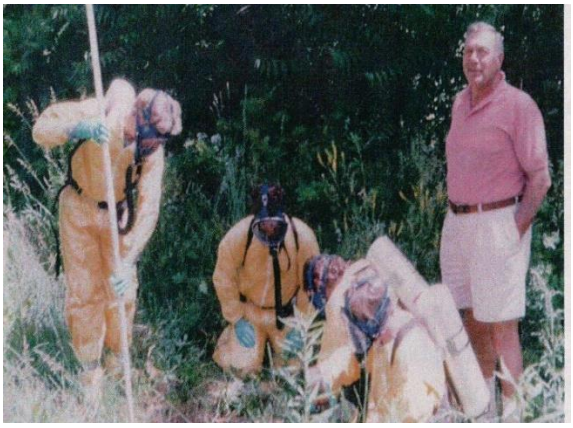
Some fire sites are to such an extent that valuable evidence may be lost in the blaze. Caution should be employed when moving thru a scene where burnt components were present as the wind and normal activity can cause particles and dust to be moved about. This dust and other burnt remains can be inhaled or enter the body by other means and can later cause hazards, respiratory or otherwise that can cause illness to the person involved.

Some scenes are on such a massive scale that it presents a challenge to investigators and first responders. Also, it can be a nightmare to secure scene and protect evidence from by standers. In addition to presenting a serious challenge to control, scenes like these can be a serious risk for blood-borne pathogens for both investigators as well as responders. The importance of wearing protective clothing and gear cannot be understated here.

5.3.2 Scene Security Challenges

Scene involving fire and burning materials is an especially dangerous site for responders and investigators alike as burning components can release toxic fumes that can be overwhelming for anyone in the vicinity of the fire. Special techniques must be considered when entering a scene where fire was involved. The scene must be first deemed safe by the fire rescue personnel before responders and investigators venture in to assist in recovery of evidence, cargo mail etc.

Some scenes are on such a massive scale that it presents a challenge to investigators and first responders. Also, it can be a nightmare to secure scene and protect evidence from by standers. In addition to presenting a serious challenge to control, scenes like these can be a serious risk for blood-borne pathogens for both investigators as well as responders. The importance of wearing protective clothing and gear cannot be understated here.



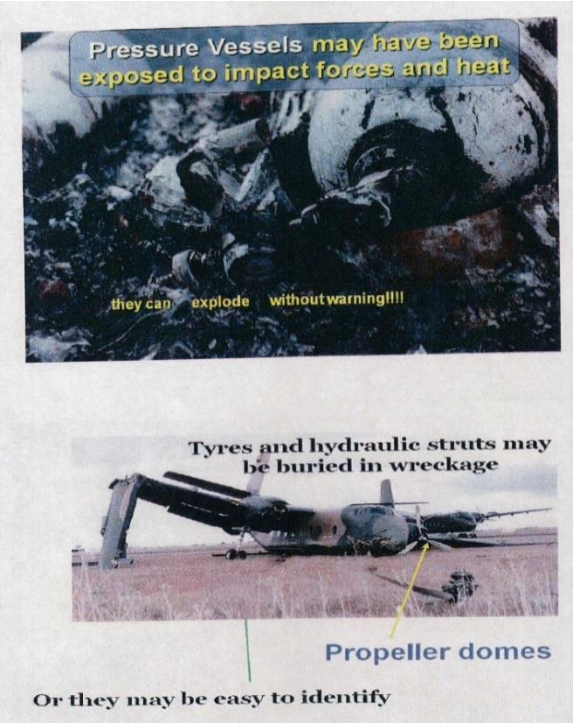
Following are other hazards that can be encountered by first responders as well as accident investigators in which precautions must be taken prior to assisting in rescue and investigation such as;

- Dangerous dust laden smoke and fumes
- Dangerous goods
- New age technology
- Pressure vessels
- Chemical hazards
- Composite and advanced composite materials

Dangerous dust laden smoke and fumes can cause health risks for persons and or communities downwind of the accident. It is especially dangerous for person on the scene. Proper techniques must be employed to remain out of the contact of such smoke and / or fumes to avoid serious respiratory or other type of illnesses.

5.3.3 Stored Energy Components

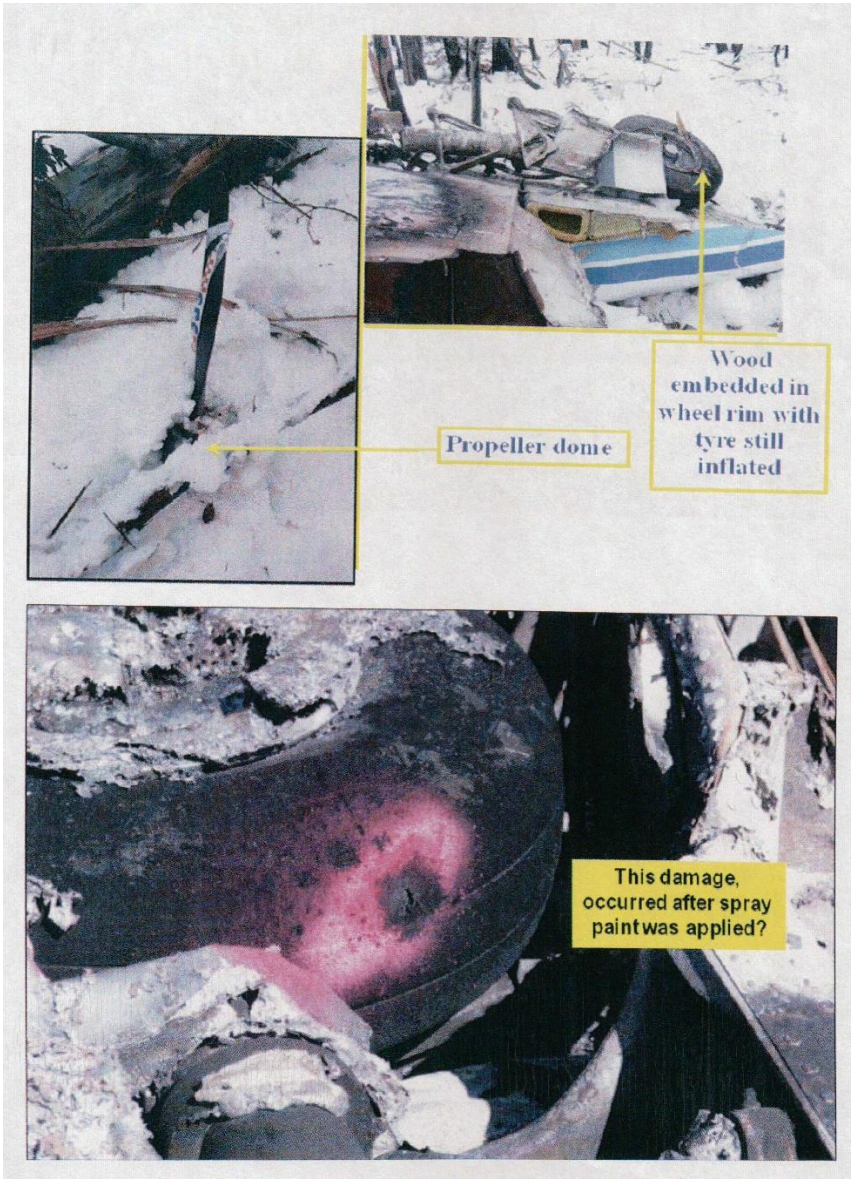
Many aircraft structures and systems have the potential to cause injury to personnel. Electrical accumulators or capacitors and emergency power supplies can be hazardous due to their electrical potential and chemical content. Hydraulic accumulators, oleo struts, wheels and fire extinguishing bottles are examples of components that have potential stored energy.



5.3.4 Pressurized Gases.

Some pressurized gases are carried onboard aircraft in containers of various designs. The rapid discharge of these can pose a risk of physical injury or of asphyxiation if released in enclosed spaces. Some fire extinguishing agents can also be toxic. Pressurized oxygen can increase the risk of fire or explosion when released.

A selection of pressurized containers recovered from aircraft accidents



5.3.5 Military and Ex-military Aircraft.

Current and former military aircraft are now commonly flying with civil registration. Civil aircraft crash investigators and emergency responders may, therefore, commonly come into close proximity with cockpit escape equipment and ejector seats and, as a result, be subject to associated hazards.

5.3.6 Recent Safety Equipment.

Other safety equipment is being introduced into civil aircraft, for example, rocket-deployed emergency parachute systems and airbag restraint systems are being installed across a range of aircraft. Often these systems are not clearly marked and may not be marked at all. The armed and unfired rocket of a rocket-deployed recovery parachute system may pose a potential hazard to investigators and rescue personnel.

Accident sites with aircraft like the cirrus or others with parachutes present an extremely dangerous site for investigators and first responders if the parachute has not been deployed prior to the accident occurring.

5.3.7 Pyrotechnics and explosives.

Most commercial and many private aircraft carry custom-built explosive charges to initiate escape slides, parachutes, fire extinguishers, cable cutters, flotation gear, deployable emergency locator transmitters, etc. Whilst the activation of these charges may pose only a small direct risk to personnel, the unexpected initiation of the systems that they operate may present a more significant risk. Pyrotechnics are carried by a variety of aircraft and therefore may be discovered amongst the aircraft wreckage. They sometimes sustain impact damage and, as a result, pose an increased risk of initiation.

Weapons may also be carried by passengers or crew as cabin or stored baggage and should be carefully treated. In the early stages of the crash investigation, perhaps at the reporting phase, coordinating personnel should seek information about any pyrotechnics or explosives known or thought to be on board the crashed aircraft and the information passed to the Investigator-in-charge. These hazards also support the need for adequate police resources to restrict the public and media from access to the accident site for their own protection

5.3.8 Damaged and unstable structures.

Generally, the hazards posed by damaged aircraft structures will be obvious and most will be readily identified. Situations sometimes arise, however, when persons on site may be exposed to unexpected hazards, for example, if wreckage moves or gives way underfoot.

Modern materials, including composite structures, may appear undamaged externally but will have lost structural integrity due to impact and/or heat damage. They can also retain significant energy under the stress of impact, which, when released, may suddenly pose a significant hazard. Structural strength may also be reduced by corrosion; for example, seawater may pose a risk to materials such as magnesium in a relatively short period of time.

5.3.9 Dangerous Goods

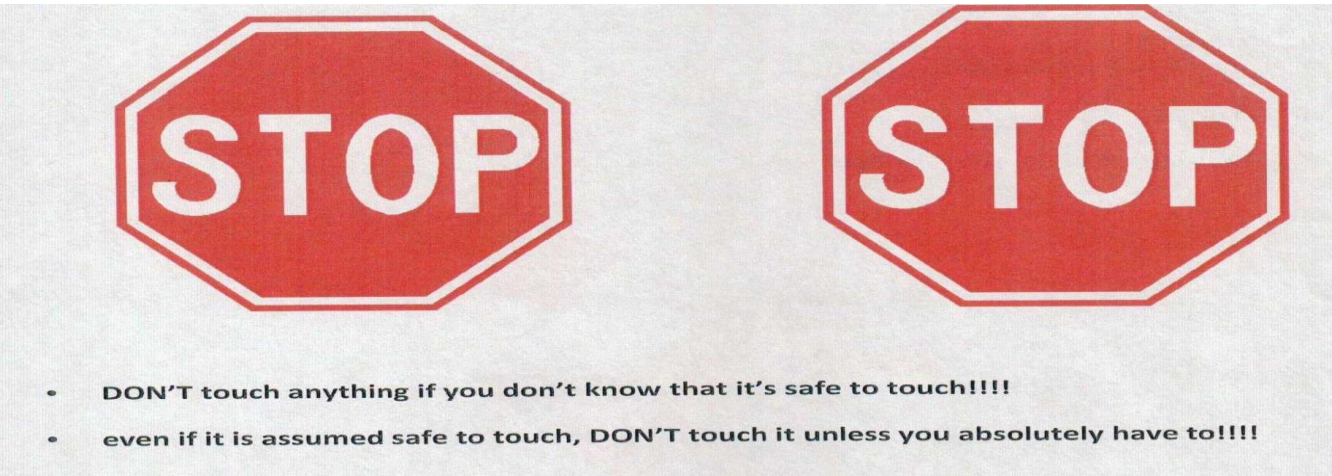
Dangerous goods on aircraft also present challenges for unsuspecting first responders or accident investigators. Therefore it is vitally important to establish the nature of the flight prior to going in to assist, to avoid unnecessary exposure to dangerous goods that can present a health risk to both investigators and responders.

Standard Practices

- Assume everything can hurt you
- Look and listen
- Look for dangerous good markings

Dangerous goods

- Should be clearly labeled
- Packages may have been damaged and their contents may have leaked.
- BEWARE – some class of DG's are incompatible with other DG's!!!!



5.4 MATERIAL HAZARDS

Damaged aircraft materials can pose health hazards to investigators and search and rescue personnel. Many States are required by national legislation to control the hazards posed by exposure to hazardous substances. This requires the *identification* of hazardous materials found at work, to make an assessment of the associated risks to health, and to put in force suitable measures to control these risks. This is not an easy task as the list of potentially hazardous materials is long. The risk of exposure is highly dependent upon the particular accident profile. Manufacturers and operators are organizations that could assist in compiling lists of materials that may become hazardous when damaged.

Groups of materials that have been considered as hazards to date include:

- metals and oxides;
- composite materials;
- chemicals and other substances; and
- radioactive materials.

Of these groups, composites have attracted the widest interest in recent times. It is pertinent that they are finding ever wider application and usage in aircraft.

5.4.1 Metals and Oxides.

Many of the metals and their respective oxides are hazardous to health when ingested into the body. However, *all* dusts and particles are considered hazardous when encountered in sufficient concentrations. It requires only relatively small quantities of some metals to pose risks to health and to have a significant effect on the body. These metals and oxides are accordingly classified as high risk. These substances may adversely react with chemicals, such as firefighting agents, so any indication of chemical reaction should be treated with the greatest care and reported to the Investigator-in-charge.

Traditionally, aircraft structures consist primarily of aluminum alloyed with small amounts of other metals including magnesium, zinc and copper. Advanced materials are under development or are already in use in new metal alloys. The properties of many of these materials, when damaged, are not well understood.
Scene involving fire and burning materials is an especially dangerous site for responders and investigators alike as burning components can release toxic fumes that can be overwhelming for anyone in the vicinity of the fire. Special techniques must be considered when entering a scene where fire was involved. The scene must be first deemed safe by the fire rescue personnel before responders and investigators venture in to assist in recovery of evidence, cargo mail etc.

Some fire sites are to such an extent that valuable evidence may be lost in the blaze. Caution should be employed when moving thru a scene where burnt components were present as the wind and normal activity can cause particles and dust to be moved about. This dust and other burnt remains can be inhaled or enter the body by other means and can later cause hazards, respiratory or otherwise that can cause illness to the person involved.

The products of combustion of many materials are hazardous when inhaled, ingested or absorbed and national safety authorities restrict exposure to them. In practice, however, due to the type of damage created in an aircraft accident, it is almost impossible to separately identify and quantify safe limits of exposure to these substances during emergency response and accident investigation activities. Furthermore, accidents in industrial areas may introduce entirely new chemicals that may adversely react with each other or with the aircraft and prove harmful to rescue or investigative personnel.

5.4.2 Composite Materials.

The use of *fibre*-based composites on aircraft is now extensive, with aircraft structures commonly consisting of more than 15 per cent by weight of these materials. A broad range of fibrous materials is used in the

construction of composite materials, including carbon, glass, Kevlar and boron, with these and others often combined to form a hybrid fibre. The resin matrix binding the fibre generally accounts for around 40 per cent of the manufactured composite material. These different fibres, not surprisingly, behave differently when subjected to the forces and effects of aircraft accidents.

Reports indicate that when subjected to fire or impact alone, composite structures are likely to release around 1 per cent of their base material as free fibres. When subjected to fire and impact damage, structures can release up to 10-12 per cent of material as free fibres.

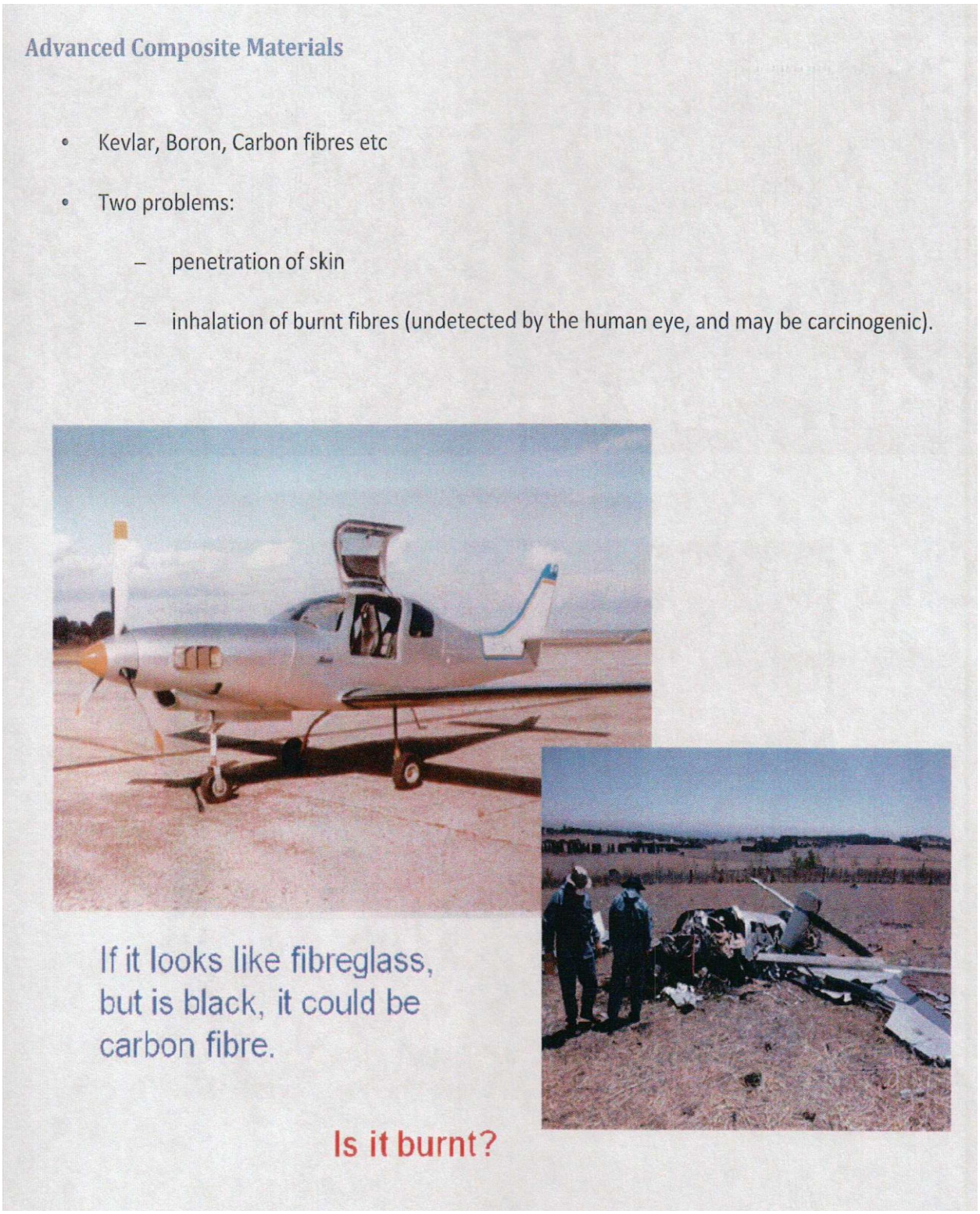
Particular concern has been raised about the potential hazard posed by damaged composite structures. Research into these hazards has been conducted at various times following the early use of composites on aircraft, although it is acknowledged that more research on the health hazards posed is required.

Research on carbon fibre indicates that this material exhibits minimal fibrogenic activity and little evidence of lung toxicity in tests. The studies show that carbon fibre is different from asbestos and mineral fibre, and less toxic than silica. As a result of recent unrelated research, some States have proposed that all synthetic mineral fibres under 6 microns (mean diameter) should be classified as irritants, and that some ceramic and mineral wools (types generally not used on aircraft) should be classified as carcinogenic (i.e. capable of causing cancer).

Other research suggests that exposure to the dusts of burnt composites may pose more of a problem than exposure to free fibres. What is clear at the present is that more research is required to be sure of the hazards and levels of risk posed by the range of materials.

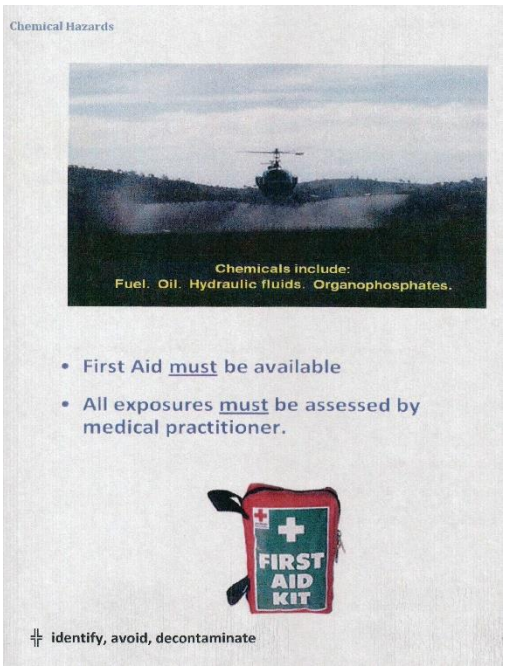
There are other short-term health effects resulting from exposure to the fibres and debris from impacted and combusted composites. Most notably, the fibres are highly irritant, particularly to the eyes, and also to the nose, throat and lungs. There is also still concern that partially burnt debris will cause contact hazards, such as dermatitis. Substances, which are taken into the lungs with fibre and dust, may also cause sensitization (allergies), which is a significant concern.

As with other hazards, appropriate procedures to limit exposure and reduce disturbance will prevent dusts and fibres from becoming airborne and minimize their hazardous nature when they do. Consideration may be given to entering the accident site from an up-wind direction so hazardous exposure is reduced as much as possible, and if encountered, provides a known exit direction with a reduced risk of further exposure.



5.4.3 Chemicals and other substances.

Aircraft contain many chemical compounds, some which may be hazardous in their natural state and others that can become hazardous when exposed to heat or other substances.



For example:

— **Viton** ® is a synthetic rubber-like material containing fluorine used for 'O' rings and gaskets in engines and hydraulic systems. If exposed to high temperatures and moisture, the material may degrade and produce a corrosive substance.

— **Batteries** contain chemicals such as lithium that reacts vigorously with water, and thionyl chloride that decomposes in air to form hydrochloric acid and sulphur dioxide.

— **Hydraulic** fluids may be hazardous in their normal state, perhaps being classed as irritants. Some also become acidic when exposed to temperatures above a certain threshold.

— **Used** mineral oils from engines are widely known to be carcinogenic and are identified in specific legislation in some States.

— Partially combusted fuels and lubricants are known to produce a range of hazardous substances.

— Asbestos, although not frequently used in aircraft construction, has been used in heat shielding materials on and around engines and in various gaskets.

5.4.4 Radioactive materials.

Radioactive materials are often used in small volumes in some aircraft components and are frequently carried as cargo in commercial operations, particularly substances for medical use. Generally, specific radioactivity of these are low, and half-lives are short. However, higher activity material is regularly carried on-board aircraft. Restrictions on packaging these are, however, very strict, ensuring that in the majority of cases, packaged contents will remain effectively inert in the event of an accident.

— **Several** radioactive materials have been used in the construction of aircraft. These are mainly materials with a low specific radioactivity, and therefore pose a low risk in their normal state. However, when reduced to dust after fire, they are likely to pose a hazard to health if ingested or inhaled. Depleted uranium has been used in ballast weights for control surfaces in a range of civil and military aircraft. It was fitted in several hundred early versions of the Boeing 747, in Lockheed aircraft, and in stretched versions of the Hercules C130 aircraft. This material has also been used to manufacture tip weights for helicopter main rotor blades.

— **Radiologically**, depleted uranium is not classed as a significant risk in its undamaged form. Where particulate is produced, however, e.g. by machining or fire damage, depleted uranium may be ingested, inhaled, or absorbed and, once in the body, the material poses a significant chemical hazard.

— **Thorium**. This material has been used extensively in components for aircraft engines, both piston and turbine, and is often alloyed with magnesium, although at relatively low concentrations. It has also been used in other components such as gearbox casings on helicopter and fixed wing aircraft. Its use has been reduced significantly in recent years, however, there are significant stocks of thoriated components available and these are, presumably, still to be used.

— **Tritium**. Beta lights are used extensively on some civil aircraft to indicate emergency exits and also in instrument lights on some military aircraft. Typical beta lights each contain a total of about 20 curies of tritium gas. Exposure to the contents of a single broken beta light could result in a dose of up to 1/10th of the current acceptable annual limit.

— **Other** *nuclides.* Americium is used in some forward looking infrared (FLIR) systems, Krypton is used within oil level indication systems, and Strontium 90 can be found within ice detection systems and in helicopter rotor crack indicating systems.

5.4.5 Cargo.

There are immense difficulties associated with identifying and assessing risks posed by cargo. A huge variety and volume of freight is carried by air, most of which is identified in some way, although a significant volume carries only a general description.

Dangerous Goods are usually well identified and documented, and information may be gathered (using dangerous goods manifests) at a very early stage to help determine the degree of hazard. While general cargo, by definition, is considered non-dangerous (in transport classification terms), in general health and safety terms, it is quite capable of posing significant hazards. It should be noted that cargo containing dangerous goods and general cargo might include the chemicals and substances mentioned above. Neither mail, nor private goods, both carried by air in large volumes, carry any indication of contents on their packaging.

When carrying out early site assessment work, it is essential to obtain full information about the complete load of cargo as soon as possible. Dangerous Goods manifests may usually be obtained quickly, but general cargo manifests should also be obtained and reviewed at a very early stage. A wide range of information is contained within manifests/cargo documents, including descriptions of packaging, general description of cargo, and contact details of consignors/consignees, etc.

5.5 PSYCHOLOGICAL HAZARDS

Accident investigations frequently require personnel to work in close proximity to disaster and trauma. This work involves dealing not just with the fatally or seriously injured, but also with survivors, relatives and colleagues of the victims. The intensity, scale, and (frequently) long duration of the task can present significant potential for adverse psychological impact on investigation teams.

After past disasters, there have been reports of rescue workers suffering from Post-traumatic Stress Disorder (PTSD), causing sleep disturbance, intrusive thoughts and flashbacks. There is little available evidence to confirm such symptoms amongst accident investigators, suggesting that the psychological impact poses less of a risk to investigators than once thought. However, this more satisfactory outcome may be due to the success of existing safety personnel management practices. These include effective selection processes, the establishment of professionalism at both an individual and team level (including good work practices) and effective peer support.

Psychological impact is still a developing area of research for medical teams, and at this time there are varying opinions as to the degree of hazard that it poses. Nevertheless, it is undeniable that some risk is always present and it is recommended that the prospect of some proactive and responsive counseling is incorporated in risk assessments as a precautionary measure to guard against any trauma resulting from the nature of the work.

Peer support is particularly valuable because colleagues are likely to quickly recognize personality changes in team members and are in a position to suggest timely counseling. In some Contracting States, it has become practice for management teams to employ the services of counselors as a matter of course. They may provide immediate assistance to any or all personnel responding to the accident. Counselors customarily play a passive role, making themselves available to individuals who either seek assistance or are referred for assistance.