الهيئــة العـامــة للطيـــران المـدنـــي
GENERAL CIVIL AVIATION AUTHORITY

United Arab Emirates

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Technical Guidance

for

Air Accident Site Safety and Control

CONTENTS

FOREWORD

Individuals attending the accident site are exposed to a wide range of occupational health and safety hazards including physical, biological, and psychological resulting from the wreckage, site nature, traumatic effects.

This Technical Guidance is promulgated to provide information on the full range of hazards that may exist at various locations and different climates, as well as the protection measures that should be taken by individuals at the accident site.

Additionally, this Technical Guidance outlines hazards that may exist in accident sites located in other States where the accredited representative of the United Arab Emirates and his advisers may travel to as participants in investigation conducted by the States of Occurrence.

When the site is handed over to the Investigation Authority (Appendix C – *Accident Site Handover Form*), the Investigation Authority's site safety officer (SSO) will become responsible for the site safety. For safe and effective control of the accident site, the SSO is responsible for ensuring that the site is secured prior to the commencement of the investigation work and assisting others in maintaining occupational health and safety.

The SSO starts an initial risk assessment from the available notification information before departure to the site. The assessment will continue upon arrival at the site in coordination with the incident commander. The SSO will then develop countermeasures to the identified risks and ensure that they are applied. Also, the investigator-in-charge (IIC) and SSO will ensure that all attendants at the site are wearing personal protective equipment (PPE) and use extreme caution when working in and around the wreckage.

Once such actions have been taken, work at the site will be permitted. All individuals should be advised to remain alerted for any undeclared hazard and, if such hazard is found, should immediately notify the IIC and/or SSO so that appropriate measures can be taken. However, the SSO will continue assessing the risks under "dynamic risk assessment" procedures and advise the IIC about the results. It is possible that the site work be terminated, delayed, or modified in case a new hazard is identified until the proper risk mitigations are implemented.

If an occupational safety or health incident takes place to any of the site attendants, the SSO will call for medical emergency and provide the necessary first aid assisted by other trained attendants.

GENERAL

If the risk remains unacceptable, activities will have to be delayed or modified and a new risk assessment shall be carried out.

ICAO Circular 315 recommends applying a Risk Management (RM) process to the accident site hazards involving the cycle of: 1) identifying hazards, 2) identifying exposure routes, 3) assessing risk, 4) introducing controls, and 5) reviewing and revising the risk assessment.

Exclusion zones and hazard prevention

The secure area may vary depending on the spread of the wreckage and the terrain, but it should normally extend to at least 50 meters from the edge of the wreckage.

To minimize the risk of inadvertent fire, the Investigation Authority will establish a no-smoking zone around the accident site. Volatile/flammable materials, such as fuel, may have been scattered over a wide area.

When using cutting devices, protective measures must be taken to avoid igniting spilled fuel.

To prevent the ingestion of harmful materials, including biological hazards, the Investigation Authority will establish a no-eating zone around the accident site.

Due to the possible ignition of fuel or damaged ordnance by radio emissions, portable communications equipment should NOT be used in the immediate vicinity of the accident site.

Approaching the wreckage

- Be aware of—
  - the aircraft type and potential hazards of the aircraft type
  - the location of accident site and the potential hazards reaching the site
  - the potential hazards at the accident site
- Listen carefully to the brief of the SSO
- Get clearance from the SSO before entering the site
- Register your name and enter from the check-in/out point. All attendants' names, their organizations, the investigation group they belong to, their contacts, and signatures must be recorded in *Site Attendance Record* (Appendix D)
- Protect yourself and wear appropriate PPE, including gloves, eye and breathing protection as required
- Protect against environmental conditions and exposure to heat of the sun and cold weather
- Have sufficient fluids and energy food, and clothing if required
- Be alert and always assume that hazards exist
- Take necessary communication equipment
- Approach from upwind (with the wind at your back) and downhill if possible
- Be aware of power cables that might have contributed to the accident and may still be live
- Respect the human remains. The human remains will be marked and notified to the local authority responsible for body identification and autopsy.

CAUTION

To avoid damaging the crash path, only the Investigation Authority investigators, or persons supporting them, are allowed to drive in the accident site. Occupants may have been ejected from the aircraft, and tire marks and traffic can destroy valuable ground impact marks

SITE HAZARDS, ASSOCIATIVE RISKS, AND MITIGATIONS

The sections below summarize the most popular air accident site hazards. Each of them is given a number that refers to the hazard register.

Appendix A – *Site Risk Matrix*, contains the general assessment information. Appendix B - *Accident Site Risk Assessment Checklist*, lists all the hazards and their mitigations.

Unstable wreckage
[HAZ-01]

Risk description

During handling and moving the wreckage, it may shift, roll over, or be suspended in trees which may cause injuries to the site attendants.

Risk mitigation

- Use protective clothing
- Moving large parts of wreckage should be supervised by investigators and carried out by professional operators using appropriate equipment
- When cranes are used, it is advisable for investigators to remain upwind of the wreckage to limit their exposure to soot, dust and other airborne substances
- If, for some reason, a part of the wreckage is left suspended, no work should take place underneath it or nearby as the cables and chains may fail and wreckage drop.

Fuel or other flammable liquids and gases
[HAZ-02]

Risk description

Aircraft fuels are a primary hazard in case of post-crash fires. If ignited, they pose danger to survivors, rescue and fire services personnel, investigators, and other site attendants.

Aircraft fuels will come from one of the following groups:

- **Avgas** is a high-octane aviation petrol suited for piston-engine aircraft. It has a relatively low flash point and is highly flammable and volatile. Avgas is used in most civil general aviation aircraft
- **Avtur** is the kerosene-type fuel used in all jet or turboprop aircraft and does not possess the low flash-point qualities of Avgas. However, when heated its flashpoint is reduced significantly. This fuel burns longer and more intensely than Avgas
- **Diesel** is also used in some general aviation aircraft and has similar characteristics to Avtur
- **Water Methanol** can be used in small quantities to provide extra power for some turboprop aircraft. This substance is alcohol-based and burns without a visible flame. If ignited during a crash, alcohol foam may be required to extinguish the flames.

  Warning. Water methanol is toxic. Wear full PPE if this substance is suspected.

  Figure 1 illustrates a chart used by the rescue and firefighting personnel indicating flammable material locations.

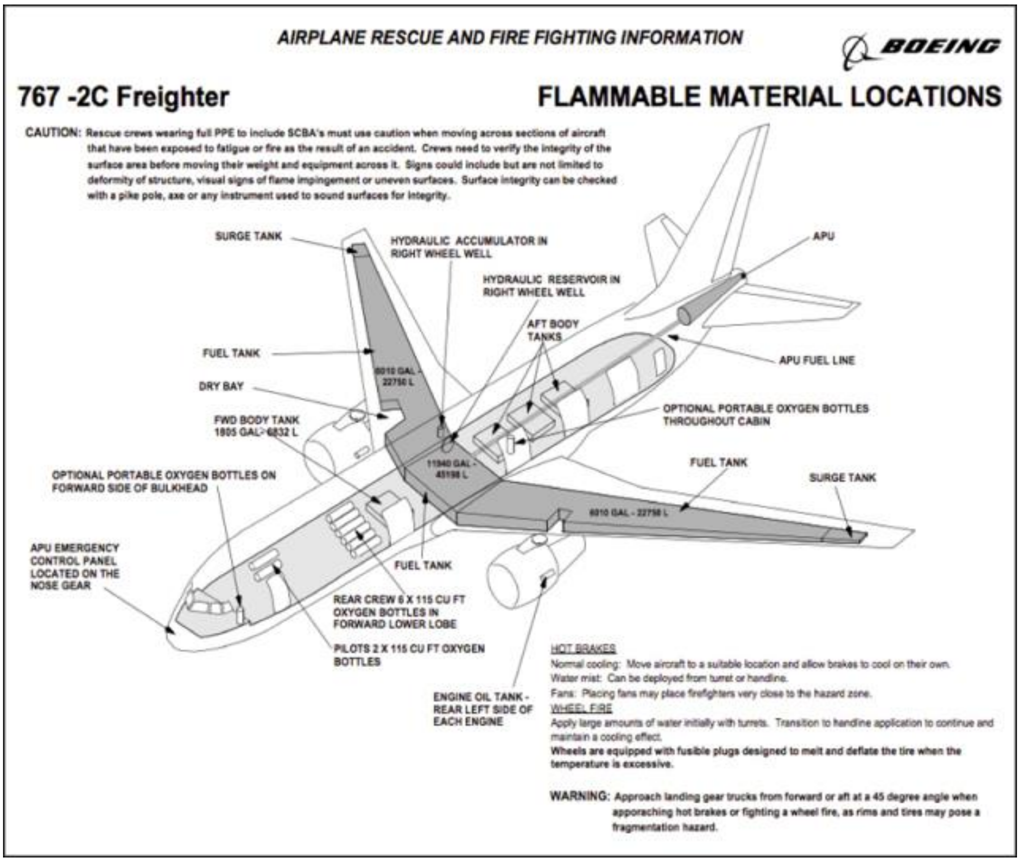

Figure 1. Example aircraft rescue and firefighting information – flammable material locations

Risk mitigation

- If aircraft fuel tanks are still intact, they should be emptied
- The quantity of fuel removed from each tank should be measured and recorded
- Firefighting equipment should be readily available while a high fire risk remains
- No smoking is permitted within the guarded area
- If there has been a large spillage of fuel, the investigators must control any activity that could increase the possibility of ignition, such as moving parts of the wreckage
- Exercise care to control possible sources of ignition, such as static electricity
- The operation of radio or electrical equipment or the use of salvage equipment should be avoided until the fire risk has been assessed and eliminated.

Metal structures

[HAZ-03]

Risk description

- If subjected to intense heat, metals can produce hazardous situations or develop toxic side effects
- Magnesium and aluminium metals in various mixtures are used extensively as structural

components in aircraft, particularly where lightweight framing is used

- Magnesium burns with intense heat and radiates powerful light
- Magnesium is also used in pyrotechnics which is the art of making and using fireworks
- Other hazardous metals such as cadmium, depleted uranium, and beryllium are used in small quantities on some aeroplanes and helicopters and can be extremely toxic when exposed to fire or cutting equipment.

Figure 2 illustrates an example of aircraft wreckage, and figure 3 illustrates an example of magnesium explosion during applying water.

Risk mitigation

- Water should NOT be applied as an extinguishing agent to burning magnesium as an explosion may occur

Figure 2. Example of aircraft wreckage

Figure 3. Magnesium explosion during water application

- Consult the firefighter experts, aircraft maintenance personnel, and design and manufacturer experts for identifying the metals, and obtain guidance for the safe handling practices.

Composite material

[HAZ-04]

Risk description

- Composite materials such as carbon fiber, fiberglass and/or kevlar in epoxy resin are used increasingly in modern aircraft and equipment
- Composite materials typically consist of carbon/graphite or boron/tungsten and are found in many parts of an aircraft, including the structural skin, control surfaces, access panels, cabin materials, cabin seats, rotor blades, and propeller blades
- Some aircraft are built entirely of composite materials. Fiberglass is found in soundproofing blankets, cockpit and cabin panels, cargo bin liners and other aircraft furnishings
- Composite materials and fiberglass may be hazardous to the eyes, skin and respiratory system, especially if the wreckage has been damaged by fire
- When involved in a fire, these materials may give off toxic fumes, and fibers may be released in the smoke plume. The small fibers released can be extremely hazardous if inhaled
- A significant composite material hazard is related to burnt carbon fiber, particularly in a high-speed impact associated with a simultaneous explosive fire
- Whether burnt or not, damaged composite fibers and shards can easily puncture the skin.

Figure 4 illustrates carbon fiber exposed to fire.

Figure 4. Carbon fiber exposed to fire

Risk mitigation

- Handling of composite materials should be minimized and only undertaken with protective equipment such as leather gloves and safety glasses or a face shield
- When handling these materials, site attendants should avoid the fibre dust by remaining upwind; and wearing goggles and face masks

- Only personnel equipped with self-contained breathing apparatus (SCBA)[1] or full-face canister respirators with appropriate cartridges should enter the accident site until all fires are extinguished and loose composite fibers suppressed
- Disposable coveralls may be needed. Contaminated clothing should be washed separately
- Splinters from fractured fibreglass panels and composites may cause injuries and should be handled with gloves
- Composite materials can be suppressed in the short term by firefighting foam, but longer term suppression can be provided by spray-on acrylic floor or a similar product or poly-acrylic acid. Be aware that once a suppressant is applied, it will be only useful until the affected area is again disturbed. It must then be re-applied to that area
- If composite and fibreglass materials have been damaged by fire, they should be sprayed with water or preferably with a fifty-fifty solution of acrylic floor wax and water before handling.

Toxic gases and chemicals
[HAZ-05]

Risk description

- Toxic gases are given off when some plastics and adhesives are burnt
- After any fires have been extinguished, loose fibers should be avoided
- Some materials used in aircraft construction may be rendered harmful after heating in a fire and then being extinguished with water. Their products may be strongly acidic (for example, fluoropolymers such as Viton O-rings used in some engines, which yield hydrofluoric acid), or dangerous to ingest (for example, some magnesium alloys or depleted uranium)
- Dust (or paper) masks cannot protect against toxic gases.

Risk mitigation

- It is imperative that all personnel at the accident site wash all exposed areas of skin before eating, drinking, or smoking
- Should emergency services personnel at the site exhibit respiratory distress or skin irritation, they should evacuate the site and institute HAZMAT (hazardous material) procedures for liquid hazards
- Any personnel with respiratory distress or skin irritation should evacuate the site and seek immediate medical attention.

Asbestos
[HAZ-06]

- Asbestos can be present in wheel brake pads and, in some older aircraft, as a heat shield such as in a firewall behind an engine or packed around the exhaust of a jet engine

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[1] SCBA: An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user. [Reference: https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134]

- It was also used in smaller quantities in high-temperature plastics and electrical wire insulation. It is uncommon in newer aircraft
- Asbestos poses a risk when it is in the form of airborne particles, so suppression with floor polish or similar wetting products limits the risk
- Asbestos dust causes health problems that may lead to serious diseases such as cancer known as (Mesothelioma), which forms tumors in the lungs, abdomen, or heart, its symptoms may begin with breathing problems and chest pain, and may lead to death within 12 months after diagnosis.

Risk mitigation

OSHA 29 CFR 1910.1001 Proof (F) (3) and Annex (F) contain general guidelines for the avoidance and prevention of asbestos dust.

Tires
[HAZ-07]

Risk description

Tires may be damaged on impact or in a hard landing and thus could explode at any time.

Risk mitigation

- Tires should be approached from the front or the rear and should be deflated as soon as possible
- Disassembly and inspection are best done at a tire shop.

Figure 5 illustrates pressurized tire as found at the accident site.

Figure 5. Pressurized tire as found at the accident site

Potential explosives
[HAZ-08]

Risk description

- These are pressure or chemical containers/vessels such as:
  - oxygen bottles

  - fire extinguisher bottles (fixed and handheld)
  - protective breathing equipment
  - nitrogen containers
  - evacuation slide inflation bottles,
  - flares
  - generators
  - hydraulic accumulators
  - high-pressure tires
  - landing gear struts and tires
  - pressurized night sun spotlight bulbs
- Solid-state chemical oxygen generators can reach temperatures of 400 ºC when they are activated
- When subjected to heat or damage, pressure containers and vessels may produce secondary explosions
- Oxygen lines can run the length of an aircraft, and if broken or cut, can cause an explosion or fire
- Aircraft restraint system with an airbag built into the restraint webbing (self-contained, not connected to aircraft power systems)
- Some civil general aviation aircraft types are fitted with rocket-deployed emergency recovery parachute systems. The parachute rocket units contain rocket propellant
- For military aircraft, rocket-powered or explosive cartridge-powered ejection seats, pyrotechnics, and unexploded ordnance stores.

Figure 6 illustrates examples of pressurized containers.

Figure 6. Examples of pressurized containers

Risk mitigation

All such items should be rendered safe with the assistance of experts and removed from the site.

Batteries
[HAZ-09]

Risk description

- Batteries may trigger sparks if contacted to metal surfaces, or open wires
- Battery acid is extremely corrosive
- The risk is more severe when large quantities of fuel have been liberated from the aircraft fuel tanks.

Risk mitigation

- Batteries should be disconnected and removed from the site
- Caution should be exercised when disconnecting and removing batteries because sparks could ignite spilled fuel and other flammable materials.

Propellers
[HAZ-10]

Risk description

Some propellers have feathering springs, and if the hub is cracked, it can come apart forcefully.

Risk mitigation

Investigators should not attempt to disassemble a propeller unit. This practice should be left to the expert.

Radioactive material
[HAZ-11]

Risk description

Table 1 illustrates examples of radioactive materials used in aircraft construction.

Table 1. Radioactive materials used in aircraft construction[2]

Material	Aircraft	Where it is used	Description of the extremist risk
Alloys, including Thorium	Various aircraft	Intakes, gearboxes, lens coatings	If inhaled as dust, thorium may remain in the lungs for a long period of time and cause an increased risk of developing lung or bone cancer, depending on the chemical form. If ingested, thorium typically leaves the body through faeces and urine within several days. The small amount of thorium left in the body will enter the bloodstream and be deposited in the bones where it may remain for many years.
Americium 241	Various aircraft	Smoke detectors, fuel cell densitometers,	Am-241 is primarily an alpha emitter, but also emits some gamma rays. It poses a more significant risk if ingested (swallowed) or inhaled. Once in the body, it tends to concentrate in the bone, liver, and muscle. Americium can stay in the body

[2] Reference: Air Accidents Investigation Branch, the United Kingdom

Reference: The United States Environmental Protection Agency [www.epa.gov]

		FLIR systems	for decades and continue to expose the surrounding tissues to radiation, increasing the risk of developing cancer.
Krypton	Many	Oil indicating systems	Krypton is considered to be a non-toxic asphyxiant. Krypton has a narcotic potency seven times greater than air, and breathing an atmosphere of 50% krypton and 50% natural air (as might happen in the locality of a leak) causes narcosis in humans similar to breathing air at four times atmospheric pressure. This is comparable to scuba diving at a depth of 30 m (100 ft) (see nitrogen narcosis) and could affect anyone breathing it. At the same time, that mixture would contain only 10% oxygen (rather than the normal 20%) and hypoxia would be a greater concern.
Radium	Various aircraft	Paints in warning signs	High rates of bone, liver, or breast cancer can result from chronic exposure to high levels of radium. Radioactive gas and radon are produced as radium decay. Radon is considered as the second leading cause of lung cancer in the United States.
Strontium 90	Helicopters	Anti-ice systems, blade integrity	When Strontium-90 enters the body mainly through food and water digestion, it acts like calcium, and it incorporates into bones and teeth. Sr-90 can cause cancers of the bone, bone marrow, and soft tissues around the bone. Sr-90 can also be inhaled.
Tritium	Various	Luminescent paints	Tritium emits a very weak beta particle. Tritium primarily enters the body in 3 forms: • When people swallow tritiated water • When people inhale tritium as a gas in the air • When people absorb it through their skin. When tritium enters the body, it disperses and spreads quickly and uniformly throughout the body, and it goes directly into soft tissues and organs. Though, tritium leaves the body in the urine within a month or so. Organic bound tritium can remain in the body for longer period of time.
Depleted Uranium	C5, C130, C145 DC/KC10, L-1011, B747	Ailerons, rudder Elevator, rudder	Depleted Uranium emits alpha particle radiation, though the particles do not go through the skin as alpha particles do not have enough energy. Therefore, exposure to the outside of the body is not considered a serious hazard. However, it poses a serious health hazard if Depleted Uranium is ingested or inhaled. Alpha particles directly affect living cells and can cause kidney damage.

Risk mitigation

Only personnel equipped with SCBA should enter the accident site until all fires are extinguished.

Soot and insulation materials
[HAZ-12]

Risk description

Soot and insulation materials are hazardous in confined spaces, such as the cabin or cargo bins.

Risk mitigation

Face masks and eye protection should be worn when working in such spaces.

Dangerous/hazardous cargo
[HAZ-13]

Risk description

- Dangerous goods may include such items as radioactive consignments, explosives, ammunition, corrosive liquids, liquid or solid poisons, or bacterial cultures
- Dangerous/hazardous cargo and small amounts of radioactive material may be present or scattered on the accident site
- Although with appropriate packaging, and protection against rough handling and moderate impact conditions, it is impossible to maintain dangerous/hazardous cargo integrity in a high-energy impact scenario
- A post-impact fire could damage the packaging and shielding, and the ensuing heat may cause the radioactive material to change into gaseous form, in which case radiation may spread
- Immediately obtain and review the cargo manifest as hazardous cargo may be present or scattered on the accident site.

Risk mitigation

- Timely coordination with carrier personnel responsible for the cargo manifest
- When appropriate, or in case of doubt, consult the manufacturers of the material involved regarding exposure hazards and protective measures
- In cases of radioactive materials changing into gas state, all participants in the rescue and firefighting operations should be checked, decontaminated, and placed under medical observation, as necessary
- No examination of the wreckage should be initiated until the level of radiation has been measured and the site declared safe.

Agricultural
[HAZ-14]

Risk description

- Agricultural/aerial spraying aircraft chemicals can be poisonous and can react with water to form poisonous gases
- The presence of chemicals at the site is often denoted by the strong smell and a coating on the surface of the ground along the accident trail.

Risk mitigation

Refer to a chemist for these hazards.

Biological hazards
[HAZ-15]

Risk description

- Investigators are at risk of exposure to biological hazards, including blood-borne pathogens such as HIV and HBV

- Biological hazards may be present in the cockpit and cabin wreckage as well as the ground where bodies and survivors have lain
- The accident site may contain liquid, semi-liquid and dried blood, other bodily fluids, fragmented bones, tissues, and internal organs. In the dried state, particles of these substances may become airborne and come into contact with unprotected eyes, nose, and mouth.

Risk mitigation

- Precautions must be taken to prevent the viruses from entering mucous membranes (such as the eyes, nose, and mouth) or non-intact skin such as open cuts or rashes
- Since it is not possible to readily identify contaminated blood and other commingled bodily fluids, it is prudent to take precautions when working around and in the wreckage, when handling the wreckage at the site, and when performing off-site examinations and tests on wreckage parts
- As part of the investigation-planning process, appropriate precautionary measures should be taken. 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 those precautions are maintained throughout an investigation;
  - procedures for the maintenance of PPE inventory;
  - proper methods for donning, removing, and disposing of contaminated PPE;
  - 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.
- Areas contaminated by spilled blood or bodily fluids should be identified and roped off and have only one single point of entry/exit
- Only persons using PPE should be allowed access to the contaminated areas
- Any components that are removed from the accident site for examination and testing should be treated with the same care as exercised at the accident site

  (The most common contaminated items include all cabin interior materials, i.e. seat belts/shoulder harnesses, seat cushions, other upholstery and trim materials, and instrument panels.)
- While wearing PPE in the biological hazard area, site attendants should not eat, drink or smoke, apply cosmetics, lip balm or sunblock, touch the face, eyes, nose or mouth, or handle contact lenses
- Biological hazard waste, such as clothing and contaminated PPE, should be disposed of
- Contaminated PPE should never be reused

- Site attendants who donned the bio-hazard suit 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
- Exposed skin should be wiped immediately with moist towels, and then washed with soap or any strong sterilizer
- 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
- Site attendants should be aware that wearing PPE in hot and humid climates may result in heat stroke unless precautions are taken to minimize heat stress. Thus, before donning PPE, a liter or more of water should be consumed
- Depending upon the heat and the humidity, and the amount of physical exertion required, it may be necessary to limit the time that site attendants can wear PPE. Once they have left the bio-hazard area, removed and disposed of their PPE, and disinfected their hands, site attendants 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 site attendants who have experienced heat stress
- Since it is important to minimize the number of site attendants, tools, and equipment that could come into direct contact with contaminated materials, only a selected number of persons should be assigned by the IIC to handle wreckage and disassemble components. Other site attendants could be assigned to take notes, draw diagrams, take photographs or use the 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
- Dispose any equipment that cannot be readily disinfected in bio-hazard disposal bags. The disposal bags and their contents are usually incinerated at appropriate facilities, such as hospitals.

Environmental & natural hazards

[HAZ-16]

Extreme Climate – Cold Weather

- Wear sufficient protection to prevent frostbite and hypothermia
- Wear layered clothing that will absorb perspiration
- Be aware of whiteout conditions, as disorientation can occur in uniformly bright and white surroundings.

Extreme Climate – Hot Weather

- Bring sufficient liquids for personal drinking needs
- In situations of high temperatures and humidity, combined with heavy exertion, drink at least half a liter of water or juice per hour
- Be aware of symptoms of heat stress and heat stroke

- Wear a wide-brimmed hat and loose-fitting clothing
- Apply sunblock.

Mountainous Terrain

The hazards of working at high elevations are altitude sickness, which is characterized by dizziness, headaches, loss of appetite, difficulty sleeping, aches and pains, a pale complexion, and loss of energy.

- Activities should be paced to conserve energy
- A briefing shall be provided to all site attendants
- If altitude sickness is suspected, the person should sit or lie down; In severe cases, the person should descend immediately to a lower altitude
- Limit physical exertion above 8,000 feet above sea level
- Keep hands free on steep climbs
- Rest frequently
- Have oxygen and other emergency equipment available at high altitudes
- Drink water or juice often to avoid dehydration
- Wear sunblock, sunglasses, and a hat
- Seek advice from the local guides who should, ideally, be accompanying the investigation team.

Deserts

- Wear a wide-brimmed hat, loose-fitting clothing, sunglasses, sunblock, and goggles
- Bring plenty of drinking water
- Limit activities during the heat of the day and set up open-sided sun shelters
- Employ local drivers; navigating on sand dunes and unmarked roads can be hazardous even in a 4WD vehicle
- Ensure that appropriate clothing and shelter suitable for temperature decreases at night are available.

Jungles

- Secure trouser legs and the tops of boots with rubber bands, strings, or duct tape to protect against leeches, insects, and crawlers
- Bring plenty of drinking water
- Compensate for the heat and humidity by reducing activities
- Maintain communications with others.

Swamps

- If swamp boats are used as a means of transportation, wear a life jacket and earplugs
- If walking in water, wear chest waders and use a tall walking stick to find level footing and

to determine water depth

- Prevent swamp water from coming into contact with open cuts and sores, since swamp water may be contaminated
- Avoid travel or work at night
- Wear clothing that covers the skin and a wide-brimmed hat with a mosquito net
- Protect against insects and leeches, as well as snakes, alligators, and crocodiles.

Poisonous plants, dangerous animals and insects
[HAZ-17]

Risk description

- The danger from plants, animals, and insects varies with location, weather, elevation, time of year, etc.
- Although most wild animals will avoid contact with humans, there are some species that are dangerous
- Poisonous snakes and mosquitoes transmit malaria and yellow fever, and are prevalent in many areas
- Ticks, which inhabit fields and forests, may carry bacterial diseases, such as Lyme disease, a bacterial infection caused by the bite of an infected tick.

Risk mitigation

- The advice of local experts should be obtained regarding the danger from plants, animals, and insects in the site
- Snakebite serums should be included in the investigator’s first aid kit
- Any protective product that contains diethyl-meta-toluamide (DEET) in a 25 to 30 percent solution should be an effective mosquito repellent

  Note. Concentrations of DEET higher than 30 percent may irritate the skin. Mosquito repellents of this type contain a solvent that may melt plastics found on cameras, watches, small tools, etc.

- For anyone working in areas where malaria and yellow fever are prevalent, take anti-malarial drugs and be inoculated against yellow fever
- When working in areas that may be infested with ticks:
  - Wear long pants and long sleeves
  - Secure pant legs with duct tape or rubber bands
  - Spray a permethrin-type tick repellent on clothing
  - Use a repellent containing the compound DEET on exposed skin areas, except for the face
  - Check the entire body for ticks daily
  - Immediately remove ticks from the skin.

Urban area
[HAZ-18]

Risk description

If the accident site is located in an urban area, the following hazards are prevalent:

- Downed power lines
- Leaking natural gas
- Heating oil or other flammable liquids or gases
- Buildings that have become structurally unsound from fire or impact damage.

Risk mitigation

Initial and dynamic risk assessments may be required to be conducted by experts.

Helicopter operations
[HAZ-19]

Helicopters are often used to reach accident sites in rugged terrain and remote areas as well as for:

- Travelling to and from the accident site
- Searching for and removing bodies and wreckage
- Aerial photography
- Flying the flight path of the accident aircraft.

Risk description and mitigation

- All persons associated with helicopter operations should be briefed on proper safety procedures, including the use of exits, headsets, restraint systems, emergency equipment, and if involved in overwater operations, the flotation gear
- The safety briefing should also address how to approach the helicopter, the main and tail rotor hazards, and the effects of rotor wash
- Never wear headgear when entering or leaving a helicopter and never go near the tail-rotor.

VACCINATION

It is highly recommended that investigators are protected against harmful biological hazards including blood-borne pathogens that he may be exposed to during the course of the investigation at the accident site.

It should be noted that in case of an accident of a UAE-registered aircraft outside of United Arab Emirates, some of foreign investigation agencies will not permit an investigator to access an accident site without proof of vaccination.

Reference for vaccination requirements are mentioned under:

- Hepatitis A&B - every 10 years
- Chicken Pox
- Mums/Measles/Rubella (MMR) - life
- Polio - booster every 10 years
- Diphtheria/Tetanus - Diphtheria/Tetanus (every 10 years);
- Yellow Fever - every 10 years
- Typhoid - every 3 years;
- Varicella - life
- Cholera
- Meningitis - every 5 years A&B
- Rabies – life
- Vaccination for Covid-19.

Investigators are encouraged to take Malaria tablets if travelling to a potential destination known for malaria.

However, the Investigation Authority will not have control over the accredited representatives from foreign States and their advisers, advisers to the investigator-in-charge, or support personnel from the various organizations to be fully vaccinated and carry a valid vaccination card. In such cases, the Investigation Authority may provide support to them, nevertheless, they will remain responsible for their health and safety through their organization’s general risk assessment or any equivalent site safety program. Accordingly, the IIC will request every site attendant to sign the Risk Disclaimer Statement (Appendix E) to relieve the Investigation Authority from liability or obligation of death, injury, or disease.

INVESTIGATORS AND SUPPORT STAFF FATIGUE

Annex 6 to the Chicago Convection defines fatigue as: "A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload."

The FAA defined fatigue as “Depletion of body energy reserves, leading to below-par performance.”

SKYbrary describes the term “fatigue”, of pilots, as the general term used to describe physical and/or mental weariness which extends beyond normal tiredness.

Physical fatigue concerns the inability to exert force with muscles to the degree that would be expected. It may be an overall tiredness of the whole body or be confined to particular muscle groups. Physical fatigue most commonly results from physical exercise or loss of sleep. Physical fatigue often leads to mental fatigue.

Mental fatigue, which may include sleepiness, concerns a general decrease in attention and ability to perform complex, or even quite simple tasks with customary efficiency. Mental fatigue often results from loss or interruption of the normal sleep pattern.”[3]

Investigators and other site attendants are vulnerable to both types of fatigue, especially in the context of the accident site stressful environment and challenges.

Fatigue may be intensified in case of major accidents that take place in airports or urban areas outside the airports since the public, media, and returning to operations continuity will put significant pressure on the Investigation Authority to accomplish the accident site tasks as fast as possible. This would require the investigators and their support personnel to work around the clock on the accident site documentation, evidence collection, and wreckage removal.

The accident site work may be lengthy with several daily working hours. In addition, the experienced human resources are normally limited, therefore rotation of more than one investigator or expert based on the roster is not a possible solution. This means that investigators and experts are obliged to work for long hours under abnormal conditions.

This requires the Investigation Authority and aviation organizations who participate at the accident site to consider fatigue preventive measures such as:

- Plan the site investigation activities considering break times
- Consider the circadian rhythm of individuals from the same environment (company, organizations, State, etc.)
- Enhance communication channels with the IIC

The SSO shall consider comfortable rest places for the investigators and support staff and also employ the MoUs with other stakeholders for providing assistance for such accommodations.

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3 https://skybrary.aero/articles/fatigue

POST-TRAUMATIC STRESS DISORDER (PTSD)

Reference: *https://www.mayoclinic.org/diseases-conditions/post-traumatic-stress-disorder/symptoms-causes/syc-20355967*

Introduction

An accident may cause serious stress to persons involved in the accident site. Those accidents with a large number of fatalities may induce psychological stress, not only to investigators but also to persons involved in the search for and identification of bodies.

Symptoms

PTSD symptoms may start within one month of a traumatic event, but sometimes symptoms may not appear until years after the event. These symptoms cause significant problems in social or work situations and in relationships. They can also interfere with the investigator's ability to accomplish his normal daily tasks.

PTSD symptoms are generally grouped into four types: intrusive memories, avoidance, negative changes in thinking and mood, and changes in physical and emotional reactions. Symptoms can vary over time or vary from person to person.

Intrusive memories

Symptoms of intrusive memories may include:

- Recurrent, unwanted distressing memories of the traumatic event
- Reliving the traumatic event as if it were happening again (flashbacks)
- Upsetting dreams or nightmares about the traumatic event
- Severe emotional distress or physical reactions to something that reminds you of the traumatic event.

Avoidance

Symptoms of avoidance may include:

- Trying to avoid thinking or talking about the traumatic event
- Avoiding places, activities or people that remind you of the traumatic event.

Negative changes in thinking and mood

Symptoms of negative changes in thinking and mood may include:

- Negative thoughts about yourself, other people, or the world
- Hopelessness about the future
- Memory problems, including not remembering important aspects of the traumatic event
- Difficulty maintaining close relationships
- Feeling detached from family and friends

- Lack of interest in activities you once enjoyed
- Difficulty experiencing positive emotions
- Feeling emotionally numb.

Changes in physical and emotional reactions

Symptoms of changes in physical and emotional reactions (also called arousal symptoms) may include:

- Being easily startled or frightened
- Always being on guard for danger
- Self-destructive behavior, such as drinking too much or driving too fast
- Trouble sleeping
- Trouble concentrating
- Irritability, angry outbursts, or aggressive behavior
- Overwhelming guilt or shame.

Intensity of symptoms

PTSD symptoms can vary in intensity over time. You may have more PTSD symptoms when you're stressed in general, or when you come across reminders of what you went through. For example, you may hear a car backfire and relive an explosion.

When to see a doctor

If the investigator has disturbing thoughts and feelings about a traumatic event for more than a month, if they're severe, or if he feels having trouble getting his life back under control, he shall inform DAAI for arranging for a psychiatric or a mental health professional consultancy. Getting treatment as soon as possible can help prevent PTSD symptoms from getting worse.

The SSO shall coordinate with a practitioner for such treatment and obtain all necessary approvals.

All measures shall be immediately and diligently undertaken to prevent any consequences and get the treatment appropriately.

Causes

- The investigator can develop a PTSD when he goes through, sees, or learns about an event involving actual or threatened death or serious injury
- Doctors are not sure why some people get PTSD. As with most mental health problems, PTSD is probably caused by a complex mix of:
  - Stressful experiences, including the amount and severity of trauma you've gone through in the investigator's life
  - Inherited mental health risks, such as a family history of anxiety and depression
  - Inherited features of the investigator's personality — often called "temperament"

- The way the investigator's brain regulates the chemicals and hormones that the body releases in response to stress.

Risk factors

- People of all ages can have PTSD. However, some factors may make an investigator more susceptible to developing PTSD after a traumatic event, such as:
  - Experiencing intense or long-lasting trauma
  - Having experienced other trauma earlier in life, such as childhood abuse
  - Having a job that increases your risk of being exposed to traumatic events, such as military personnel and first responders
  - Having other mental health problems, such as anxiety or depression
  - Having problems with substance misuse, such as excessive drinking or drug use
  - Lacking a good support system of family and friends
  - Having blood relatives with mental health problems, including anxiety or depression.

Complications

- PTSD can disrupt your whole life — the job, relationships, health, and enjoyment of everyday activities.
- Having PTSD may also increase the investigator's risk of other mental health problems, such as:
  - Depression and anxiety
  - Issues with drugs or alcohol use
  - Eating disorders
  - Suicidal thoughts and actions.

Prevention

- After surviving a traumatic event, many people have PTSD-like symptoms at first, such as being unable to stop thinking about what has happened. Fear, anxiety, anger, depression, and guilt are all common reactions to trauma. However, the majority of people exposed to trauma do not develop long-term post-traumatic stress disorder.
- Getting timely help and support may prevent normal stress reactions from getting worse and developing into PTSD. This may mean turning to family and friends who will listen and offer comfort. It may mean seeking out a mental health professional for a brief course of therapy. Some people may also find it helpful to turn to their faith community.
- Support from others also may help prevent you from turning to unhealthy coping methods, such as misuse of alcohol or drugs.

OVERSIGHT OF ORGANIZATIONS

- The Investigation Authority shall ensure that organizations maintain sufficient guidance material to assist their personnel who may be assigned tasks at the accident site.
- The guidance material shall incorporate generic risk assessment, and a list of maintained necessary logistics for their personnel health and safety.
- Special attention shall be given to:
  - a register of accident site hazards;
  - risk assessment matrix and mitigations;
  - generic plans and procedures including a common risk assessment and site control plan;
  - handling PTSD and human fatigue;
  - the availability and maintenance of PPE;
  - training program including familiarization with site hazards, risk mitigations, first aid, and blood-borne pathogens; and
  - maintenance of vaccination records, as required.
- The Investigation Authority will review the organizations' procedure periodically. The above contents are to be used as checkpoints.

PPE CONTENTS

The following provides general PPE contents:

- *Disposable latex gloves.* Latex gloves should be durable even though they are to be worn under work gloves. All latex gloves should be properly disposed of prior to leaving the accident site.
- *Work gloves.* Work gloves should be as durable as practical and provide the hand, wrist, and forearm with puncture and abrasion protection. Leather, nitrile, and kevlar gloves are commonly used. All three types should be disinfected or properly disposed of prior to leaving the accident site.
- *Face mask*s. Face masks should cover the nose and mouth. Masks come in disposable and reusable configurations and should be disinfected or properly disposed of prior to leaving the accident site.
- *Protective goggles.* Protective goggles should enclose the eyes by sealing around the top, bottom, and sides. Common safety glasses are not acceptable. Goggles should be fitted with one-way check valves or vents to prevent fogging and should be disinfected or properly disposed of prior to leaving the accident site.
- *Disposable protective suits*. Protective suits should be durable and liquid-resistant and should fit properly. If possible, they should have elastic-type hoods and elastic pant cuffs. Duct tape can be used to alter the suits and to patch tears. Protective suits should be properly disposed of prior to leaving the accident site.
- *Disposable shoe covers and protective boots.* Disposable shoe covers made of polyvinyl chloride (PVC) or butyl rubber are recommended. Leather, rubber, or Gortex work boots are also acceptable. Disposable shoe covers and protective boots should be disinfected or properly disposed of prior to leaving the accident site.
- *Disinfection chemicals*. Two chemical types are commonly used to disinfect PPE.
- Rubbing alcohol of 70 per cent strength is effective and is available in wet towels, as well as in large hand towels. The most effective disinfectant solution is a mixture of common household bleach and water, with one-part bleach to ten parts of water. Never mix alcohol and bleach.
- *Biological hazard disposal bags*. Biological hazard disposal bags must be used for disposal of the contaminated PPE. The bags are red or orange and are labelled “Biological hazard”. For transport, the disposed material should be double bagged.

FIRST AID

The first aid training that investigator undergoes is a comprehensive training course that incorporates the most popular occupation safety and health incidents and their first aid procedure.

A basic first aid guidance is provided by the University of Maine System. The publication is recognized by the United States Occupational Safety and Health Administration (OSHA) and can be downloaded from the below link:

https://www.osha.gov/medical-first-aid/recognition

The SSO shall maintain the latest revision of this document.

REFERENCES

1. Air Accident and Incident Investigation Regulation (AAIR)
2. Air Accident Site Regulation
3. ICAO Doc 9756, Part 1, section 5.4.6, and Parts 2 and 3
4. ICAO Cir 315 – Hazards at Aircraft Accident Sites
5. Code AAID.GEN.004 – Investigation QRH
6. https://www.mayoclinic.org/diseases-conditions/post-traumatic-stress-disorder/symptoms-causes/syc-20355967
7. https://www.osha.gov/medical-first-aid/recognition

APPENDIX A. SITE RISK MATRIX

Hazard		Exposure Route	Risk	Control
Biological	Blood Borne pathogens • HIV • Hepatitis B/C	• Cuts • Punctures • Via mucous membranes	**Low** Unlikely Probability Critical Severity • Severe injury	• Vaccinate • Control access • Decontaminate • Wear PPE
Chemical	• Petroleum, oil, lubricants/fluids • Metals/ oxides • Viton (rubber)	• Inhalation • Ingestion • Contact	**Medium** Likely Probability Moderate Severity • Minor injury and/or • Degraded operational capability	• Control access • Avoid/cordon • Neutralize • Decontaminate • No eating on site • Wear PPE
Environmental	• Cold/heat • Fatigue • Insects/wildlife • Enemy/Security • Political situation	Variable	**Medium** Likely Probability Moderate Severity • Minor injury and/or • Degraded operational capability	• Control access • Implement site security • Apply work/rest cycles • Feeding/hydration • Insect repellent/sunscreen/ tick removal • Wear clothing appropriate for the weather • Wear PPE
Physical	• Broken structures • Composite fiber • Stored energy • Explosives • Radiological	• Cuts • Punctures • Crush • Inhalation/Ingestion • Contact/proximity	**High** Likely Probability Critical Severity • Severe injury and/or • Significantly degraded operational capability	• Control access • Avoid/cordon • Disarm • Apply Fixant (CF) • Decontaminate • No eating on site • Wear PPE
Psychological	Traumatic exposure	• Direct exposure • Indirect exposure (vicarious trauma, narratives)	**Medium** Likely Probability Moderate Severity • Minor injury and/or • Degraded operational capability	• Control access • Apply work/rest cycles • Monitoring • Limit exposure and control information release • Wear PPE

APPENDIX B. ACCIDENT SITE RISK ASSESSMENT CHECKLIST
[Reference: ICAO Circular 315] *Tips to the user: complete this form as applicable to the nature of the accident site, its environment and topography*
Accident details: ....
Aircraft: ....
Location: .... Date/time..

Category/ [HAZ-#]	Hazard	Identified/ condition	Location	Control measures	Risk acceptable?
Unstable wreckage [HAZ-01]	• Wreckage vulnerable to shifting or roll over • Wreckage suspended in trees • Damaged and unstable structures • Ground installations • Security • Unequal load distribution during aircraft recovery				
Fire [HAZ-02] [HAZ-03] [HAZ-08] [HAZ-09] [HAZ-10]	• Fuel and fuel tanks • Flammable fluids • Leaking oxygen • Leaking or hot batteries • Smoldering materials • Cutting tools and other heat generating sources • Pyrotechnics • Hot brakes and tires • Magnesium				
Composite material [HAZ-04]	• Dust and fibers • Sharp edges • Shards				
Toxic gases and chemicals [HAZ-05]	• Plastic fires • Rubber fires • Adhesive fire • Hydrazine				
Asbestos [HAZ-06]	• Wheel brake • Firewall heat shield • Electrical wire installations • Asbestos dust				
Tires [HAZ-07]	• Inflated tires				
High pressure systems [HAZ-08]	• Hydraulic systems • Pneumatic systems • Shocks, struts • Engine fire bottles • Pressure vessels • Compressed air				

	• Hydraulics • Oleos • Oxygen system • Oxygen bottles • Aerosol containers • Fire extinguishers • Evacuation chutes • Flares • Life rafts/jackets				
Explosives [HAZ-08] [HAZ-13]	• Munitions and weapons • Ejector seat components • Pressurized bottles • Rocket-deployed parachute system • Cartridge-operated devices				
Electrical [HAZ-09]	• Batteries and systems • Battery acid and gases				
Propellers [HAZ-10]	• Feathering springs • Cracked hub				
Radioactive [HAZ-11]	• Weapons and ammunition • Structural materials • Anti-icing systems • Crack indicator systems				
Soot and insulation materials [HAZ-12]	• Combustion residue • Soot • Smoke and smoldering material				
Dangerous/ hazardous cargo [HAZ-13]	• Radioactive consignments • Explosives • Ammunition • Corrosive liquids • Liquid or solid poisons or bacterial cultures				
Agricultural [HAZ-14]	• Spraying chemicals				
Biological [HAZ-15]	• Blood-borne pathogen • Local health hazards				
Environment [HAZ-16]	• Heat stress • Cold exposure • Water hazards • Weather • Terrain				
Poisonous Plants, Dangerous Animals and Insects [HAZ-17]	• Poisonous plants • Poisonous insects and snakes • Ticks • Wild animals				
Urban area [HAZ-18]	• Downed power lines • Leaking natural gas • Heating oil or other flammable liquids or gases • Structurally unsound buildings				

Helicopter operations [HAZ-19]	Brief about: • Safety procedures • Use of exits, headsets, restraint systems, emergency equipment • Flotation gear if involved in overwater operations • How to approach the helicopter, the main and tail rotor hazards, and the effects of rotor wash • Never wear headgear entering or leaving a helicopter • Never go near the tail-rotor				

Emergency termination:..

Emergency Procedures:...:

Emergency contacts:..

Pre-operations brief (review this plan with all participants): ....

Post-operations brief (Incidents, problems, observations): ....

Prepared by: ....

Date:...

(List names of participants)

APPENDIX C. ACCIDENT SITE HANDOVER FORM

الهيئة العامة للطيران المدني GENERAL CIVIL AVIATION AUTHORITY	United Arab Emirates
ACCIDENT SITE HANDOVER FORM **نموذج تسليم موقع الحادث**	
Place of the accident site: **مكان موقع الحادث**	
Date of and time of handover: **تاريخ ووقت تسليم الموقع**	
Incident commander (authority/rank): **قائد الحدث (الجهة المعنية/الرتبة)**	
Remarks: (ملاحظات)	
Incident commander signature: (Designated responsible authority in-charge) **توقيع قائد الحدث** (المسؤول المعين من قبل الجهة المعنية)	**IIC signature** **توقيع المحقق المسؤول**

APPENDIX D. SITE ATTENDANCE RECORD

[AIFN #]
Dare of occurrence:
Started/completed:
Location:

Full name	Organisation	Group	Contacts	Signature

APPENDIX E. RISK DISCLAIMER STATEMENT

Risk Disclaimer Statement

"The Investigation Authority requires you to comply with the site control, and health and safety, and environmental protection measures.

The brief provided by the Site Safety Officer (SSO) is for your information and caution. Attendants shall seek the advice of SSO for the hazards existing in the accident site and shall adhere to the given instructions concerning occupational health and safety.

The Investigation Authority is not responsible or liable in any manner for the attendants who got injury caused by incident of exposure to a site hazards. If you feel that you need a medical emergency, report to the SSO."

To be completed by the site attendant:

I hereby declare that I have read and fully understood the above Risk Disclaimer Statement.

I possess a vaccination card that records vaccinations taken in accordance with ICAO Doc 9756, Part I: ☐ Yes ☐ No

Name: ____

Date: ____