7.2. Risk Assessment

As per Standard Terms of Reference, Risk Assessment and Disaster management plan is required for Airport project. Thus, Disaster Management Plan will be developed to reduce the impact of disasters like earthquake, fire etc. and to encourage recovery and Training will be given to staff & contractors about disaster management and handling.

Hazard Analysis involves identification and quantification of various hazards (unsafe conditions). On the other hand, risk analysis deals with identification and quantification of risks, the equipment and personnel are exposed to, due to accidents resulting from the hazard present in the project.

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks, which the neighboring populations are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of populations etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies.

7.3. Approach

Risk involves the occurrence or potential occurrence of some accident consisting of an event or sequence of events. The risk analysis assessment study covers the following:

- Identification of potential hazard areas
- Visualization of the resulting scenarios in terms of fire
- Assess the overall damage potential of the identified hazardous events and the impact zones from the accidental scenarios
- Assess the overall suitability of the site from hazard minimization and disaster mitigation point of view
- Preparation of broad emergency management plan (DMP).

7.4. Hazard Identification

Identification of hazards at Airport is of primary significance in the analysis, quantification and cost-effective control of unlikely events of accidents. A classic definition of hazard states that hazard is in fact the characteristics of system/process that presents potential for an accident. Hence, all the components of proposed project need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident.

Hisar Airport will deal with two materials, which are generally hazardous in nature by virtue of their intrinsic chemical properties (highly inflammable). Fire, explosion, toxic release or combinations of these are the hazards associated with projects/ plants using hazardous chemicals. More comprehensive, systematic and sophisticated methods of **Safety Engineering,** such as, **Hazard Analysis** and **Quantitative Risk Assessment** have now been developed to improve upon the integrity, reliability and safety of such projects.

The Primary emphasis in safety engineering is to reduce risk to human life, property and environment. Some of the more important methods used to achieve this are.

- **Quantitative Risk Analysis:** Provides a relative measure of the likelihood and severity of various possible hazardous events by critically examining the process and design.
- **Work Safety Analysis:** The technique discerns whether the layout and operating procedures in practice have any inherent infirmities
- **Safety Audit:** Takes a careful look at operating conditions, work practices and work environments to detect unsafe conditions

Together, these three broad tools attempt to minimize the chances of accidents occurring. Yet, there always exists, no matter how remote, probability of occurrence of a major accident. If the accident involves highly hazardous chemicals in sufficiently large quantities, the consequences may be serious to the plant, to surrounding areas and the populations residing therein. It may happen usually as the result of a malfunction of the normal operating procedures. It may also be precipitated by the intervention of an outside force such as a cyclone, flood, earthquake or deliberate acts of arson or sabotage. This chapter deals with the risks associated with the Plant, its mitigation, and the Disaster Management Plan.

Several hazards may endanger the Airport, health and safety of workers and may cause danger to the surrounding environment. The following hazards are to be identified, assessed and suitable preventive/mitigating plans taken prior to rolling out project works initiation. Details of Hazards are given in **Table 7.2**

Table 7.2 : Details of Hazard

Type of Hazard	Hazard	Details
Natural Hazard	Flood	Rana Minor is located within the project site. This mainly can occur only during the excess rain.
	Earthquakes	The project site is located at Seismic Zone III, thus area is at Moderate risk.
	Lightening	Electrical energy from lightning will flow out in all directions of lowest electrical impedance to equalize the electrical potential. Lightning poses a serious threat to the safety of people working outdoors: • Refuelling • Catering • Other aircraft services • Baggage handling • Aircraft marshalling, towering etc. • Passenger boarding/deplaning (passenger stairs) • Airport workers maintaining airports grounds

	Wildlife Strike	Bir Hisar forest is adjacent to the Airport boundary in East direction. Thus, chances of Bird or Animal strike are High.
Man Made	Leakage of flammable material	800 KL ATF will be stored at the airport for refuelling of aircraft. Thus, Chances of explosion are high.
	Crashing of aircraft	This can occur due to technical fault.
	Bomb Threat	Terrorism Risk
	Air raids	
	Sabotage	
	Hijacking	
	Fire & explosion	This can be occur due to the electric spark, leakage in fuelling area, fire in fuel storage area, fire in aircraft, fire in GSE etc.
	Electricity	Fatalities can arise due to electric shocks, burns and when contacted with overhead or underground power cables.
	Mechanical	The Mechanical fault can cause the risk & hazard which include the Aircraft, GSE, elevator, DG sets
	Chemical	Spillage of oil and other chemicals.

7.5. Preventions

As per Hazard identified, few measures will be adopted to reduce the risk at the first place. Details are given below

7.5.1. Flood

- Rana Distributary exists at boundary of phase II development area. No interference is envisaged during phase II development. However, during development of further phases, relocation of the canal is needed. PWD has proposed to shift the canal along the boundary of project (outside the premises of 7200 acre) along the Chandigarh-Sirsa highway. Flow of Distributary shall be maintain as per contour level.
- Drainage & Sewerage System will be provided all over the project site
- Rainwater harvesting will be designed for peak rainfall
- Cleaning of Storm water line and rainwater harvesting will be done prior to the monsoon season
- Sewage line will be connected through outside sewerage system for disposal of excess sewage.

7.5.2. Earthquake

- Structure will be design as per NBC 2016.
- All norms for safety of structure will be followed
- All the raw material will be chosen as per standard norms laid by NBC 2016.

7.5.3. Lightning

- Lightning detectors will be used at airport for recording, analyzing and predicting of thunderstorms. Figure showing procedure for safety during lightning is given in **Figure 7.2**
- Use of an automated warning and alerting system
- Ensure that the building is well grounded and every conductive path is bonded to the ground system.
- Lightning arrestor will be installed at every building.
- Fuel servicing operations shall be suspended where there are lightning flashes in the immediate vicinity of the airport.
- A written procedure shall be established for fuelling operations.

Figure 7.2 : Procedure for safety during lightning

7.5.4. Wildlife Strike

Bird-strike events are relatively common, occur most often on the ground or at low altitude, and are usually benign. However, bird strikes can have significant economic and occasional safety consequences for flight operations. Pilots and operators should be knowledgeable about the hazard, and flight crews should use facts, data, and standard operating procedures to reduce the potential for and consequences of a bird strike. Three-quarters of bird strikes involve the wing or engines, but they can damage almost any part of an airplane. Single or multiple large birds, relatively small numbers of medium-size birds, and large flocks of relatively small birds are all problematic and have resulted in accidents. Wildlife Hazard Management Plan may be implemented by a single airport employee undertaking wildlife control activities on an occasional "as needed" basis or by a full-time wildlife biologist with a staff of operations personnel providing continuous bird. Bird identification is important because all species have unique vcalozations, behaviors, and habitat preferences that are useful in field identification. **Figure 7.3**[21] provides a list of

[21] Wildlife Hazard Management at Airports second Edition, July 2005 approved by FAA (Prepared by Ledward C. Clearly and Richard A. Dolbeer)- page 115

the relative hazard of various species groups based on the percent of reported strikes that cause damage or an effect-on-flight.

. Ranking of 25 species groups as to relative hazard to aircraft (1=most hazardous) based on three criteria (damage, major damage, and effect-on-flight), a composite ranking based on all three rankings, and a relative hazard score. Data were derived from the FAA National Wildlife Strike Database, January 1990–April 2003[1].

Species group	Ranking by criteria			Composite ranking[5]	Relative hazard score[6]
	Damage[2]	Major damage[3]	Effect on flight[4]		
Deer	1	1	1	1	100
Vultures	2	2	2	2	64
Geese	3	3	6	3	55
Cormorants/pelicans	4	5	3	4	54
Cranes	7	6	4	5	47
Eagles	6	9	8	6	41
Ducks	5	8	10	7	39
Osprey	8	4	8	8	39
Turkey/pheasants	9	7	11	9	33
Herons	11	14	9	10	27
Hawks (buteos)	10	12	12	11	25
Gulls	12	11	13	12	24
Rock pigeon	13	10	14	13	23
Owls	14	13	20	14	23
Horned lark/snow bunting	18	15	15	15	17
Crows/ravens	15	16	16	16	16
Coyote	16	19	5	17	14
Mourning dove	17	17	17	18	14
Shorebirds	19	21	18	19	10
Blackbirds/starling	20	22	19	20	10
American kestrel	21	18	21	21	9
Meadowlarks	22	20	22	22	7
Swallows	24	23	24	23	4
Sparrows	25	24	23	24	4
Nighthawks	23	25	25	25	1

[1] Excerpted from the *Special Report for the FAA, Ranking the Hazard Level of Wildlife Species to Civil Aviation in the USA: Update #1, July 2, 2003*. Refer to this report for additional explanations of criteria and method of ranking.

[2] Aircraft incurred at least some damage (destroyed, substantial, minor, or unknown) from strike.

[3] Aircraft incurred damage or structural failure that adversely affected the structure strength, performance, or flight characteristics and that would normally require major repair or replacement of the affected component, or the damage sustained makes it inadvisable to restore aircraft to airworthy condition.

[4] Aborted takeoff, engine shutdown, precautionary landing, or other.

[5] Relative rank of each species group was compared with every other group for the three variables, placing the species group with the greatest hazard rank for $\geq$ 2 of the 3 variables above the next highest ranked group, then proceeding down the list.

[6] Percentage values, from Tables 3 and 4 in Footnote 1 of the *Special Report*, for the three criteria were summed and scaled down from 100, with 100 as the score for the species group with the maximum summed values and the greatest potential hazard to aircraft.

Figure 7.3 : List of the relative hazard of various species group based on the reported strikes

Airports are responsible for bird control and should provide adequate wildlife control measures. If large birds or flocks of birds are reported or observed near the runway, the flight crew should consider:

- Delaying the takeoff or landing when fuel permits. Advise the tower and wait for airport action before continuing.
- Take off or land on another runway that is free of bird activity, if available.

To prevent or reduce the consequences of a bird strike, the flight crew should:

- Discuss bird strikes during takeoff and approach briefings when operating at airports with known or suspected bird activity.
- Be extremely vigilant if birds are reported on final approach. If birds are expected on final approach, plan additional landing distance to account for the possibility of no thrust reverser use if a bird strike occurs.
- Pilots should not rely on onboard weather radar, landing lights, airplane markings, time of day, or visibility to prevent bird strikes.
- Flight operations may need to be modified in the presence of known or anticipated bird activity.
- Delay takeoff or landing in the presence of bird activity.
- Below 10,000 feet, keep speed below 250 knots if operationally possible.
- Below 2,000 feet, climb at the maximum rate to reduce the flight time exposure to a strike hazard.
- Descend with idle power and avoid extended low-altitude level flight, particularly over water courses, nature reserves, or other areas of known or expected bird activity.
- When landing is assured, consider landing through birds versus a missed approach to avoid birds. This reduces the energy of the collision, the potential for increased damage associated with engines at a high power level, and the potential for multiple engine ingestions at low airplane energy states and low altitude.
- Avoid or minimize manoeuvring at low altitude to avoid birds.

Measures suggested by FAA

Four basic control strategies are available to solve wildlife problems on airports:

- **Aircraft flight schedule modification:** Pilot could be advised not to depart during a 20-minuted period at sunrise or sunset during winter when large flocks of blackbirds cross an airport going to and from an off-airport roosting site. Air traffic controllers on occasion might need to temporarily close a runway with unusually high bird activity or a large mammal (e.g., deer) incursion until wildlife control personnel can disperse the animals.
- **Habitat Modification and exclusion:** Habitat modification means changing the environment to make it less attractive or inaccessible to the problem wildlife. All wildlife requires food, cover, and water to survive. Any action that reduces, eliminates, or excludes one or more of these elements will result in a proportional reduction in the wildlife population at the airport. Habitat modifications to make the airport and surrounding area as unattractive as

possible to hazardous wildlife must be the foundation of every airport's Wildlife Hazard Management Plan.

- Be aware of food attractants for birds that exist on and in proximity to the airport. On the airport, require bird-proof storage of food waste, prohibit bird feeding, and promote good sanitation and litter control programs.
- Do not use trees and other landscaping plants for the street side of airports that produce fruits or seeds attractive to birds. On airside areas, the large expanses of grass and forbs can sometimes provide ideal habitat for rodent and insect populations that attract raptors, gulls, other bird species, and mammalian predators such as coyotes. In addition, grasses allowed to produce seed heads can provide a desirable food source for doves, blackbirds, and other flocking species. The management of airside vegetation to minimize rodents, insects, and seeds might be complex, requiring insecticide, herbicide, and rodenticide applications; changes in vegetation cover; and adjustments in mowing schedules (e.g., mowing at night to minimize bird feeding on insects exposed by the mowing).
- Take care when selecting and spacing plants for airport landscaping. Avoid plants that produce fruits and seeds desired by birds. Also avoid the creation of areas of dense cover for roosting, especially by European starlings and blackbirds. Thinning the canopy of trees, or selectively removing trees to increase their spacing, can help eliminate bird roosts that form in trees on airports.
- Water acts as a magnet for birds; therefore, eliminate all standing water on an airport to the greatest extent possible. Fill or modify to allow rapid drainage of depressions in paved and vegetated areas, and disturbed areas at construction sites that accumulate standing water after rain. This is particularly important at coastal airports where fresh water is highly attractive to birds for drinking and bathing. Do not establish retention ponds, open drainage ditches, outdoor fountains and other wetland sites on or adjacent to airports.
- If food, water, or cover cannot be eliminated by habitat modification, then actions can sometimes be taken to exclude the wildlife from the desired resource. Exclusion involves the use of physical barriers to deny wildlife access to a particular area. As with habitat modification, exclusion techniques, such as installing a covered drainage ditch

- **Repellent Techniques:** Repellent and harassment techniques are designed to make the area or resource desired by wildlife unattractive or to make the wildlife uncomfortable or fearful. Long term, the cost-effectiveness of repelling wildlife usually does not compare favourably with habitat modification or exclusion techniques. Habitat modifications and exclusion techniques will

never completely rid an airport of problem wildlife; therefore, repellent techniques are a key component of any wildlife hazard management plan.

- Repellents work by affecting the animal's senses through chemical, auditory, or visual means. Habituation or acclimation of birds and mammals to most repellent devices or techniques is a major problem.
- Regular patrols of airside areas to disperse birds and other hazardous wildlife are a critical component of an integrated program of wildlife hazard management on airports. Often, driving a vehicle toward the wildlife will be enough to cause the wildlife to disperse, especially if the driver has been deploying repellent and removal techniques and strategies
- Probably the most commonly used audio scaring device for deer is the propane cannon. However, deer rapidly habituate to propane cannons.
- Most visual repellents are simply a variation on an ancient theme—the scarecrow. In general, visual repellents, such as hawk effigies or silhouettes, eye-spot balloons, flags, and Mylar reflecting tapes, have shown only short-term effectiveness and are inappropriate for use as a long-term solution to bird problems on airports.
- Visual repellents such as flags and effigies have proven ineffective for repelling mammals.

- **Wildlife Removal:** Removal can be accomplished by capturing and relocating or by killing the target animals. With few exceptions, a federal Migratory Bird Depredation Permit, and in many cases a state permit, is required before any migratory birds may be taken (captured or killed). A state permit is generally necessary before any state-protected birds or mammals may be taken. Any capturing or killing must be done humanely and only by people who are trained in wildlife species identification and the techniques to be deployed.

Habitat modifications to minimize food cover, and water and physical barriers to exclude wildlife are the foundations of wildlife hazard management programs for airports. In addition, an integrated array of repellent techniques is necessary to disrupt normal behaviour and to stress hazardous wildlife that attempt to use the airport. These repellent techniques must be used judiciously and backed by real threats to minimize habituation. To this end, lethal control of selected individuals of common species is sometimes necessary to reinforce repellent actions. Furthermore, the management of a wildlife hazard situation on an airport might require removal of a particular animal or group of animals or require that a local population of a problem species be reduced by lethal means until a long-term, nonlethal solution is implemented. Finally, the most critical factor for the success of a wildlife hazard management program is to have motivated and trained professionals who are knowledgeable about the wildlife species attempting to use the airport environment and the techniques used to manage the problems these species create.

7.5.5. Crashing of Aircraft

All safety norms laid by DGCA/ICAO/FAA/MoCA shall be followed.

7.5.6. Bomb Threat, Air raids, Sabotage, Hijacking

Airport security refers to the techniques and methods used in an attempt to protect passengers, staff, aircraft, and airport property from accidental/malicious harm, crime, and other threats. Aviation security is a combination of human and material resources to safeguard civil aviation against unlawful interference. Government of India, has established " Bureau of Civil Aviation Security" (BCAS) under Ministry of Civil Aviation which is responsible for regulating, monitoring, training, overseeing, and coordination of Airport Security function at all the civil airports and civil enclaves. BCAS has laid down security regulations and exhaustive guidelines for all the airport operators.

Hisar Airport Master Plan has been drawn conforming to the regulations and guidelines of BCAS. The plan includes, provision of boundary wall, a perimeter road for patrolling and vigil, isolation bay, cooling pit etc. BCAS laid down norms have also been duly complied with in geometrical layout of the facilities.

Provision has also been made for procuring adequate quantity of security equipment namely, hand-held metal detector, door frame metal detector, x-ray baggage scanning machines etc.

The security at the airport shall be provided by highly trained manpower by CISF. Access to all the vital facilities and installations shall be guarded and controlled by CISF as per BCAS directives from time to time.

Additional security measures would be taken as per directives of BCAS based on threat and risk perception.

7.5.7. Fire & Explosion

In accordance with the provisions of Annex 14, States are required to provide rescue and firefighting equipment and services at an airport. Besides aircraft fires the fire safety services at an airport are also expected to cater to incidents of fire in the passenger terminals, cargo terminal, air traffic control setup and ancillary buildings. Fire and emergency services are expected to cope with an emergencies occurring at the aerodrome or in its vicinity. The objective of safety services is to minimize the effects of an emergency, particularly in respect of saving lives and minimizing loses; and maintaining uninterrupted aircraft operations to the extent possible or at least to restore airport operations as soon as possible.

The rupture of fuel tanks in an aircraft crash and the consequent spillage of highly volatile fuels, and other flammable liquids used by aircraft, present a high degree of probability of ignition, if these liquids come into contact with hot metal parts of the aircraft or because of sparks caused by the movement of wreckage or disturbance of the electrical circuit. Fires may also occur through the discharge of accumulated electrostatic charges at the time of ground contact or during fuelling operations. An outstanding characteristic of aircraft fires

is their tendency to reach lethal intensity within a very short time. For this reason, the provision of adequate and special means of dealing promptly with an aircraft accident or incident occurring at, or in the immediate vicinity of, an airport assumes primary importance because it is within this area that there are maximum opportunities of saving lives.

Appropriate level of protection is planned to be provided at Hisar Airport for rescue and fire fighting services in the master plan. In Phase II of development of the airport it is noted from the traffic forecast that most of the operations shall be that of Code-C aircraft. Since the overall length of Code-C aircraft operating within the country, is higher than the average overall length of Airport Fire Category 6, as defined in Annex 14, and a few Code-C aircraft like B737-800, B737-900, and A321-211, have overall length exceeding 39mt, it is planned to develop the airport for **Airport Fire Category 7**. Further, in accordance with the requirement, it will be developed to Category 9. As per ICAO recommendations, a minimum of 200% of foam concentrate and complementary agent will be held in reserve and will be available at all times on the aerodrome.

Observing all the norms as laid down in Annex-14, the location of the Fire Station is proposed in the Master Plan. Plan showing location of the Fire Station and distances to various airport facilities is also shown in **Figure 7.4**. The location of the Fire station is such that it can reach any part of the operational area and become effective within the prescribed response time. Provision has also been made for a number of various sized reservoirs available throughout the aerodrome. Two such reservoirs each of 50,000L capacity are proposed, one each close to the runway extremities. Provision is also made for one OHT of 50,000L and an underground reservoir of 100,000L at the Fire Station.

Airport terminal building, ATCT and CNS installation buildings and airport hangar are classified under Business-cum-Assembly, and storage & hazardous based on the classification of building and hence shall comply with proper fire prevention and fire protection, confirming to high hazard occupancy as per National Building Code (NBC). Accordingly, highest fire safety protection measures shall be in-built in detailed design of the buildings.

Building fire protection systems have been categorized into Active measures and Passive measures. Active measures involve the detection and alarm that informs the occurrence of a fire and triggers sort of counteraction towards fire extinguishment and; control of smoke spread.

Passive fire protection measures are proactive approach taken at building design stage. Passive measures are concerned with building structure integrity, compartmentation etc. The priority of Structural Fire Protection is to carry out search & rescue operation without the building collapsing and prevent disproportionate damage to property. During the detailed design process, due care will be taken to provide an effective and safe design from a fire safety point. Consideration need to be given to both Active and Passive Fire Protection.

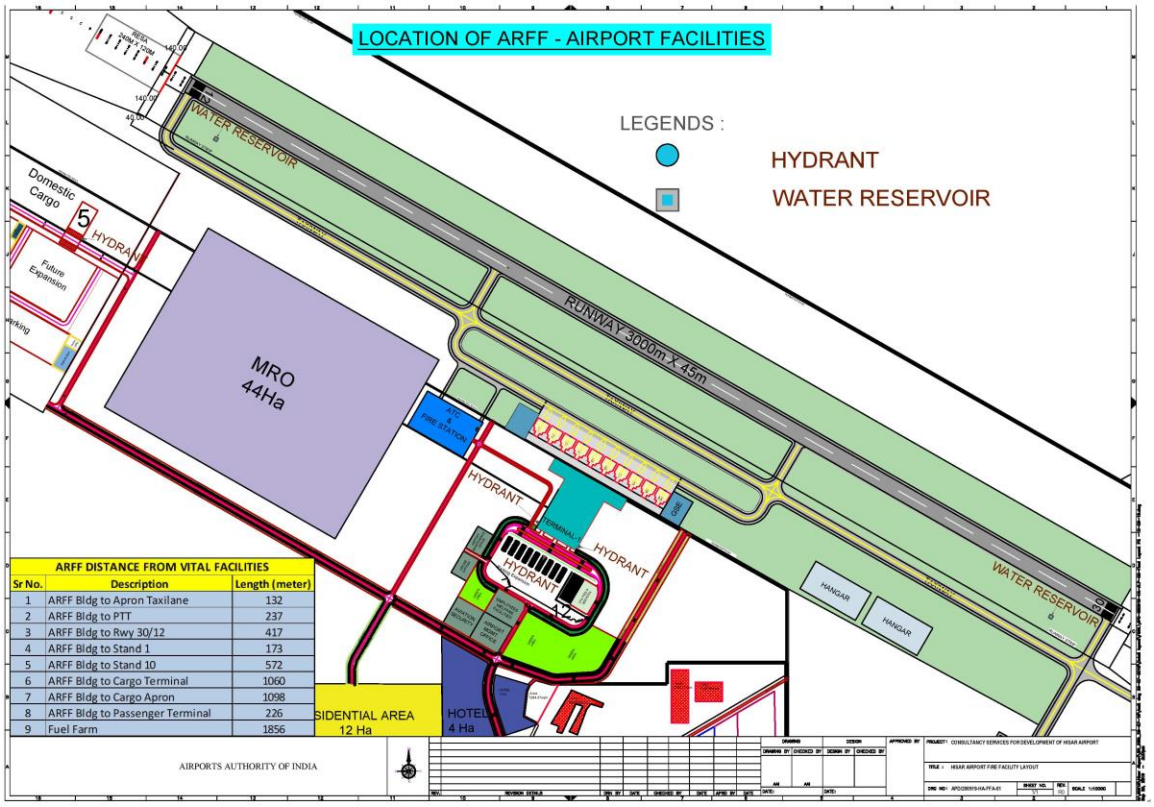
All buildings would be designed such that occupant could escape to the place of ultimate safety this should be in the open air where dispersal, away from the building, can be achieved when fire occurs and to ensure that adequate escape routes are also provided. Automatic fire detection and alarm system would be installed in all areas used by public as per norms of national fire protection association. All the areas shall be served by hydrant system/wet riser for fire protection of terminal, cargo and other buildings. Automatic sprinkler systems shall be provided in the terminal and Cargo building as per NBC. Three Fire Hydrants to serve the terminal building and one close to Cargo/ Fuel Farm are included in the plan.

Fire exits plans will be conspicuously posted on each floor showing clearly the routes to appropriate exits. Emergency lighting for exit signage in English and Hindi, and adequate egress illumination in the event of a power outage, shall be incorporated in the design.

First aid firefighting appliances would also be provided at all Terminal Building, Technical/ATS Building, CNS Equipment Building, Electrical Substations, and Aircraft Hanger etc.

Other measures:

- Safety officers will be appointed
- Routine Drill will be done
- All fire safety equipments will be installed in the complex as per norms
    - Fire Hydrant
    - Fire Extinguishers
    - Sprinkler
    - Stand by pumps
    - Booster Pumps
    - Water Tanks
    - Fire Sensor
    - Alarm System



ARFF DISTANCE FROM VITAL FACILITIES		
Sr No.	Description	Length (meter)
1	ARFF Bldg to Apron Taxilane	132
2	ARFF Bldg to PTT	237
3	ARFF Bldg to Rwy 30/12	417
4	ARFF Bldg to Stand 1	173
5	ARFF Bldg to Stand 10	572
6	ARFF Bldg to Cargo Terminal	1060
7	ARFF Bldg to Cargo Apron	1098
8	ARFF Bldg to Passenger Terminal	226
9	Fuel Farm	1856

Figure 7.4 : Fire Fighting Plan

7.5.7.1 *Hazardous Materials Bulk Storages at Airport*

The Major hazardous chemical to be stored at the Hisar Airport site will be ATF (Aviation Turbine Fuel) for Aircraft refuelling and Diesel (for DG set and other vehicles) as given below in the **Table 7.3**

Table 7.3 : Bulk Storages of Hazardous Materials

S. No	Fuel	Storage Details	Storage & Control Measures	Remarks
1.	ATF	2 X 500 KL	Under-ground MS Tanks	Inflammable
2.	ATF	~ 12-20 KL	Tankers for refueling Aircraft	Inflammable
3.	Diesel	10 KL	Overground MS Tank	Inflammable

7.5.7.1.1 Hazardous Analysis of Bulk Storage Materials

The materials coming under hazardous category as specified by MSIHC Rules, 1989 (including subsequent amendments) is given below in **Table 7.4**

Table 7.4 : Hazard Analysis of Bulk Storage Materials

S No	Material	S. No & Threshold Quantity (TQ in Kg) as per MSHIC Rules	Chemicals Hazards Potential	Remarks

		Schedule-1, Part-II	Schedule-2, Part-I	Schedule-3, Part-I	Hazards	Toxic DT->---mg/Kg; OT----mg/Kg; IT----mg/l; (Rats)	
1.	ATF CAS RN 64741-86-2)UN No: 1863 BP: 200--260 ^{0}C Flash Point: ~35 --` 62 ^{0}C Auto ignition Temp.-238° C Watery colorless liquids. Less dense than water and insoluble in water LEL -0.7% (V/V) UEL – 5% (V/V)	---	29 TQ-1: 10000 MT TQ-2: 10000 MT	5 TQ-1: 2500 MT TQ-2: 20000 MT	Vapor causes slight irritation of eyes and nose. Liquid irritates stomach; if taken into lungs causes coughing, distress, and rapidly developing pulmonary edema.	Occupational Exposure Limit (OEL) = 575 mg/m3 (100 ppm) 8-hour (TWA - Time Weighted Average)	*Highly flammable liquids* : chemicals which have a flash point lower than or equal to 60°C but higher than 23°C. [As per MSIHC Rules]
2.	HSD CAS No:68476-30-2 UN No.-1202 Flammable Liquid-Class-3 BP- 150 – 400°C Vapour Pressure (35°C)- <1 mm at 38°C Specific Gravity-0.81 – 0.91 at 20°C LEL -0.6% (V/V) UEL – 7.5% (V/V) Flash Point > 32° C [] Auto ignition Temp.-256° C	---	29 TQ-1: 10000 MT TQ-2: 10000 MT	5 TQ-1: 2500 MT TQ-2: 20000 MT	LIQUID: Irritating to skin and eyes. Harmful if swallowed. Hazardous Waste ID No.-17 Hazchem Code-3Y* NFPA Hazard Signal Health-0 Flammability-2 Reactivity/ Stabilty-0	PAC:-1:300 PAC-2: 3300 PAC-3: 20000 mg/m^3 PACs (Protective Action Criteria)	*Highly flammable liquids* : chemicals which have a flash point lower than or equal to 60°C but higher than 23°C. [As per MSIHC Rules]

Airport will be storing ATF and Diesel in Bulk. Both the petroleum products are hazardous as per MSIHC Rules. The risk is through liquid and gaseous materials which

are volatile material. The inflammable/toxic vapours due to spillage of such material can travel to some and cause damage.

7.5.7.2 *Detailed QRA Approach: Rule Sets and Assumptions*

Identification of hazards and likely scenarios (based on Level-1 and Level-2 activities) calls for detailed analysis of each scenario for potential of damage, impact area (may vary with weather conditions / wind direction) and safety system in place. Subsequently each incident is classified according to relative risk classifications provided in Table below as **Table 7.5**

Table 7.5 : Risk Classification

Stage	Description
High (> 10^{-2}/yr.)	A failure which could reasonably be expected to occur within the expected life time of the plant. Examples of high failure likelihood are process leaks or single instrument or valve failures or a human error which could result in releases of hazardous materials.
Moderate (10^{-2} --10^{-4}/yr.)	A failure or sequence of failures which has a low probability of occurrence within the expected lifetime of the plant. Examples of moderate likelihood are dual instrument or valve failures, combination of instrument failures and human errors, or single failures of small process lines or fittings.
Low (<10^{-4})	A failure or series of failures which have a very low probability of occurrence within the expected lifetime of plant. Examples of 'low' likelihood are multiple instruments or valve failures or multiple human errors, or single spontaneous failures of tanks or process vessels.
Minor Incidents	Impact limited to the local area of the event with potent for 'knock – on-events'
Serious Incident	One that could cause: 1. Any serious injury or fatality on/off site; 2. Property damage of $ 1 million offsite or $ 5 million onsite.
Extensive Incident	One that is five or more times worse than a serious incident.

Assigning a relative risk to each scenario provides a means of prioritising associated risk mitigation measures and planned actions.

7.5.7.2.1 Thermal Hazards

In order to understand the damages produced by various scenarios, it is appropriate to understand the physiological/physical effects of thermal radiation intensities. The thermal

radiation due to tank fire usually results in burn on the human body. Furthermore, inanimate objects like equipment, piping, cables, etc. may also be affected and also need to be evaluated for damages. **Tables 7.6, 7.7 and Table 7.8** (below), respectively give tolerable intensities of various objects and desirable escape time for thermal radiation.

Thermal hazards could be from fires or explosion. Fire releases energy slowly while explosion release energy very rapidly (typically in micro seconds). Explosion is rapid expansion of gases resulting in rapidly moving shock wave. Explosion can be confined (within a vessel or building) or unconfined (due to release of flammable gases).

BLEVE (boiling liquid expanding vapour explosion) occurs if a vessel containing a liquid at a temperature above its atmospheric boiling point ruptures. The subsequent BLEVE is the explosive vaporisation of large fraction of its vapour contents; possibly followed by combustion or explosion of the vaporised cloud if it is combustible range.

Thermal hazards have been considered for various scenarios including: Fire in fuel storage tank/ Aircraft refuelling zone.

Table 7.6 : Effects due to Incident Radiation Intensity

Incident Radiation kW/m^2	Damage Type
0.7	Equivalent to Solar Radiation
1.6	No discomfort on long duration
4.0	Sufficient to cause pain within 20 sec. Blistering of skin (first degree burn are likely).
9.5	Pain threshold reached after 8 sec. Second degree burn after 20 sec.
12.5	Minimum energy required for piloted ignition of wood, melting of plastic tubing etc.
25	Minimum Energy required for piloted ignition of wood, melting, plastic tubing etc.
37.5	Sufficient to cause damage to process equipment.
62.0	Spontaneous ignition of wood.

Table 7.7 : Thermal Radiation Impact to Human

Exposure Duration	Radiation Energy {1% lethality; kW/m^2}	Radiation Energy for 2nd degree burns; kW/m^2	Radiation Energy for 1st degree burns; kW/m^2
10 sec	21.2	16	12.5
30	9.3	7.0	4.0

Table 7.8 : Tolerable Intensities for Various Objects

Sl. No	Objects	Tolerable Intensities (kw/m^2)
1	Drenched Tank	38
2	Special Buildings (No window, fire proof doors)	25
3	Normal Buildings	14

Sl. No	Objects	Tolerable Intensities (kw/m^2)
4	Vegetation	10-12
5	Escape Route	6 (up to 30 sec.)
6	Personnel in Emergencies	3 (up to 30 sec.)
7	Plastic Cables	2
8	Stationary Personnel	1.5

Damage due to Explosion: Both ATF and Diesel are not explosive as such however in vulnerable conditions (like high thermal radiation due to fire in nearby area an ATF/Diesel pool can evaporate fast and can cause BLEVE.

As a safety measure HISSAR AIRPORT is storing ATF **in underground tanks** in isolated place with all safety measures as per Petroleum Rules. Damage estimates based on overpressure are given in **Table 7.9** below

Table 7.9 : Damage due to Overpressure

Sl. No	Overpressure (psig / bar)	Damage
1.	0.04	Loud Noise / sonic boom glass failure
2.	0.15	Typical pressure for glass failure
3.	0.5 - 1	Large and small windows usually shattered
4.	0.7	Minor damage to house structure
5.	1	Partial demolition of houses, made uninhabitable.
6.	2.3	Lower limit of serious structure damage
7.	5 – 7	Nearly complete destruction of houses
8.	9	Loaded train box wagons completely demolished
9.	10	Probable total destruction of houses
10.	200	Limits of crater lip

In Hisar Airport case explosion possibility is little.

7.5.7.2.2 ATF Hazards

ATF is a highly flammable liquid. The fuel has a low vapour pressure at ambient temperature, which makes the liquid less volatile. Hence, it evaporates slowly in case of fuel leakage and remains in the atmosphere posing threat of fire. Also, the fuel has a flash point lower than the ambient temperature of Hissar.in summers (~46 ^{0}C). This means that the fuel will give off flammable vapour at a concentration sufficient to cause ignition. However, significant heat source is, required to ignite the fuel and therefore proper safety management has to be implemented. Since at Hisar the ATF **storage is underground** there are very less chances of such occurrence.

ATF is classified for supply purpose as harmful as a result of the aspiration hazard and irritation to the skin. Toxicity following a single exposure to high levels (orally, dermally or by inhalation) of ATF is of low order; however, exposure to high vapour concentration can lead to nausea, headache and dizziness. Accidental ingestion can lead to chemical burning of the mouth. Ingestion can lead to vomiting and aspiration into the lungs which can result in chemical pneumonitis which can be fatal. Prolonged and repeated skin contact can lead to defatting of the skin, drying, cracking and dermatitis.

Storage Hazards

Typical storage hazards are applicable for this type of tank farm systems. Sources of ignition can include lightning, open flame, electrical spark, static discharge, chemical reaction, or any heat source that can raise or ignite the fuel-air vapor mixture. Since at Hisar the ATF storage is underground there are very less chances of such occurrence. The release of ATF could occur from transfer stations (gantry areas), storage to refueller systems, valve glands or pipelines leakages due to several reasons. The most typical emergency relating to fuel handling is a fuel overflow or spill. Such events can be very minor in nature involving just a few liters of product, or they can be a catastrophic event involving hundreds of litres of fuel.

Combustion Hazards

The combustion products of aviation fuel include carbon dioxide, nitrogen oxides and sulphur oxides. Incomplete combustion will generate thick black smoke and potentially hazardous gases including carbon monoxide. However, smoke from such fires is buoyant and does not tend to seriously impact people on the ground in the open air.

Electrostatic Hazards of ATF

ATF has a low electrical conductivity. This provides for static electricity to be generated and charges to be accumulated. According to HSE, UK, the degree to which a static charge may be acquired by aviation fuels depends upon many factors such as.

- Amount and type of residual impurities
- Dissolved water
- Linear velocity through piping systems
- Presence of static generating mechanisms e.g. filters and
- Opportunity for the fuel to relax for a period of time to allow any charge generated to dissipate safely to earth

In order to reduce the accumulated amount of static electricity, antistatic additives are added to the fuel. This works by enhancing the conductivity of the fuel in order to shorten the time required for dissipating the static charge safely to earth.

Health Hazard

ATF is classified, for supply purposes as harmful, as a result of the aspiration hazard and irritation to the skin.

Acute Health Hazard

Toxicity following a single exposure to high levels (orally, dermally or by inhalation) of ATF is of a low order. However, exposure to higher vapour concentrations can lead to nausea, headache and dizziness. If it is accidentally ingested, irritation to the gastric mucous membranes can lead to vomiting and aspiration into the lungs can result in chemical pneumonitis which can be fatal.

Inhalation: Under normal conditions of use ATF is not expected to present an inhalation hazard.

Skin: ATF is slightly irritating to the skin, and has a defatting action on the skin.

Eyes: ATF may cause discomfort to the eye.
Chronic Health Hazards: Prolonged and repeated contact with ATF can be detrimental to health. The main hazards arise from skin contact and in the inhalation of mists. Skin contact over long periods can lead to defatting of the skin, drying, cracking and possibly dermatitis. Excessive and prolonged inhalation of mists may cause chronic inflammatory reaction of the lungs and a form of pulmonary fibrosis.

Exposure Limit Values
ATF does not contain any components to which exposure limits apply, however it is chemically very similar to white spirit, for which the following UK occupational exposure standards apply (HSE, 2000):

- Occupational Exposure Limit (OEL) = 575 mg/m3 (100 ppm) 8-hour TWA value
- Occupational Exposure Limit (OEL) = 720 mg/m3 (125 ppm) 10-min TWA value (TWA - Time Weighted Average)
- Diesel has also got similar hazards. It is stored in much less quantity but in over ground tank

7.5.7.3 *Effect & Consequence Analysis*

As a part of risk assessment study, maximum credible accident analysis (MCA) is carried out to determine the maximum loss scenario from this analysis. It is an eventuality, which is possible and will have maximum consequential distances for the particular hazardous chemicals under evaluation.
The selection of the accident scenarios is based on the engineering and professional judgment, accident descriptions of the past in similar type of plants & the expertise in risk analysis studies.

Hazardous Conditions
An accidental release of Diesel and ATF from tanks or piping during unloading and refueling of aircraft would result in formation of fixed or spreading pool of released qualities. In case of immediate ignition, a pool fire will result. Delayed ignition may result in explosion or flash fire, if quantity of explosive mass is sufficient and some confinement is present.

Pool Fire
A leak or spill of sufficient quantities of petroleum product will result in an accumulation of petroleum product on the ground. If ignited, the resulting fire is known as spreading or fixed pool fire. In case any object comes in contact with the flame above the pool, it will be severely damaged or destroyed and personnel exposed to flame will suffer extensive burn injuries. Objects and personnel outside the actual flame volume may also be affected or injured by radiant heat. The extent of damage or injury depends on the heat flux and duration of fire and exposure. If a large area of the body receives second and third degree burns, it can result in fatalities.
The extent of injury to people depends on the heat flux and duration of exposure. The extent of damage to personnel and property depends on the size of the pool and the duration of fire.

7.5.7.3.1 Likely Failure Scenarios

Few likely failure scenarios have been selected after critical appraisal of raw materials and storage inventories. Failure scenarios selected are as given in **Table 7.10** below

Table 7.10 : Different Failure Scenarios

S. No.	Scenario	Remark
RM-1	ATF Heavy Spillage while Filling Underground Tanks--Fire and Thermal Hazard	Thermal
RM-2	ATF Heavy Spillage while Transporting ATF to Aircraft --Fire and Thermal Hazard	Thermal
RM-3	Diesel Tank Spillage & Fire Thermal Hazard	Thermal

7.5.7.3.2 Weather Effect

The effect of ambient conditions on the impact of fire / heat radiation and GLC of hazardous / toxic material can be beneficial as well as harmful. A high wind (turbulence) can dilute the toxic material while stable environment can extend the reach of IDLH or IT (inhalation LC50 rats for products) concentration to long distance. Any inflammable gas / vapour release in turbulent weather will soon dilute the hazardous gases below LEL and thus save the disaster.

7.5.7.4 *Hazardous Incidents Impact*

The identified failure scenarios in **Table 7.10** have been analysed (Using ALOHA and EFFECT Modules) for the impact Zones considering damage due to thermal and toxic impacts. Each incident will have impact on the surrounding environment which in extreme case may cross plant boundary. The impact zones for various scenarios are given in **Table 7.11**

Table 7.11 : Hazards Scenario Impact

Scenario No.	Scenario	Impact Zone (m)	Remarks
Scenario Raw Material			
RM-1	ATF Heavy Spillage while Filling Underground Tanks--Fire and Thermal Hazard	❖ 35	1st Degree Burn; Template 1
RM-2	ATF Heavy Spillage while Transporting ATF to Aircraft --Fire and Thermal Hazard	❖ 27	1st Degree Burn; Template 2
RM-3	Diesel Tank Spillage & Fire Thermal Hazard	❖ 25	1st Degree Burn; Template 3

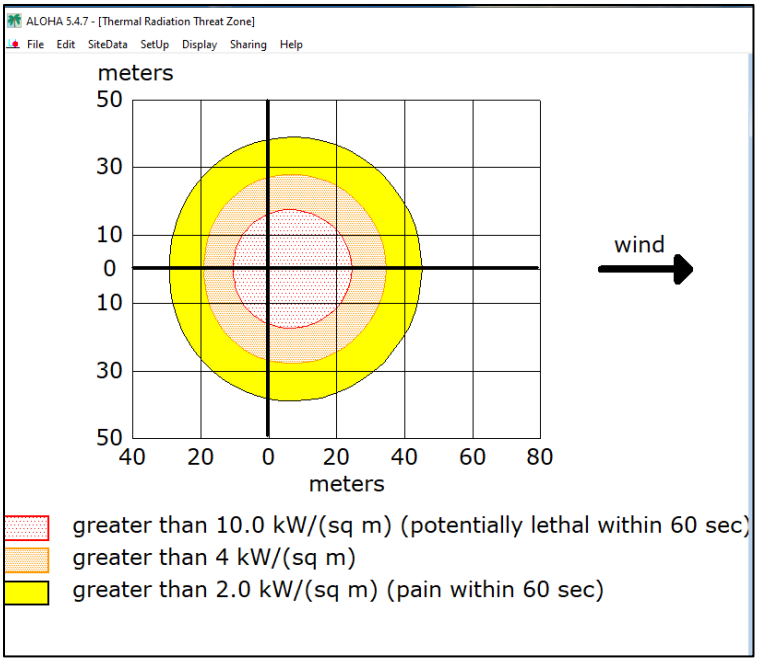


Figure 7.5 ATF Heavy Spillage while Filling Underground Tanks- Fire and Thermal Hazard

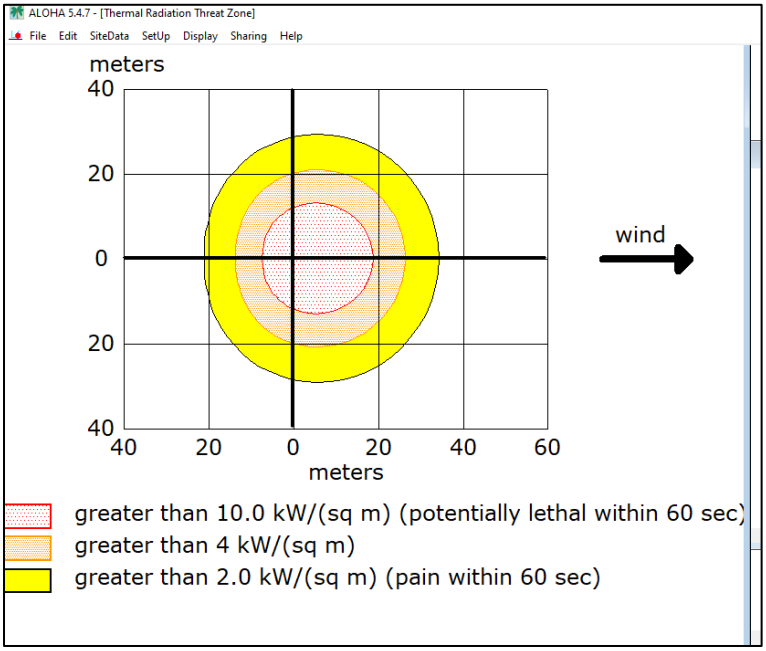


Figure 7.6 ATF Heavy Spillage while Transporting ATF to Aircraft- Fire and Thermal Hazard

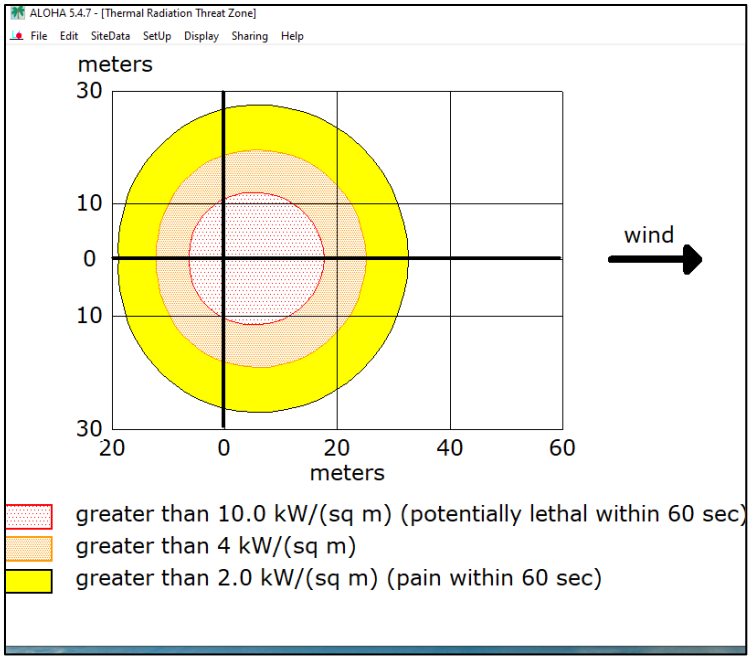


Figure 7.7 Diesel Tank Spillage & Fire Thermal Hazard

7.5.7.5 *Consequence Analysis*

Since the materials involved in Hisar Airport case are only inflammable, the possible scenarios are pool fire and thermal impact Templates shows proposed storage tanks failures / hazardous incidents and consequential impact zone.

7.5.7.5.1 Thermal Hazards

Thermal hazards are mainly due to ATF/Diesel leakage/spillage and pool fire Thermal impacts are limited to ~ 35 m only i.e. within the plant boundary limit. However, the thermal impact can go further due to domino effect. Any incident/accident involving ATF tankers resulting at sensitive places like.

- Aircraft
- Other Vehicles
- Buses

Can result in heavy damage/losses or domino impact.

7.5.7.6 *Conclusion and Recommendations*

Risk Assessment is carried out with the objective to identify the potential hazards from bulk storage facilities at Hisar Airport expansion/development project. Important conclusions and recommendations arising out of the Risk Analysis for Proposed Project are listed below

- Thermal radiation from pool fires are well within the boundary.
- It is recommended that the adjacent Diesel tank/ underground ATF tanks shall be thermally protected by firewater.
- Use corrosion-resistant structural materials and lighting and ventilation systems in the storage area.

- Diesel Storage tank shall be above ground and surrounded with dikes capable of holding entire contents.
- Limit quantity of material in storage up to 80%.
- Restrict access to storage farm area.
- Storage tank farm should be protected with barbed fie fencing with appropriate marking/signs.
- Keep storage area separate from populated work areas.
- Inspect periodically for deficiencies such as damage or leaks.
- Have appropriate fire extinguishers available in and near the storage area.
- Cathodic protection/spark proof lighting system/ alarm etc. provided in tank farm area.

Preventive Maintenance: Routinely inspect and conduct preventive maintenance of equipment/ facilities at the unit.

Instruments: All the instruments like pressure, temperature transmitters/gauges and alarms switches and safety interlocks should be tested for their intended application as per the preventive maintenance schedule. Similarly, the emergency shutdown system should be tested as per the preventive maintenance schedule.

7.5.7.7 *Risk Mitigation Measures for Fuelling of Aircrafts*

- Equipment performing aircraft servicing function will not be positioned within 3 m radius of aircraft fuel vent openings
- Equipment other than that performing aircraft servicing functions will not be positioned within 15 m of aircraft during fuel servicing operations
- The accessibility to the aircraft by fire vehicles will be established during aircraft fuel servicing.
- Handheld intrinsically safe communication devices used within 3 m from the fuel vent will be intrinsically safe
- For open hose discharge capacity of the aircraft refuelling system, at least one listed wheeled extinguisher having a rating of not less than 80-B.
- Presence of at least 2 x 9kg ABC dry powder fire extinguishers at both sides of the refuelling browser / dispenser
- Spark plugs & other exposed terminal connections will be insulated.
- All vehicles, other than those performing fuel servicing, will not to be driven or parked under aircraft wings.
- Electric tools, drills or similar tools likely to produce sparks or arcs will not be used
- Hot works within 50 / 75 metres of refuelling operations will be ceased (for 50m, a MOM approved Safety Officer shall be present)
- The ground service activities do not impede the egress should there be an emergency.

- One aerobridge or mobile step or integral stairs will be positioned with the aircraft door fully opened for evacuation of passengers.
- A Clear area for emergency evacuation of the aircraft will be maintained at the rear (or front) aircraft exit door.

Other Mitigation Measures

- Rule 25A of the Aircraft Rules, 1937 prescribes the procedures of fuelling of aircraft shall be followed
- The fuelling of an aircraft shall be done under the supervision of a person nominated by operator or as specified in the Quality Control Manual and shall be carried out by authorised person from the oil company.
- The aircraft operator shall provide the written instructions to the fuelling company regarding the correct procedure of fuelling and precautions to be taken for particular types of aircraft
- The refuelling equipment shall be placed in such a way that a clear exit path is maintained all round the equipment to and from the aircraft to allow its quick removal in case of need
- It shall be ensured that any accidental spillage from the aircraft air vent does not fall on the fuelling equipment.
- The refuelling of an aircraft shall be done in an open place so designated. As a general guide, the fuelling places shall be at least 15 metres away from the nearest building except those parts of building, which are constructed for the purpose of direct loading/unloading of aircraft. The aircraft shall not be fuelled within 30 metres of radar equipment under test or in use in aircraft or ground installations. The refuelling shall be carried out on a level surface as far as possible. The nominated person shall ensure that there is adequate restraint of the aircraft by checking that the brakes are applied, and the wheel chocks are placed properly before the fuelling operations are started.
- Fuelling of an aircraft by the oil company shall be started only after the fuel samples have been approved by the aircraft operator and a clearance has been given to the oil company to start the fuelling operations and the confirmation of sample approval shall be duly signed by an authorized person of operator on the delivery voucher after completion of fuelling..
- Within Fuelling Zone, smoking, the use of naked lights or operation of switches on lighting systems of other than approved pattern shall be forbidden.
- Unless fuelling takes place in a designated `No Smoking Area', `No Smoking' signs shall be predominantly displayed not more than 15 metres away from the fuelling equipment and aircraft tank vents
- Equipment with all metal wheels or rod capable or producing sparks shall not be moved in the fuelling zone while fuelling is in progress.
- Aircraft borne auxiliary power units (APUs) which have an exhaust influx discharging into the zone shall be started before filler caps are removed or fuelling connections made.

- Ground Power Units (GPUs) whenever used shall be positioned not less than 6 metres from the aircraft filling and venting points and the fuelling equipment
- Only approved vehicles and equipment shall be run in the fuelling zone. These vehicles and equipment's shall be subjected to regular inspection and maintenance to preserve their safety characteristics
- In the case of a spillage covering an area greater than 5 square metres, fuelling operations shall stop. All persons shall be evacuated from the effected area to a place at least 15 metres from the spillage. Movement of persons and vehicles in the affected area shall be avoided. It shall be ensured that all activities are restricted to reduce the risk of ignition.
- Engines of vehicles within 6 metres of a spillage shall not be started until the area is declared safe
- It is essential that all personnel connected with the fuelling operations are adequately trained by their employers and are supplied with appropriate instructions and guidance on safe operating procedures. All such personnel shall be fully conversant with the operation of firefighting equipment provided for the fuelling operations.
- Before and during fuelling, it shall be ensured that no hazard arises to the personnel or equipment from the efflux from other aircraft or APUs. If the hazardous conditions exist, fuelling operation shall immediately by suspended until conditions permit resumption of fuelling operations.

All measures suggested by AAI under Corporate Safety Management System Manual (AAI-SAF-001 dated 20.05.2013) shall be followed.

7.5.8. Electricity

- Safety norms as per Indian Electricity rules 1956 and ECBC shall be followed
- Earthling system will be provided
- All the wires will be selected as per norms
- Design shall be done as per all Indian Code
- Sand bags will be provided near to the electric control panel
- Precaution banners will be displayed wherever required
- Regular maintenance will be done to check any loop hole.
- Routine Drill will be done
- Sign of Danger at all hazard place will be displayed
- PPE will be provided to the workers

7.5.9. Mechanical

- All mechanical equipment will be services in routine
- Sign of Danger at all hazard place will be displayed
- All safeguards will be provided at appropriate places
- Periodic change of all damaged equipment will be done
- Logbook will be prepared

7.5.10. Chemical

- Isolated place will be provided for stooge of chemical
- Full surveillance will be done on chemical storage area
- Fire system will be provided at chemical storage area
- MSDS will be displayed
- Separate storage of Fuel will be done.
- License will be taken from concern department

7.6. Disaster Management Plan

Hisar Airport is storing highly inflammable fuel namely ATF and Diesel in quantity less than Threshold Limit as specified in MSIHC Rules as shown in Table above. However, Airport will prepare Disaster Management Plan (DMP) and submit it to State authorities (State Pollution Board, Factory Inspector etc.) for approval (if required).

This DMP has been designed based on the range, scales and effects of "Major Generic Hazards" described in the Risk Assessment and prediction of various hazardous scenarios. The DMP addresses the range of thermal and mechanical impacts of these major hazards so that potential harm to people onsite and off-site, proposed project and environment can be reduced to a practicable minimum. The scenarios of loss of containment are credible worst cases to which this DMP is linked.

The important aspect in emergency management is to prevent by technical and organizational measures, the unintentional escape of hazardous materials out of the facility and minimize accidents and losses. Emergency planning demonstrates the organization's commitment to the safety of employees and increases the organization's safety awareness. The format and contents of the Disaster Management Plan have been developed taking into consideration the regulatory guidelines, other applicable documents and accepted industry good practice principles formulated as a result of lessons learned in actual emergencies requiring extensive emergency response. A plan can work smoothly and effectively only if the instructions are correctly and promptly followed and action taken at various levels is well coordinated.

7.6.1. Objective of Emergency Planning

The objective of the disaster management plan is to describe the emergency response organization, the resources available and response actions applicable. It deals with various types of emergencies that could occur at the proposed airport project with the response organization structure being deployed in the shortest time possible during an emergency. Thus, the objectives of emergency response plan can be summarized as:

- Rapid control and containment of the hazardous situation.
- Minimizing the risk and impact of an event/accident; and
- Effective rehabilitation of the affected persons, and prevention of damage to property.
- To effectively achieve, the objectives of emergency planning, the critical elements that form the backbone of the plan are:

- Reliable and early detection of an emergency and careful planning.
- The command, co-ordination, and response organization structure along with efficient trained personnel.
- The availability of resources for handling emergencies.
- Appropriate emergency response actions.
- Effective notification and communication facilities;
- Regular review and updating of the plan; and
- Proper training of the personnel.

7.6.2. Categorization of Emergencies

The emergencies at proposed airport can be classified under several headings. These headings are listed below together with a description of the type of emergency:

Fires on the Ground: Fire on the ground can be aircraft related and non-aircraft related. Fire involving aircraft can be at any location on the taxiway or apron area where the aircraft is parked. Non-aircraft related fire involves mainly the terminal buildings, ATF and HSD storage, etc.

Natural Disasters: According to the seismic-zoning map of India, the Hisar Airport project area falls in Zone III of seismicity is a natural hazard for proposed airport project. Storm and heavy rain/lightening are also natural hazards for the airport.

During a major disaster such as severe fire outbreak at terminal building, the various emergency operations will be established immediately to mitigate the disaster. The emergency operations and coordination centers at proposed Airport will comprise Crisis Management Centre (CMC), Emergency Coordination Centre (ECC has its own functions and roles to perform during the crisis:

Established by the Airport Management, the Crisis Management Centre is to function as an overall overseeing and controlling authority of the crisis mitigating process during a major on ground fire. The committee of the Crisis Management Centre comprises the following permanent and supporting members: Functions of the CMC include.

- Formulate strategic plans and policies, as well as engage in high level decision making for the mitigation of crisis.
- Control coordinate and support operations during an Incident.
- Oversee the work and progress of protracted firefighting and rescue, and salvage operations.
- Liaise with the airline concerned, local authorities, ministries, and governmental departments for support.
- Arrange and provide welfare to the staff involved in the mitigation of crisis.
- Regulate the release of information to the public on the facts of the aircraft disaster.
- Issue press releases and organize press conferences.
- Ensure that the post-accident operations are completed expeditiously so that the proposed airport can resume normal operations in the shortest possible time

7.6.3. Emergency Coordination Centre (ECC)

Located near to Entry Gate, the Emergency Coordination Centre will be established by the Terminal Manager, Airport Operator, during a major disaster, to coordinate the response and functions of the external supporting organizations, agencies, and services involved in the mitigation of the emergency. The committee of ECC comprises the following officials:

- Terminal Manager- Chairman
- Engineering In-charge- Alternate Chairman
- Manager- Civil
- Manager- Electrical
- Security Officer
- CISF Representative
- IAF Representative
- Police Representative

Support incident site firefighting and rescue operations through liaison and coordination with the external organizations/agencies/ services. Facilitate mobilization of external resources to the crash site, such as issuing emergency passes and arranging with Apron Control for "Follow-me" vehicles. Arrange and facilitate visits by the VVIPs to the site (if any).

The FRRC serves as a secure area, away from the attentions of the media, for the friends and relatives of those involved in an accident. The documentation process within the FRRC helps to confirm who was on the site/aircraft and facilitates the reunion. On receiving the "Fire" message, Terminal Manager will set up the FRRC. The staff shall man the FRRC, and the police shall take charge of the security of the area. At the FRRC, the airline staff shall

- Attempt to verify the identity of the visitors on entry;
- Conduct documentation and briefing;
- Update with the latest information including passenger manifest, that has been officially cleared;
- Provide care and comfort including refreshments;
- Arrange for doctors and/or CARE officers through ECC on a need basis

Command structure and communication flow among various emergency / coordination centers is given here:

Assembly Area (AA): Assembly area is an area set up near the incident site to temporarily receive the uninjured casualties until the arrangements to transport them to the Hospital is made. Two Assembly Areas (AA) will be near Grass Lawns in front of terminal building

Media Management: Terminal Manager – Chairman and his team shall take the lead to handle all press matters. They are single point media interaction. They will be responsible for developing the overall information management plan, with emphasis on

strategies to manage the information flow. They will also be responsible for the preparation of press releases and the organization of press conferences.

All press personnel will first be directed to Airport Operator's Media Centre. At the Media Centre, press briefing, communications and transportation service for taking the press personnel to and from the accident site, when permissible, will be arranged/provided.
No unauthorized persons shall be allowed in the Media Centre. Only members of the press, free-lance reporters and photographers wearing a valid pass issued by Airport Operator will be admitted to the Media Centre, or transported to the scene of the accident.

Emergency Procedures:

Fires on the Ground (Aircraft Related Fires Occurring In Aircraft Movement Areas)

An Aircraft can catch fire while it is taxiing in the movement area or parked. Such a scenario can arise from a defect or malicious act, and may develop into a major disaster. When the aircraft on the ground on fire is sighted, Airport Fire Service through the crash alarm communication system will be informed and provide details of the aircraft fire, for example:

- Location of aircraft;
- Nature of fire (e.g. undercarriage fire, engine fire);
- Number of POB; and
- Presence of dangerous goods, if known.

The Air Traffic Controller shall give clearance to the responding fire vehicles to enter the runway/taxiway as soon as possible. If the fire is large and has caused extensive damage to the aircraft and external resources are required to aid in the mitigation process, the Air Traffic Controller shall declare "Aircraft on Fire". The standard text and format used for the "Aircraft on Fire" message shall be as follows:

Aircraft on Fire

- Aircraft Operator;
- Aircraft Type & *Flight Number; Location of Aircraft;
- Nature of Fire (e.g. undercarriage fire, engine fire);
- Number of Persons on Board (POB);
- Any Dangerous Goods on Board.
- The use of the phrase "Aircraft on Fire" is to give distinction and therefore avoid confusion between aircraft crash and aircraft on the ground on fire

Fires on the Ground (Fires involving at Proposed Airport Project Site, i.e., Non- Aircraft Related Fires)

Fire may occur at any of the part of Greenfield International Airport. If out of control, such a fire may cripple the key proposed airport facilities and disrupt the normal operations. During a fire occurrence, however small it may appear to be, any person discovering it shall:
Raise the fire alarm via the nearest manual call point. If no manual call point is readily available, raise the alarm by other available means. Inform the Fire Service immediately

of the exact location of the fire via the following telephone numbers. Operate a suitable fire extinguisher where readily available, or any water hose reel within range. [*Note: Attempt to put out the fire using a fire extinguisher shall only be carried out if the fire is small (i.e., at incipient stage) and does not pose any danger to the operator. Also take note that water shall not be used on fire involving liquid such as HSD, as well as on energized electrical equipment unless such equipment has been de-energized.) On receipt of a structural fire call, the Fire Operator shall request the caller to provide the following details

- Location of Fire
- Type of Fire
- Name of Caller
- Telephone number of Caller

Training and Education:

Regular training would be provided to all personnel who have a role in planning and operational response to an emergency. The main goal of training for emergencies is to enable the participants to understand their roles in the response organization, the tasks associated with each position and the procedures for maintaining effective communications with other response functions and individuals.

The training objectives are

- To familiarize personnel with the contents and manner of implementation of the plan and its procedures.
- To train personnel in the performance of the specific duties assigned to them in the plan and in the applicable implementation procedures.
- To keep personnel informed of any changes in the plan and the implementing procedures.
- To maintain a high degree of preparedness at all levels of the Emergency Response Organization.
- Train new personnel who may have moved within the facility organization.
- Test the validity, effectiveness, timing and content of the plan; and
- Update and modify the plan on the basis of experience acquired through exercises and drills.

Mock Drills and Exercises

Regular training would be provided to all personnel who have a role in planning and operational response to an emergency. The main goal of training for emergencies is to enable the participants to understand their roles in the response organization, the tasks associated with each position and the procedures for maintaining effective communications with other response functions and individuals.

- To test, efficacy, timing, and content of the plan and implementing procedures;
- To ensure, that the emergency organization personnel are familiar with their duties and responsibilities by demonstration;
- Provide hands-on experience with the procedures to be implemented during emergency; and Maintain emergency preparedness.

The frequency of the drills would vary depending on the severity of the hazard. However, drills would be conducted once in a year. Scenarios may be developed in such a manner as to accomplish more than one event objective. Drills and exercises will be conducted as realistically as is reasonably practicable.

Planning for drills and exercises would include:

- The basic objectives;
- The dates, times and places;
- The participating organizations;
- The events to be simulated;
- An approximate schedule of events;
- Arrangements for qualified observers; and
- An appropriate critique of drills/exercises with participants

Evaluation of drills and exercises would be carried out which would include comments from the participants and observers. Discrepancies noted by the drill observers during the drill shall be pointed out during the drill. The individual responsible for conducting the drill or exercise would prepare a written evaluation of the drill or exercise. The evaluation would include assessments and recommendations on:

- Areas that require immediate correction;
- Areas where additional training is needed;
- Suggested modifications to the plan or procedures; and
- Deficiencies in equipment, training, and facilities

The evaluation of a drill or exercise shall be submitted to the Terminal Manager for review and acceptance who shall then determine the corrective actions to be taken and assign the responsibility to appropriate personnel. The Safety In-charge would track all approved drill and exercise corrective actions as a means of assuring that corrections are made in a reasonable amount of time, and shall advise the Terminal Manager of the status of implementation of corrective actions. Records of drills, exercises, evaluations, and corrective actions would be duly maintained.

Updating of Emergency Plan

Hisar Airport Emergency Plan and implementing procedures would be reviewed and updated to ensure compliance with relevant regulations and applicable state and local emergency plans. The need for updating is based on following aspects:

- Written evaluations of mock drills exercises which identify deficiencies or more desirable methods, procedures, or organizations.
- Changes in key personnel involved in the organization.
- Changes in the facility organization structure.
- Changes in regulations.
- Recommendations received from other organizations and state agencies.

7.7. Emergency Management Plan

Emergency Management Plan is necessarily a combination of various actions, which are to be taken in a very short time but in a pre-set sequence to deal effectively and efficiently with any disaster, emergency or accident with an aim to keep the loss to the minimum.

The project will have to have complete liaison and co-ordination with outside agencies to minimize the effect of such disaster/emergency. The major function of the plan is to formulate a procedure for:

- Controlling it with minimum damage to men, material and machine
- Rescuing victims and treat them suitably
- Safeguarding others (evacuating them to safe places)
- Identifying the person affected
- Information to relatives of the causalities
- Providing authoritative information to news media and others concerned
- Preserving relevant records needed as evidence in any subsequent enquiry

7.7.1. Scope

The aim of hazard control and disaster management is concerned with preventing accidents through good design, operation, maintenance and inspection, by which it is possible to reduce the risk of an accident, but it is not possible to eliminate it. Since, absolute safety is not achievable, an essential part of hazard control must include mitigating the effect of an accidents.

An important element of mitigating is emergency planning i.e. recognizing that accidents are possible, assessing the consequences of such accidents and deciding on the emergency procedures, both on site and off site, that would need to be implemented in the event of emergency.

Emergency planning is just one aspect of safety and cannot be considered in isolation. In particular, it is not a substitute for maintaining good standards within the project. Before starting to prepare the plan, project management will ensure that the necessary standards and safety precautions are administered.

Emergency plans are likely to be separate for on-site and off-site, but they must be consistent with each other, i.e. they must be related to the same assessed emergency conditions. The on-site plan is called Disaster Management Plan (DMP) and the off-site plan is called Emergency Preparedness Plan (EPP).

7.7.2. Objectives

The overall objectives of an emergency plan are:

- To localize the emergency and if possible, eliminate it; and
- To minimize the effects of the accident on people and property

Elimination of hazard will require prompt action by operators and emergency staff using, for example, fire-fighting equipment and water sprays. Minimizing the effect will include rescue, first aid, evacuation, rehabilitation and giving information promptly to people living nearby.

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7.7.3. Formulation of DMP

The assessment of the risk and hazards leads either to improvements being made to the project, in the form of additional safeguards or better procedures, or to the decision being taken that the risk is sufficiently small to be accepted.

The plan will be substantial document including following:

- Assessment of the size and nature of the events foreseen and probability of their occurrence;
- Formulation of the plan and liaison with outside authorities, including the emergency services;
- Procedure for- raising the alarm and communication both within and outside the works;
- Appointment of key personnel and their duties and responsibilities are:
    - work incident controller
    - works main controller
- Emergency control centre;

The project will set out the way in which designed people at the site for the incident can initiate supplementary action both insides or outside the works at an appropriate time. An essential element of the plan must be the provision for attempting to make safe the affected unit, for example by shutting it down. On a project site, the plan will contain the full sequence of key personnel to be called in from other sections or from off-site.

It is particularly important that the requirement of the plan for emergency resources, both personnel and equipment, are reasonable and can be quickly assembled in the event of an emergency. Management will consider whether sufficient resources exist at the site to carry out the plan for the various assessed incidents in conjunction with the emergency services, for example sufficient water for cooling and fire fighting. The time element is of great significance but is often overlooked.

7.7.4. Emergency Plan

Emergency is the one which may or may not cause material damage or injury but likely to have an impact on the project. Such an emergency may be controlled using resources and resources available in the surrounding establishments.

Scope of Emergency Plan

The scope of the plan is to ensure safety of life, protection of environment and protection of property. Although the emergency may be caused by different factors such as natural calamity, civil disturbance, sabotage, equipment failure, human error, it will normally manifest in the form of fire, etc.

Objective of Emergency Plan

- To localize the emergency and if possible eliminate
- To control and contain the incident as early as possible
- To safeguard other employees by evacuating them to safe assembly points
- To minimize the damage to the project;
- To rescue accident victims and organize medical treatments
- To re-establish normal conditions; and preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency.

Emergency Response Team

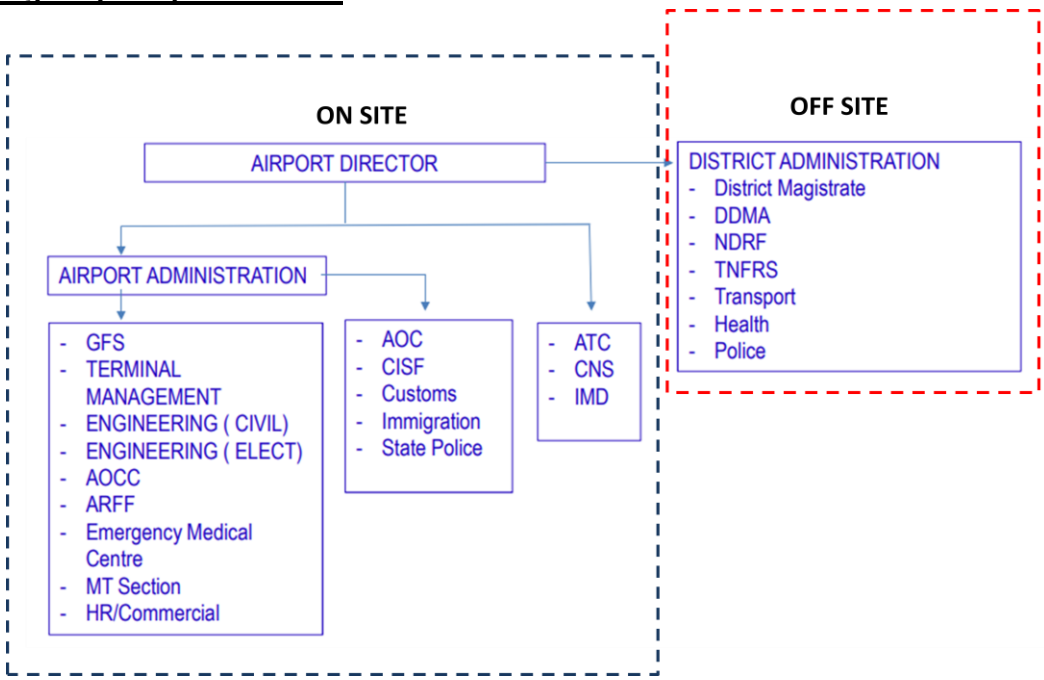

Figure 7.8 Emergency Response Team

7.7.5. Roles and Responsibility in Handling Emergencies

Table 7.12 : Roles and Responsibility in Handling Emergencies

Description	Responsibilities for airport Emergency
Airport Director	• Serve as Emergency Coordinator. • Assume Incident Command responsibility for all response and

Description	Responsibilities for airport Emergency
	• Recovery operations, as appropriate. • Establish, promulgate, coordinate, maintain, and implement the Airport Emergency Plan (AEP). • Contact concern department and provide appropriate alerts and notifications. • Coordinate the closing of the airport when necessary and initiate the dissemination of relevant safety-related information to aviation users (NOTAMs).
Aircraft Operator	• Provide full details of aircraft-related information, as appropriate, to include number of persons, fuel, and dangerous goods on board. • Coordinate transportation, accommodations, and other arrangements for uninjured passengers. • Coordinate use of air carrier/aircraft personnel and other supplies and equipment for all types of emergencies occurring at the airport.
City Administrator	• Provide access to city resources.
Fire Department	• Manage and direct firefighting and rescue operations. • Direct search and rescue or hazardous materials response. • Coordinate mutual aid resources through Incident Command System. • Assist with search and rescue or evacuations. • Assume Incident Command as appropriate.
Police Department	• Manage and direct police operations. • Assist with traffic control and scene security. • Assist with search and rescue or evacuations. • Respond as needed for activities involving crowds or assemblies of people. • Respond to bomb threats or acts of terrorism. • Assume Incident Command as appropriate.
Hospital	• Provide emergency medical services to the airport during emergency conditions to include triage, stabilization, first aid, medical care, and transportation of the injured. • Coordinate planning, response, and recovery efforts with hospitals, fire and police departments, airport operator, etc. • Coordinate the hospital disaster plan with the airport and community • Emergency Operations Plan (EOP).
Public Work Department	• Coordinate use of resources for debris removal or building maintenance. • Coordinate restoration of utilities. • Provide equipment for emergency response and recovery.

7.7.6. Crisis Management Centre (CMC)

Established by the airport operator, the CMC is to function as an overall overseeing and controlling authority of the crisis mitigation process during an emergency. The committee of the CMC comprises the following permanent and supporting members: Permanent members of CMC are:

- Chief Operating Officer Head (Engineering/Maintenance)
- Head (Utility)
- Head (Security)
- Head (Airside Management)
- Terminal Manager
- Supporting members of CMC are: Ministry of Civil Aviation representative
- DGCA representative
- Airline concerned representative
- CISF representative
- Police representative
- Any other agencies required for proper handling of the crisis.

7.7.7. Policy

An airport shall have a formally adopted safety policy and / or safety objective in place, endorsed by the Accountable Executive (Chief Executive Officer, Chief Operating Officer or Chairman of the Board) to confirm senior management commitment to safety. This policy shall be clearly state its objective, identify accountabilities, provide a timeframe and a detailed plan (processes). It shall also define a strategy to implement the organization's workplace health and safety policy, which may be a stand-alone or part of a comprehensive safety policy. The safety policy will incorporate measures to assess and control (eliminate or reduce as low as reasonably possible) the hazards associated with airport operations.