Civil Aviation Authority of Nepal

Airport Rescue and Fire Fighting Services Manual

Second Edition-2019 (2076 B.S)

Approved by:

Director General
Civil Aviation Authority of Nepal

2019

Airport Rescue and Fire Fighting Manual

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Airport Rescue and Fire Fighting Services Manual

Record of Amendment

No. of Amendment	Details of Amendment	Date of Amendment	Entered by Name/Sig	Date entered	Remarks

Forewords

Nepal as a contracting state of International Civil Aviation Organization– ICAO since 1960, has made all possible efforts to protect safety of passengers, crew, aircraft, ground staff, buildings, airport and air navigation facilities and general public as well. Despite of these efforts, possibilities of emergency situation cannot be ignored. In such emergency situation particularly in situations where fire is involved either in aircraft or buildings, infrastructures or equipment, it has been felt the absence of a manual required for the effective implementation of Rescue and Fire Fighting Services (RFFS) which necessarily includes the command, control, communication procedures and the operation of services. Keeping under consideration of this ground reality, this manual has been adopted to assist airport operators in executing their duties in responding effectively the emergency situations as stipulated in airport emergency plan document of the respective airports.

This manual has been prepared by complying with ICAO Annex 14, Chapter 9 Standards and ICAO Document 9137- AN/898 - Airport Services Manual Part 1 (Rescue and Fire Fighting) to the extent possible and commensuration the provisions of Airport Emergency Plan of the respective airports.

Manual also contains the materials to assist the RFF managers, supervisors and fire fighters concerning the level of protection to be provided at an airport, critical area concept and the procedures by which the scale of extinguishing agents have been related to the critical area.

If any provisions of this manual contradicts with the respective provisions of AEP, in that case the provisions of latter shall prevail to the extent of contradiction.

Any suggestions from the stakeholders shall be appreciated and considered as important elements for the amendment and updating the manual towards implementing it in more effective way.

Date: ……/……../2019
……/……/ 2076 Civil Aviation Authority of Nepal

Chapter 1
General

1.1. Introduction

The principal objective of Rescue and Fire Fighting Service is to save lives in the event of aircraft accident or incident. This manual sets out the minimum requirements to be met in the provision of RFF Services at licensed airports as well as hub airports of Nepal. The facilities required by this manual have assessed to being the minimum necessary for flights required by the Air Navigation in order to use a licensed airports. The RFFS shall be provided throughout the hours at licensed airport and hub airports is available for use by aircraft engaged in flights required to use an airport and for 15 minutes after the departure of the last aircraft.

Requirements to deal with building fires and fires involving fuel or recommendations for the foaming of runway are not taken into account. The quantities of extinguishing agents and numbers of RFF personnel required for licensing of the airport are not designed to deal with building fires, runway foaming and fires involving fuel installations. However, where Civil Aviation Offices choose to deploy RFF resources to any such incidents, this shall not prejudice the response objective and minimum discharge rates specified in this manual.

The RFFS shall be established at a level commensurate with the size of aircraft using the airport and organized, equipped, staffed and trained to ensure rapid and effective deployment in the event of an accident/Incidents. Policies and procedures relating to the provision and management of the RFFS shall be described in, or reference to the Aerodrome Manual.

The level and standards of RFFS to be provided at airports in the Nepal a n accordance with the International Civil Aviation Organization, Standards and Recommended Practices.

1.2 Objective of the Manual

Primary objective of this manual is to ensure the smooth operation of RFF service in accordance with the airport category to protect lives in the event of aircraft and airport emergencies specifically in case of fire. Guidance is also given on equipment, extinguishing agents, personnel, training and emergency procedure to provide RFFS effectively, efficiently in a consistent manner.

The purpose and scope of this manual is to implement the ICAO standards and recommended practices as well as to assist all rescue and firefighting personnel in performing their role and responsibilities in systematically, efficiently and ultimately more effective manner to protect lives and properties.

1.3. Applicability

This manual is applicable to:

- All the airports of Nepal where RFF Services are available.
- All the aircraft operators operating their services on airports of Nepal.
- All the stakeholders at the airports of Nepal.
- All the emergency services and organizations (on and off airport) as mentioned in Airport Emergency Plan of the respective airports.

1.4. Review and Amendments of the Manual

Civil Aviation Authority of Nepal, Rescue and Fire Fighting Department shall review the manual on regular basis and at any time if required.

In the course of reviewing the manual following items shall be kept under consideration:-

- Any amendment in ICAO Annex -14 and ICAO Airport Services Manual part-1, Rescue and Fire Fighting service (DOC 9137-AN/898),
- Civil Aviation requirements for Aerodrome(CAR-14),
- Local requirements and
- Suggestions received from the stakeholders.

On the basis of the elements as mentioned above, Civil Aviation Authority of Nepal, Rescue and Fire Fighting Department shall make the proposal for the amendment of the manual and submit to CAAN, Director General for approval.

1.5. Legal Enforcement

This manual has been given legal enforcement by virtue of;

International:

- International Civil Aviation Organization – ICAO Annex -14, Chapter 9
- International Civil Aviation Organization – ICAO Airport Services Manual Part – 1 (9137-AN/898)

National:

- Civil Aviation Act, 1959
- Civil Aviation Authority of Nepal Act, 1996
- Civil Aviation requirements for Aerodrome (CAR-14).
- Airport Emergency Plan – AEP
- Aerodrome Manual

1.6. Need of Rescue and Fire Fighting Service

Rescue and Fire Fighting Services must assume at all times the possibility of and need for extinguishing fire which may exist at the time of landing, take off, taxiing and parking of aircraft, immediately after aircraft accident or incident and at any time during the rescue and firefighting operation.

The fire safety must have to commit to ensure that our passengers and colleagues have a safe working environment.

Consideration shall be given that;

- Possible spillage of highly volatile fuel and other flammable liquids during aircraft crash may result to high degree of ignition if these fuel and liquids come into contact with hot metal parts of aircraft or because of sparks caused by the movement of wreckage or disturbance of the electrical circuit.
- Fire may also occur through discharge of accumulated electrostatic charges at the time of ground contact or during the fueling operation.
- Aircraft fire tends to reach lethal intensity within a very short time presenting a severe hazard to lives directly involved in Fire Fighting and can hamper the rescue operation.
- Special tools shall be provided to the rescue team in order to gaining access to the interior of aircraft fuselage only if their use is regarded as extreme measures to be taken whenever for special reasons normal means of access are unavailable or unsuitable for use. 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 time frame that there are the greatest opportunities of saving lives.

1.7. RFF Administration and Management

The RFF service at an airport should normally be under the administrative control of the CAAN Airport Civil Aviation Office, which should also be responsible for ensuring that the service provided is organized, equipped, staffed, and operated in such a manner as to achieve its principle objective of saving lives in the event of an aircraft accident or incident. The airport management may designate public or private organizations suitably located and equipped to support the RFF service. It is intended to the fire station housing the RFF service be located on the airport premises and suitably located so that responses will not be delayed and will ensure response times can be met.

Under the administrative control of respective Civil Aviation Office, chief of fire station shall be responsible to manage the service.

1.8. Daily Station Routine

To ensure the effectiveness of the service and performance of the RFF personnel, Chief of Fire Station shall be responsible to prepare and implement daily station routine as well as Standard Operating Procedures (SOP). Guidance of such routine is attached in Appendix-A

During checking the performance of fire vehicles guidance attached in Appendix-B shall be used.

1.9. Audit and Inspection.

The recommendation made by Audit inspection of concerned airport authority shall be responsible for the correction of findings along with the Corrective Action Plan (CAP) for the efficient firefighting activities and operation

1.10. Coordination between Mutual Aid agencies

A prior agreement or Memorandum Of Understanding (MOU) between Airport Civil Aviation Office and City Fire Fighting Service or other agencies such as Local Police, Armed Police Force Nepal, Nepal Army, local Red Cross, Hospitals shall be made to gain their assistance in responding emergency situation.

1.11. Grid Map

A detailed grid map of the relevant airport and its surrounding areas shall be provided. This map includes the information of topography, access roads and location of water supplies, location of assemble area, local stand by point, rendezvous points, staging areas, highway, difficult terrain etc. and the other map of surrounding communities depicting appropriate medical facilities etc. within a distance of approximately 8 km from a center of the airport.

Grid map shall be made available at the control tower, fire watchtower, fire fighting vehicle, other supporting vehicles and mutual aid agencies.

Chapter 2
Definitions

Aerodrome - A defined area in land or water associated with buildings, installations and equipment which is either wholly or partly used for take-off, landing and surface movement of aircraft. See "airport".

Acts of Unlawful Interference– These are acts or attempted acts such as to jeopardize the safety of civil aviation and air transport, i.e.

- Unlawful seizure of aircraft in flight,
- Unlawful seizure of aircraft on the ground,
- Hostage-taking on board aircraft or on aerodromes,
- Forcible intrusion on board aircraft, at an airport or on the premises of an aeronautical facility,
- Introduction on board an aircraft or at an airport of a weapon or hazardous device or material intended for criminal purposes,
- communication of false information such as to jeopardize the safety of an aircraft in flight or on the ground, of passengers, crew, ground personnel or the general public, at an airport or on the premises of a civil aviation facility.

Aircraft – *A*ny machine that can derive support in the atmosphere from the reactions of the air against the earth's surface.

Aircraft Accident – An aircraft accident which has occurred on or in the vicinity of the airport.

Aircraft In Flight – An aircraft shall be deemed to be in flight at any time from the movement with all its external doors closed following embarkation until the moment when any such door is opened for disembarkation. Provided that in case of a forced landing, the aircraft shall be deemed to be continued in flight until the competent authorities take over responsibility for the aircraft and for persons and property on board.

Aircraft In Service – An aircraft shall be deemed to be in service from the beginning of the pre-flight preparation of the aircraft by ground personnel or by the crew for a specific flight until twenty-four hours after landing. Such period of service shall, in any event, extend for the entire period during which the aircraft is in flight as defined above.

Aircraft Operator– A person, organization or enterprise engaged in or offering to engage in regular public transport or charter aircraft operations. Within the context of this Program "aircraft operator" shall mean the operator of any aircraft engaged in commercial air transport operations and any entity conducting general aviation operations, including corporate aviation operations, using aircraft with a maximum take-off mass greater than 5.700 kg.

Aircraft Stand – a designated area on an apron intended to be used for parking an aircraft.

Air Navigation Installation - Any building, works, apparatus or equipment used wholly or mainly for the purpose of assisting air traffic control or as an aid to air navigation, together with any land contiguous or adjacent to such buildings, works, apparatus or equipment and used wholly or mainly for the purpose connected therewith.

Airport – Any area of land or water designed, equipped, set apart or commonly used for affording facilities for the landing and taking off of aircraft and includes any area of the space, whether on

ground, roof of a building or elsewhere, which is designed, equipped or set apart for affording facilities for the landing and taking off of aircraft capable of descending or climbing vertically.

Airport Civil Aviation Office-Any office working at an airport under the CAAN for the efficient operation of the airport including the provision of civil aviation security measures

Airport Operator – a person/organization whose name appears on licensed document of an airport.

Airside – The movement area of an airport, adjacent terrain and buildings or portions of buildings thereof, access to which is controlled.

Apron – A defined area, on a land aerodrome, intended to accommodate aircraft for the purposes of loading or unloading passengers, mail or cargo, fueling, parking or maintenance.

Bomb Threat – A communicated threat, anonymous or otherwise, which suggests, or implies, whether true or false, that the safety of an aircraft in flight or on the ground, or any airport or civil aviation facility or any person may be in danger from an explosive or other item or device

Dangerous Goods – Articles or substances which are capable of posing significant risk to health, safety, property of the environment and which are shown in the list of dangerous goods in the Technical Instructions or which are classified according to those instructions.

Command Post – The location at the scene of an emergency where the on-scene commander is located and where command, co-ordination, control, and communications are centralized.

Crew Member – A person assigned by duty on an aircraft during a flight operations duty period.

Explosive Device – Any device that can be triggered to explode. A list of such articles shall be attached to Airport Security Program.

Flight Crew – The operating crew of an aircraft including the flight deck and cabin crew.

Fire Pit – A pit where hot fire drill is carried out. The minimum size of pit shall be 30x20x1 Meter.

Full Emergency – When it is known that an aircraft approaching to an airport is or is suspected to be in such trouble that there is a danger of an accident.

Grid Map – Airport grid map showing airport and adjacent areas up to 4 km from airport perimeter boundary. It helps easily to find out exact location of aircraft accident or incident

Incendiary Device – Any device containing an inflammatory substance for causing a fire.

International Airport – any airport designated by the Contracting State in which territory situated as an airport of entry or exits for international air traffic, where formalities incident to customs, immigration, public health, animal and plant quarantine and similar procedures are carried out.

Landside – that area of an airport and buildings to which both traveling passengers and the non-traveling public have unrestricted access.

Local Standby – when an aircraft approaching to an airport is known or is suspected to have developed some trouble but the trouble is not such as would normally involve any serious difficulty in effecting a safe landing.

Movement Area – that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the maneuvering area and the apron(s).

Response Time – The operational objective of the rescue and fire-fighting service shall be to achieve a response time of two minutes not exceeding three minutes to the end of each runway as well as to any other part of the movement area, in optimum conditions of visibility and surface conditions. Response time is considered to be the time between initial call to the rescue and

firefighting service and the time when the first responding vehicle is in position to apply foam at a rate of at least 50% of discharge rate specified in table 1.1 and 1.2

Rendezvous Point – a rendezvous point is a pre-arranged reference point i.e. road junction, cross road or other specified place, to which personnel and vehicle responding to an emergency situation initially proceed to receive directions to staging areas and /or accident/ incident site.

Staging Area – A staging area is a pre-arranged strategically placed area where support response personnel, vehicles and other equipment can be held in readiness for use during an emergency. Normally one of the staging area is located in the vicinity of the fire station

S***tandby Point*** – It is pre-determined point/ place for the fire fighting vehicle to stay stand by to cope with any type of pre informed emergency.

Triage and Triage Area– Triage is the sorting and classification of casualties to determine the order of priority for treatment/transportation. T A is located where triage operations are performed.

Vulnerable Point – An installation or facility at an airport which, in the opinion of the Civil Aviation Authority, would impair civil aviation operations at the airport if damaged or destroyed.

Chapter 3
Level of Protection

The level of protection to be provided at an airport should be based on the airport category. Airports should be categorized for rescue and firefighting purposes.

3.1. Airport category

The airport category for rescue and Fire Fighting should be based on the dimensions of the Aeroplanes using the airport as adjusted for their frequency of operations.

The airports of Nepal have been categorized for the provision of rescue and Fire Fighting services on the basis of:-

- The biggest type of aircraft operating currently on those airports.
- The airport category for rescue and Fire Fighting should be based on the overall length of the longest Aeroplane normally using the airport and their maximum fuselage width.
- The airport category should be determined from Table 3-1 by categorizing the Aeroplanes using the airport, first evaluating their overall length and second their fuselage width. If selecting the category appropriate to the largest Aeroplane's overall length, that Aeroplane's fuselage width is greater than the maximum width in Table 3-1 for that category, then the category for that Aeroplane is actually one category higher.
- Airports should be categorized by counting the Aeroplane movements in the busiest consecutive three months of the years as follows:
    - ✓ When the number of movements of the Aeroplanes in the highest category normally using the Airports is 700 or greater in the busiest consecutive three months, then that category should be the airport category.
    - ✓ When the number of movements of the Aeroplanes in the higher category normally using Airport is less than 700 in the busiest consecutive three months, then the airport category may be one less than the highest Aeroplane category even when there is wide range of difference between the dimensions of the Aeroplanes which are included in reaching 700 movements.
    - ✓ Either a take-off or a landing constitutes a movement. Movement of scheduled, non-scheduled and general aviation operations should be counted in determining the airport category. When past traffic levels are unavailable, the level of RFFS should be assessed from the best available information. For this assessment should be recorded.

Airports shall be categorized as per Table 3-1 for the purpose of providing rescue and firefighting services:-

Table 3- 1

Overall length of aircraft	Maximum Fuselage	Airport Category
0 - 8.9 m	2 m	1
9 - 11.9 m	2 m	2
12 - 17.9 m	3 m	3
18 - 23.9 m	4 m	4
24 - 27.9 m	4 m	5
28 - 38.9 m	5 m	6
39 - 48.9 m	5 m	7
49 - 60.9 m	7 m	8
61 - 75.9 m	7 m	9
76 - 89.9 m	8 m	10

The RFF category provided and promulgated by an airport shall be determined in a consistent manner with reference to above table.

On the basis of above parameters, airports of Nepal have been categorized as follows:-

S N	Name of the Airport	Largest Type of Aircraft operating	Airport Category	Remark
1	Tribhuvan Int,l Airport, Kathmandu	B-777, Airbus-330.	IX	
2	Biratnagar Airport	ATR- 72, CRJ 700	V	
3	Simara Airport	ATR-72	V	
4	Gautam Buddha Airport	ATR-72, CRJ 700	V	
5	Pokhara Airport	ATR-72	V	
6	Nepalgunj Airport	ATR- 72 CRJ 700	V	

The provision of RFFS to the Category set out in paragraph 3.1 is a mandatory requirement. However, there may be circumstances when a part of the facility is temporarily unavailable due to technical failure of a vehicle or piece of equipment or sudden illness of a member of staff or any unforeseen event or during airport emergency exercises immediate action should be taken by the airport management to reinstate facilities. During the temporary depletion, the Category of RFFS shall not be less than the equivalent of ONE category below that of the RFF category according to the size of Aeroplanes expecting to use the aerodrome. If any depletion is significant enough to warrant a restriction of Aeroplane movements then the temporary level of RFFS stated in terms of specific RFF Category, should be immediately promulgated by NOTAM and radio. Generally, temporary depletion should not last more than 24 hours at an aerodrome.

Licensed airports should consider developing contingency plans like a preventive maintenance plan, arrangements to cover unplanned leave to limit the need for temporary depletion of the promulgated level of RFFS. Licensed airports should consider the provision of reserve facilities to limit the need for temporary depletion.

3.2. Types of Extinguishing Agents:

Both Principal and complementary extinguishing Agents should be provided at an Airport. Principal Agents produce a permanent control, i.e.; for a period of several minutes or longer. Complementary agents have rapid fire suppression capability but offer a transient control which is usually only available during application.

3.2.1. The Principal Extinguishing agents should be:

a) a foam meeting performance level A; or
b) a foam meeting performance level B; or
c) a foam meting performance level C ; or
d) a combination of these agents.

3.2.2. The complementary Extinguishing agents should be:

a) Dry chemical powders (Classes B and C powders); or
b) Other Extinguishing agents with at least the same Fire Fighting capability.

3.3. Amount of Extinguishing Agents

The amounts of water for foam production and the complementary agents to be provided on the RFF vehicles should be in accordance with the airport category determined under T 3-2. The amounts in 3-2 are the minimum amounts of extinguishing agents to be provided. Whenever it is possible to provide additional protection, bearing in mind the recurrent maintenance need of equipment or any unusual operational hazards particular to an airport.

Elements included in the following table shall be considered to determine the amount of extinguishing agents in respective category of airport:-

	Foam meeting performance level A		Foam meeting performance level B		Foam meeting performance level C		Complementary agents	
Airport category	Water (L)	Discharge rate foam solution/m (L)	Water (L)	Discharge rate foam solution/m (L)	Water (L)	Discharge rate foam solution/m (L)	Dry chemical powders (kg)	Discharge rate kg/second
1	350	350	230	230	160	160	45	2.25
2	1000	800	670	550	460	360	90	2.25

3	**1800**	**1300**	**1200**	**900**	**820**	**630**	**135**	**2.25**
4	**3600**	**2600**	**2400**	**1800**	**1700**	**1100**	**135**	**2.25**
5	**8100**	**4500**	**5400**	**3000**	**390**	**2200**	**180**	**2.25**
6	**11800**	**6000**	**7900**	**4000**	**5800**	**2900**	**225**	**2.25**
7	**18200**	**7900**	**12100**	**5300**	**8800**	**3800**	**225**	**2.25**
8	**27300**	**10800**	**18200**	**7200**	**12800**	**5100**	**450**	**4.5**
9	**36400**	**13500**	**24300**	**9000**	**17100**	**6300**	**450**	**4.5**
10	**48200**	**16600**	**32300**	**11200**	**22800**	**7900**	**450**	**4.5**

Table 3-2 Minimum useable amounts of extinguishing agents

The quality of foam concentrate separately provided on vehicle for foam production should be in proportion to the quantity of water provided and the foam concentrate selected. The amount of foam concentrate should be sufficient to supply at least two full loads of such quantity of water where sufficient additional water supplies are immediately to ensure a rapid replenishment of the water content carried.

The amounts of water supplied for foam production are predicated on an application rate of 8.2 L/min/m2 for performance level A foam and 5.5 L/min/m2 for performance level B and 3.75 L/min/m2 for a performance level C. These application rates are considered to be the optimum rates at which control can be achieved within one minute control time. Control time is the time required to reduce the initial intensity of the fire by 90 percent. The amounts in Table 3-2 have been determined by adding the quantity of extinguishing agents which are required to obtain a control time and the quantity of extinguishing agents which are required for continued control of the fire there after and/or for possible complete of extinguishment.

From 1 Jan 2015, at aerodrome where operations by Aeroplanes larger than the average size in a given category are planned, the quantities of water shall be recalculated and the amounts of water for foam production and the discharge rates for foam solution shall be increased accordingly as per table 3.3 and table 3.4.

Table-3.3.

Maximum Quantities of extinguishing agents based on the largest dimension of an aeroplane

(Performance level A foam, application rate 8.2 L/min/m^2)

RFF Category	Largest theoretical length of aeroplane L (m	Fuselage width	Total width of protection area	Theoretical critical area A_T= L×(k_1+w)	practical critical area A_p= 2/3 A_T	Q_1= 8.2×1 ×A_p	Q_2=k_2×Q_1	∑Q= Q_1+Q_2	Discharge rate(L/min)Application rate of 8.2L/Min/m^2
1	9	2	12+2=14	126	84	689	0.0	689	689
2	12	2	12+2=14	168	112	918	0.27×918= 248	1166	918
3	18	3	14+3=17	306	204	1673	0.30×1673 =502	2175	1673
4	24	4	17+4=21	504	336	2755	0.58×2755 =1598	4353	2755
5	28	4	30+4=34	952	635	5207	0.75×5207 =3905	9112	5207
6	39	5	30+5=35	1365	910	7462	1.0×7462= 7462	14924	7462
7	49	5	30+5=35	1715	1144	9381	1.29×9381 =12101	21482	9381
8	61	7	30+7=37	2257	1505	12341	1.52×1234 1=18758	31099	12341
9	76	7	30+7=37	2812	1876	15383	1.70×1538 3=26100	41483	15383
10	90	8	30+8=38	3420	2281	18704	1.9×18704 =35538	54242	18704

Table- 3.4

Maximum Quantities of extinguishing agents based on the largest dimension of an aeroplane

(Performance level B foam application rate 5.5 L/min/m^2)

RFF Category	Largest theoretical length of aeroplane L (m)	Fuselage width	Total width of protection area	Theoretical critical area A_T= L×(k_1+w)	Practical critical area A_p= 2/3 A_T	Q_1= 5.5×1×A_p	Q_2= K_2×Q_1	∑Q= Q_1+Q_2	Discharge rate (L/m) Application rate of 5.5L/Min/m^2
1	9	2	12+2=14	126	84	462	0.0	462	462
2	12	2	12+2=14	168	112	616	0.27×616 =166	782	616
3	18	3	14+3=17	306	204	1122	0.30×1122 =337	1459	1122
4	24	4	17+4=21	504	336	1848	0.58×1848 =1072	2920	1848
5	28	4	30+4=34	952	635	3493	0.75×3493 =2620	6113	3493
6	39	5	30+5=35	1365	910	5005	1.0×5005 =5005	10010	5005
7	49	5	30+5=35	1715	1144	6292	1.29×6292 =8117	14409	6292
8	61	7	30+7=37	2257	1505	8278	1.52×8278 =12583	20861	8278
9	76	7	30+7=37	2812	1876	10318	1.70×1031 8=17541	27859	10318
10	90	8	30+8=38	3420	2281	12546	1.9×12546 =23837	36383	12546

For airport categories 1 and 2, up to 100 percent of the water may be replaced by complementary agent. For the replacing purpose, 1 kg of a complementary agent shall be taken as equivalent to 1.0 L of water.

3.4. Critical Area:

The critical area is a concept for rescue of the occupants of an aircraft. As per this concept, priority is to be given to control the fire adjacent to the fuselage. Fire Fighting should be concentrated to safeguard the integrity of fuselage and maintain tolerable conditions for its occupants.

There is need to distinguish between the theoretical critical area **(A_T)** and practical critical area (**A_P**).The practical critical area represents the actual aircraft accident conditions and the theoretical critical area within which it may be necessary to control the fire.

Critical Area for Calculating Quantities of Water:

The Formula for the Theoretical and practical critical area are:

A. Theoretical critical Area (A_T) :

Overall Length.

L ≤ 12m	L × (12m + W)
12m ≤ L ≤ 18m	L × (14m + W)
18m ≤ L ≤ 24m	L × (17m + W)
L ≥ 24m.	L × (30m + W)

Where;

L = The overall length of the aircraft.

W = The maximum width of the aircraft fuselage.

B. Practical critical Area (A_P) :

The Practical critical Area has been found to the approximately two thirds of the theoretical critical Area, i.e;

$A_P = 0.667 \times A_T$.

C. Quantity of Water :

The quantity of water for foam production can be calculated from the following formula:

$Q = Q_1 + Q_2$.

where, Q= The total water required.

Q_1= The water for control of the fire in the practical critical area.

Q_2= The water Required after control has been established and is needed for such factors as maintenance of control and/or extinguishment of the remaining fire.

$Q_1 = A_p \times R \times T$.

where; A_p= The practical critical area.

R= the Rate of Application.

T= time of Application.

D. The graph mentioned in the preceding paragraph gives the following approximate values for aeroplanes representative of each Airport Category :

Airport Category	Q_2= percentage of Q_1 percentage.
1	0
2	27
3	30
4	58
5	75
6	100
7	129
8	152
9	170
10	190

3.5. Discharge Rates:

Discharge rates should meet the requirement of obtaining one minute control time on the critical area and therefore it should be determined for each category by multiplying the critical area by application rate. The discharge rates of the foam solution and Dry Chemical powder should not be less than the rates shown in Table 3-2.

3.6. Supply and Storage of Extinguishing Agents:

To meet the requirement of airport category, chief of respective Airport Civil Aviation Office shall arrange and store required amount of extinguishing agents including the amount required for the vehicle replenishment purpose.

The quantities of the various extinguishing agents to be provided in the rescue and fire fighting vehicles should be in accordance with the airport category. A reserve supply of foam concentrate and complementary agent equivalent to 200 per cent of the quantities of these agents to be provided in the rescue and fire fighting vehicles should be maintained on the airport for vehicle replenishment purposes. Vehicle foam tanks must be full at all times when the vehicle is in operational service.

3.7. Response Time:

3.7.1. Response time shall be considered to be the time between the initial call to the RFF service and the time when the first responding vehicle(s) is (are) in position to apply foam at a rate of at least 50 per cent of the discharge rate specified in Table 3.2. The operational objective of the

RFF service should be to achieve response times of two minutes and not exceeding three minutes to the end of each runway, as well as to any other part of the movement area, in optimum conditions of visibility and surface conditions.

3.7.2. Consideration of response times should also be given to landing and take-off areas for the exclusive use of helicopters.

3.7.3. Other supporting vehicle required to deliver he amounts of extinguishing agent should arrive to the site not later than after the arrival of first responding vehicle.

3.7.4. To meet the operational objective as nearly as possible in times of traffic/apron congestion or in less than optimum conditions of visibility, it may be necessary to provide suitable guidance, equipment, access routes and/or procedures for RFF vehicles.

3.8. Fire Station:

Fire station shall be located at the airport in such an area to meet the response time. All the fire fighting and rescue vehicles shall be housed in fire station at all time. Satellite fire stations should be provided whenever the response time cannot be achieved from a single fire station.

The fire station should be located so that the access for RFF vehicles into the runway area is direct and clear, requiring a minimum number of turns.

3.9. Communication and Alerting Service:

The provision of effective communications is a key consideration when preparing to deal with an aircraft incident or accident. A discrete communication system such as direct hot line, intercom, VHF Set etc. shall be provided to establish an immediate contact between followings units in case of an emergency to meet the response time as well as to respond the emergency in well systematized and effective manner.

Air Traffic Control Tower	–	Fire Station Watch Tower
Air Traffic Control Tower	–	RFF crew En –route
RFF Personnel	-	Aircraft Crew member
Fire Station Watch Tower	-	RFF crew En –route
RFF crew En–route	-	Another RFF crew En-route

RT communications equipment shall be provided to ensure the airport fire officer (s) to communicate with the flight deck. It is recommended that a recording facility for this specific frequency be provided. The use of this specific frequency is limited to direct communications between the fire officer and pilot when the aircraft is on the ground and only within the period of a declared emergency.

All RFF vehicles shall be provided with adequate communications equipment with effective range. Equipment to provide effective communication between vehicle driver and foam monitor operators shall be provided.

Where the deployment of personnel and vehicles for non-fire service duties includes entry to

buildings, aircraft or aerodrome installations, portable communications equipment shall be provided to ensure that to respond to aircraft incidents capability is maintained.

3.10. Number of Vehicles:

3.10.1. In addition to the above, suitable rescue and firefighting vehicles and equipment shall be available at airports where the area to be covered by the service includes water, swamp or other difficult environments that cannot be fully served by conventional wheeled vehicles. This is particularly important where a significant portion of approach/departure operations takes place over this area. The purpose of these special vehicles is to rescue aircraft occupants at an aircraft accident that may occur in this area. Details on characteristics of these types of vehicles can be found in Chapter 5.

3.10.2. A preventive maintenance plan should be derived to ensure maximum mechanical efficiency of the RFF vehicles. In this connection, due regard should be made to the possible need to provide reserve vehicles to take the place of those which become temporarily unserviceable.

Table 3.5 Minimum Number of Fire Vehicles.

Airport Category	Number of fire fighting vehicle
1	1
2	1
3	1
4	1
5	1
6	2
7	2
8	3
9	3
10	3

Chapter 4
Airport Facilities required for Rescue and Fire Fighting Services

4.1 Water Supply

4.1.1. Supplementary water supplies, for the expeditious replenishment of RFF vehicles should be prearranged. Availability of sufficient quantity of water from sources in proximity to apron as a support to aircraft rescue and fire-fighting operations is most desirable. The objective of providing additional water supplies at adequate pressure and flow is to ensure rapid replenishment of aerodrome RFF service vehicles.

4.1.2. Additional water to replenish vehicles may be required in as little as five minutes after an accident, therefore an analysis should be conducted to determine the extent to which the replenishing vehicles and their associated storage and delivery facilities, should be provided.

4.1.3. When conducting the analysis, the following factors should be considered but not limited to:

a) Sizes and types of aircraft using the aerodrome;
b) The capacities and discharge rates of aerodrome fire vehicles;
c) The provision of strategically located hydrants;
d) The provision of strategically located static water supplies;
e) Vehicle response times;
f) Historical data of water used during aircraft accidents;
g) The need and availability of supplementary pumping capacity;
h) The provision of additional vehicle-borne supplies;
i) The level of support provided by local authority emergency services;
j) The pre-determined response of local authority emergency services;
k) Fixed pumps where provided a rapid and less resource-intensive method of replenishment;
l) Additional water supplies adjacent to airport fire service training areas; and
m) Overhead static water supplies.

4.2. Emergency Access Roads:

Emergency access roads should be provided on an aerodrome where terrain conditions permit their construction, so as to facilitate achieving minimum response times. Particular attention should be given to the provision of ready access to approach areas upto 1000m from the threshold, or at least within the aerodrome boundary. Where a fence is provided, the need for convenient access to outside areas should be facilitated by the provision of emergency gates of frangible barriers.

Emergency access roads should be capable of supporting the heaviest vehicles which will use them, usable in all weather conditions. Roads within 90m of a runway should be surfaced to prevent surface erosion and the transfer of debris to the runway. Sufficient vertical clearance should be provided from overhead obstructions for the largest vehicles and should be marked to indicate its purpose, with a prohibition of vehicle parking in its immediate vicinity.

When surface of the road is indistinguishable from the surrounding area or in areas where snow may obscure the location of the road edge markers should be placed at intervals of about 10m.

Chapter 5
Communication and Alarm Requirements

5.1 System Facilities

5.1.1. The efficiency of RFF services is significantly dependent on the reliability and effectiveness of its communication and alarm system. In addition, the successful conduct of the total firefighting and related rescue operation will be facilitated by the system for alerting and mobilizing other participating emergency support personnel.

5.1.2. Consistent with the individual requirements of each airport there should be provision for:

a) Direct communication between air traffic control (or other activating authority provided by the airport authority) and the airport fire station(s) to ensure the prompt dispatch of RFF vehicles in the event of an aircraft emergency;

b) Communication between air traffic control and the RFF crews en-route to, or in attendance at, an aircraft accident/incident. To provide guidance to the RFF vehicles during low visibility conditions, some form of navigational assistance may be required (see 3.7.5);

c) Communication between the fire station, or the main station, where more than one is provided, and the RFF vehicles;

d) Communication between the RFF vehicles, including where necessary, a system to provide intercommunication between the crew members of an RFF vehicle; and

e) Emergency alarm systems to alert auxiliary personnel and appropriate organizations located on or off the airport.

5.1.3 Additionally, direct communication may be provided between the RFF services and the flight crew of an aircraft in an emergency on the ground.

5.2. Fire Station Communications

5.2.1 In considering the scope of fire station communications, two important factors need to be considered. The first is the extent of the workload in the watch room when an aircraft accident or incident occurs. The second consideration relates to those airports operating more than one fire station. Where two or more stations are provided, it is usual to designate one as the main station and its watch room as the master watch room, which is continuously staffed. It is essential to differentiate between the minimum requirements in main and satellite fire stations and to identify the systems which can serve both. The fire station watch tower/room should be more effectively equipped and operated in its primary role.

5.2.2 Calls to the airport fire station(s) for attendance at an aircraft accident/incident normally originate from air traffic control. Air traffic control should be linked with the main fire station by a direct telephone line not passing through any intermediate switchboard so as to avoid delays. This line is usually provided with a distinctive buzzer in the watch tower/room and is safeguarded against buzzer defects by a warning light. This line can be linked to the alarm system in the main and satellite fire station(s) so that the initiation of a call by air traffic control simultaneously alerts all personnel. The alarm system may also be used to activate RFF vehicle room doors. A separate switch for activating the alarm system should be provided in each fire station watch tower/room.

5.2.3 Fire stations should be provided with a public address system so that details of the emergency, giving location, type of aircraft involved, preferential routing for RFF vehicles, can be conveyed to crew members. Control of this system would normally be located in the master watch room,

which would also have a switch for silencing the alarm system to avoid any interference with the effective use of the broadcast facility.

5.2.4 Some calls for emergency services may reach the main fire station from the airport telephone switchboard and it is usual to have a special telephone circuit for these priority calls. As some of these calls will be of lower priority than that associated with an aircraft accident/incident, it is not necessary to link this circuit with the alarm system. The alerting and directing of these responses can be controlled from the master watch room. A separate telephone circuit, for calls of a non-emergency nature, should also be provided in each watch room.

5.2.5 Where the master watch room is required to mobilize off-airport support services for aircraft-related or other emergency situations, direct telephone circuits with appropriate priority indications should be provided to the appropriate control centers.

5.2.6 Satellite fire station watch rooms should be linked to the master watch room by a direct telephone line. The satellite fire station should be served by the public address and alarm system operated by the master watch room as well as having the ability to activate the alarm system and make public address broadcasts within its station. A grid reference map(s) should be displayed.

5.2.7 Grid reference maps, etc., should be placed directly in front of the watch room attendant's position.

5.2.8 All telephone and radio equipment in each watch room should be regularly monitored for its serviceability and arrangements should exist for emergency repair and maintenance of this equipment. The continuity of electrical supplies to fire stations should be ensured by connection to secondary power supplies.

5.3. RFF Vehicle Communications

5.3.1 When RFF vehicles leave fire stations and enter the maneuvering area they come under the direction of air traffic control. These vehicles must be equipped with two-way radio communications equipment, through which their movements can at all times be subject to direction by air traffic control. The choice of a direct air traffic control/fire service frequency, monitored in the master watch room, or a discrete airport fire service frequency, relaying air traffic control instructions and information, will be a matter for the airport or appropriate authority to determine, based on local operational and technical considerations. A discrete frequency minimizes the extent to which fire service activities involve an air traffic control channel at a busy airport. It is important to provide the fire service with the facility to communicate with flight crew members in certain types of incidents, particularly where undercarriage situations are involved or aircraft evacuation may be proposed. Technical solutions are available to permit both a discrete frequency and an aircraft "talk-through" facility, subject to air traffic control approval. All transmissions should be recorded once an emergency situation has been declared.

5.3.2 The radio equipment on RFF vehicles must accommodate communication between vehicles, en route to, and in operation at, an aircraft accident. Within individual vehicles there should be an intercommunication system, particularly between drivers and monitor operators, to optimize the deployment of the vehicles at an accident. The provision of a communication facility within an appliance must recognize the likelihood of high noise levels and this may require the use of noise-cancelling microphones, headsets and loudspeakers for effective intercommunication.

5.3.3 The RFF vehicles should be provided with communication equipment capable of communicating directly with an aircraft in an emergency situation using an aeronautical radio frequency. The aeronautical radio frequency permits the RFF service and the aircraft to communicate with each

other directly allowing the RFF crew to issue critical information regarding the exact nature of, and the hazards associated with, an emergency in progress along with recommendations for actions. Where provided, the aeronautical radio frequency may be selected by air traffic control and notified to the aircraft and the RFF service. The requirements and responsibilities for the utilization of a radio frequency between the RFF service and the flight crew of an aircraft in an emergency situation should be detailed in a procedure agreed to between the air traffic services and the airport operator.

5.3.4 Communications between the flight crew, air traffic control and the RFF service should be maintained throughout the emergency response. Due to the critical and timely nature of the information transmitted on this frequency, transmissions should be limited to air traffic control, the pilot of the aircraft and the officer-in-charge of the RFF operations. The officer-in-charge of the RFF operations should delay transmissions to the aircraft until cleared by air traffic control, unless the nature of the transmission is critical to emergency operations.

5.3.5 Standard operating procedures (SOP) explaining the use of the dedicated radio frequency should be developed outlining why, when and how it should be used.

5.3.6 At the accident site the officer-in-charge of RFF operations may leave the vehicle and make observations on foot, and can then direct and inform crew members in all aspects of fire-ground operations using a portable megaphone. This equipment may also serve a subsidiary role in communications with aircraft crew members, the occupants of the aircraft and other persons responding to the accident.

5.4 Other Communications and Alerting Facilities

5.4.1 The mobilization of all parties and agencies required to respond to an aircraft emergency on a large airport will require the provision and management of a complex communications system. The requirement is examined in the *Airport Services Manual* (Doc 9137), Part 7 — *Airport Emergency Planning,* Chapter 12. Part 7 covers all aspects of airport emergency planning of which communications is a vital element, and which must be subject to individual consideration by airport authorities in relation to local facilities.

5.4.2 Where auxiliary personnel, not on standby duty, are required to respond to an emergency, an audible alarm (siren or air horn) should be provided which can be clearly heard in appropriate areas above normal noise level and all wind conditions. Personnel responding to alarm signals of this nature must have access to a telephone number, from which more precise information as to the nature of the emergency and their response requirement can be acquired and to appropriate transport facilities to achieve this response.

5.4.3 Direct communication between the RFF personnel and the flight crew during an emergency does not necessarily involve speech only as the possible use of hand signals, in particular at smaller airports, may be considered.

Chapter 6
Specifications for Rescue and Fire Fighting Vehicles

RFF vehicles shall be specified so that the response objective is met in all circumstances of optimum visibility and surface conditions. RFF vehicles shall be capable of carrying their full load with maximum traction and mobility on and off paved surface in optimum weather conditions. Vehicles may also be designed to carry required rescue equipment and complementary extinguishing agents. The amounts of foam concentrate carried should be sufficient to supply at least two full loads of water tank capacity. The vehicle shall be capable of being deployed in a way that ensures that response objective are achieved and that continuous agent application at the appropriate rate may be fully maintained.

6.1 Factors to be considered in determining the specifications

Following factors shall be considered to prepare the specification in procuring the new vehicle

Phase – 1 (Preliminary considerations)

- Role of new vehicle
- Capacity related to present or future airport RFF category
- Quantitative advantage of adopting improved extinguishing agents
- Compatibility of new vehicle with existing fleet
- Dimension or loading limitations imposed by local terrains or airport features

Phase – 2 (Preparation of Specification)

- Quantities and type of extinguishing agents – output requirements, discharge patterns and replenishment facilities
- Crew cab capacity, design and safety aspects – instrumentation, accessibility for operations, control system- ease of driving and operating simplicity
- Equipment – range and stowage- need for special equipment
- Automotive performance – minimum acceptance criteria
- Access for preventive maintenance and support – protective treatments and finishes

Phase – 3 (Additional contractual consideration)

- Provision of training for fire services personnel and supporting personnel
- Pre-delivery acceptance test –Factory acceptance test – FAT
- Provision of technical manual
- Initial commissioning at airport
- In – service support by suppliers technical staff
- Supply of spare parts with new vehicle

6.2. Characteristics and performance of rescue and fire fighting vehicles

In addition to the above factors as mentioned in 5.1, following characteristics should be considered in selecting new firefighting vehicle to be used also as rapid intervention purpose:-

Details	**Vehicle up to 4500 L**	**Vehicle over 4500L**
Monitor	Optional for categories 1 and 2 Required for categories 3 to 9	Required
Design feature	High discharge capacity	High and low discharge capacity
Range	Appropriate to longest aircraft	Appropriate to longest aircraft
Hand-lines	Required	Required
Under Truck Nozzles	Optional	Required
Bumper Turret	Optional	Optional
Acceleration	80km/hour within 25 sec. at the normal operating	80km/hour within 40 sec. at the normal operating temperature.
Top Speed	At least 105 km/hour	At least 100km/hour
All wheel drive capability	Required	Required
Automatic or semi-automatic transmission	Required	Required
Single rear wheel configuration	Preferable for categories 1 and 2 Required for categories 3 to 9	Required
Minimum angle of approach and departure	30 Degree	30 Degree
Minimum angle of tilt (static)	30 Degree	28 Degree
Under chassis clearance	I4 inches (356mm)	I4 inches (356mm)

Foam tenders equipped with foam monitors should be able to produce foam whilst on the move at minimum speed of 10 km/hr. Monitors and sideline branch pipes should have the capability to deliver foam in a jet or dispersed pattern and are to be capable of at least 50 percent of the discharge rate required for the RFF Category. Monitor platforms should be designed to provide a safe area for working. The crew compartment shall be capable of safely accommodating personnel and their equipment, including breathing apparatus. If appropriate, sufficient space shall be provided to facilitate the donning of personal protective equipment. All seats should be fitted with safely restrained to accepted road use standards and face towards.

Fixed or portable lighting equipment shall be fitted with Foam tenders sufficiently to illuminate the incident/accident site. Adequate communication facilities should be installed in RFF vehicles.

6.3. Equipment to be carried on Rescue and Fire Fighting Vehicle

Equipment for Rescue Operation	Airport Cat 1-2	Airport Cat 3-5	Airport Cat 6-7	Airport Cat 8-10
Adjustable Wrench	1	1	1	1
Axe rescue large non –wedge type	-	1	1	1
Axe rescue small non –wedge or aircraft type	1	2	4	4
Cutler bolt 61cms	1	1	1	1
Crowbar 95cms	1	1	1	1
Crowbar 1.65m	-	-	1	1
Chisel cold2.5cms	-	1	1	1
Flash lights/hand lamps	2	3	4	8
Hammer 1.8 kg	-	1	1	1
Hook, grab or salving	1	1	2	3
Saw or Hacksaw	1	1	1	1
Blanket, Fire resisting	1	1	2	3
Ladder overall length appropriate to aircraft type in use	1	1	2	3
Rope line 15m length	1	1	2	3
Pliers 17.8cms side cutting	1	1	1	1
Pliers slip joint 2.5cms	1	1	1	1
Screw Drivers set	1	1	1	1
Snipers tin1	1	1	1	1
Chocks 15cms high	-	-	1	1
Chocks 10cms high	1	1	-	-
Powered rescue saw complete with two blades or pneumatic rescue chisel complete-plus spare cylinder, chisel and retaining springs	1	1	1	2
Seat Belt/harness cutting tool	1	2	3	4
Gloves ,flame resistant	2	3	4	6
Breathing apparatus and spare cylinder	One set/ person	One set/ person	One set/ person	One set/ person
Oxygen Inhaler	-	1	1	1
Hydraulic or pneumatic forcing tool	-	1	1	2
Medical first aid kit	1	1	2	3
Tarpaulin	1	1	2	3
Fan for ventilation and cooling	-	1	2	3
Protective Clothing	One set/person	One set/person	One set/person	One set/person
Stretcher	1	2	2	2
Rope line 30m length	-	-	2	3
Ropes 6 m Length	Onset/per	Onset/per	Onset/per	Onset/pers

Suitable and adequate lockers and stowage facilities should be provided to carry required rescue equipment and complementary extinguishing agents. All equipment shall be safely and securely stowed

whilst allowing maximum accessibility.

Following additional factors may be found of benefit to the operation of RFF vehicles:

- Forward and Rear facing cameras infra-red etc., with video recording.
- Mapping/Global Positioning System Systems.
- Automatic tire Deflation/inflation.
- Extending working platform.
- Safety warning/interlocks for the safe operation of critical systems fitted to the vehicle.
- Traction Control.
- Anti-lock braking systems.

Chapter 7
Protective Clothing and Respiratory Equipment

Protective clothing and respiratory equipment are the personal protective for Rescue and Fire Fighters. All personnel shall be provided with protective clothing and respiratory protective equipment to the hazard and risk. Airport management should provide adequate training and facilities for the use, care and maintenance of personal protective equipment.

7.1 Use and type of protective clothing

Following factors shall be considered in determining the type of clothing for its use during hours of duty to meet the response time:-

- Wearing all or some elements of the clothing is necessary to ensure the immediate response when a call for attendance at an aircraft is received. Some forms of protective clothing are difficult to wear inside the fire vehicle crew compartment.
- Some of the elements of protective clothing must be worn at all times during the duty, there may be significant effect on the wearer in locations with high temperature (Such as in airports located in Tarai areas like Biratnagar, Simara, Bhairawa and Nepalgunj). In such locations there may be a compromise solution depending upon the degree of protection and some forms of clothing specifically designed for use in such areas. This compromise does not to expose operatives (RFF personnel responding aircraft fire) to unacceptable risk but to ensure that the immediate response is feasible.
- If the protective clothing has to be shared on an impersonal basis, it is essential to recognize the problem which may arise for aesthetic and hygienic reasons. Costs of protective clothing may be a reasonable ground for requiring elements for protective clothing.

7.2 Types and Qualities of Protective Clothes

- Protective Clothing should be distinct from ordinary fire service uniforms and is worn during rescue and Fire Fighting activities including training.
- It should be designed to protect fire fighters from radiated heat and injuries that may arise from impact of operational activities.

7.3 Components of Protective Clothing

Typical protective clothing consists following components;-

7.3.1 Helmet:- It should provide adequate protection to the RFF personnel. It should be used during firefighting activities for the protection of head and neck as well from heat and electrical conductivity. Helmet should not give the wearer impression of being isolated and must permit both speech and the reception and audible signals or words of command. It should have movable visor and wide angle vision.

7.3.2. Protective Suits:- Protective suits are classified into two categories, structural Fire Fighting and proximity suits. Proximity Suits are designed to permit fire fighters to approach and suppress a fire situation. These suits are not intended to provide the level of protection necessary for entering active fire areas, are provided in one piece overall design and in two pieces jacket and trousers combinations. Materials of suits should match the climatic and other considerations in the location of intended use.

Qualities of Proximity Suits:-

- Proximity suits should provide thermal insulation, resistant to radiant heat, and occasional direct flame contact.
- Material should be lightweight, provide freedom for movement, comfortable and easy to wear without assistance.
- Fabrics should not be bulky and should be resistant to tearing and abrasion.
- May be coated in a reflective medium to minimize the effects of radiated heat on the water.
- Fastening should be easily secured by the wearer to ensure their security under stress and resistant to damage by heat or flame contact. Seam should be waterproof and pockets should drainage holes in the lower corner.
- It should be capable of being cleaned without reducing its protective qualities.

7.3.3. Boots:- Uppers should be of tough, flexible, heat resistant material, extended up to the mid- calf or knee level. Should be of a non-slip material. Rubber boots shall not be used.

7.3.4. Gloves:- Gloves should be protected wrist. Construction should permit the wearer to operate switches, fastenings and hand tools. Back of the gloves should be reflective surface to minimize radiated heat effects and that the pal and fingers should be provided in a material resistant to abrasion and penetration by sharp objects. All seams should be liquid penetration proof.

7.4 Respiratory Equipment

7.4.1. Fire Fighters entering any environment in which fire is present during an aircraft incident, as well as during overhaul, should be protected with self-contained respiratory equipment. This applies equally to aircraft that comprise aluminum composite fiber materials.

7.4.2. Increasingly composite fibre material is being used in construction of modern aircraft and in particular replacing the external alununium skin. If fire involved in composite fibre, can produce dangerous substance such as hydrogen cyanide, hydrogen chloride, hydrogen sulfide, hydrogen fluoride, acrolein and nitrogen dioxide.

7.4.3. Fire fighters shall be provided with respiratory equipment to protect themselves against dangerous toxic gases such as carbon monoxide, hydrogen chloride, chlorine, hydrogen cyanide those may be produced by burning aircraft cabin interior materials.

7.4.3. It is essential to ensure that the respiratory equipment selected is adequate in terms of its basic function and its operational duration for the rescue and firefighting.

7.5.4. Wherever respiratory equipment is operated, adequate arrangements must be made for the recharging of breathing apparatus with pure air and a quantity of spare parts should be held to ensure the continuous availability of the service.

Chapter 8
Ambulance and Medical Service

Ambulance service shall be provided in the licensed airport. Civil Aviation Office shall arrange to have sufficient medical supplies, available on or in the vicinity of the airport to treat the passenger and crew capacity of the largest aircraft normally using the airport. The availability of ambulance and medical services should form part of the over-all emergency plan established to deal with aircraft accident/incident. As the city ambulance and medical service takes time to reach airport/crash site, airport rescue and fire service station shall be provided with ambulance and medical service/first aid for the establishment of initial triage and provide first aid till arrival of city medical service (to work as airport medical service as mentioned in airport emergency plan of respective airport). Ambulance team should be qualified in first aid.
The extent of these facilities shall be determined on the basis of type and density of traffic.

Ambulance should be able to move even in the terrain in the vicinity of airport.

Depending upon the frequency and volume of traffic movement, as a measure of economy the vehicle used for other purposes may be used as ambulance (in domestic airports) provided such use will not interfere with its availability in the event of need. But such vehicle must be suitably modified to permit the carriage of stretchers and other necessary equipment.

The provision of portable lighting should be considered for illuminating an accident scene particularly triage and casualty handling areas.

Chapter 9
Extinguishing Agents Characteristics

General

Principal extinguishing agent shall be a Foam which meets either performance level A or B and C. The principal extinguishing agent should be aqueous film forming foam or film forming fluoroprotein foam or fluoroprotein foam or protein foam or a combination of these agents. The complementary extinguishing agents shall be any combination of Dry Chemical powder and gaseous agents with proven low environmental impacts like Clean Agent or Heltron or any other agent which demonstrates equivalent performance. The minimum quantities of extinguishing agents required to each RFF Category are set out in Table 3-2. It is a mandatory requirement.

9.1 Principal Extinguishing Agents

9.1.1. Foam:- It shall always be reminded that foam is used to provide an air excluding blanket which prevents volatile flammable vapors from mixing with air or oxygen. To achieve this objective fire fighters shall follow the following guidance:-

- Foam must flow over the fuel surface
- Foam must be resist disruption due to wind or exposure to heat or flame
- Foam must be capable of resealing any ruptures caused by disturbances of blanketing.

9.1.2. **Method of foam production:-** Foam solution is produced either in pre-mixed forms or by the use of a proportioning system, which are delivered at a pre-determined pressure to nozzle which induce air to aspirate the solution. The pressure may be created by a pump or, with vehicles of smaller capacity, by a compressed gas source usually either dry nitrogen or dry air. In all cases the system will produce an acceptable foam only if the solution is delivered in the appropriate volume and in the correct pressure range to the aspirating nozzle or nozzles.

9.1.3. **Quality of Foam:-** The quality of foam produced by a rescue and fire fighting vehicle using any of the concentrated type will significantly affect the control and extinguishment times of an aircraft fire. Any foam concentrate to be used in aircraft rescue and fire fighting vehicle should meet or exceed the criteria in given below specifications, so as to achieve the performance level A ,B and **C** as appropriate.

9.1.4. Specification:

The pH value of foam concentrate should be as neutral as possible and should register between the values of 6 and 8.5.

The viscosity measurement of a foam concentrate when at its lowest temperature should not exceed 200 mm/s. when a foam concentrate is tested by the centrifuge method, foams should contain no greater than 0.5 per cent of sediment.

Functional fire tests shall be carried out to determine the suitability of foam concentrate in the airport environment.

9.1.5. Fire Test Method

9.1.5.1. **Objective:** Test shall be conducted to evaluate the ability of a foam concentrate to:

a) Extinguish a fire of:
   2.8m^2 performance level A
   4.5 m2 performance level B
   7.3m2 performance level C

b) Resist burn back due to exposure to fuel and heat.

9.1.5.2. Equipment:

a) A circular fire steel tray of:
   2.8m^2 performance level A
   4.5 m^2 performance level B
   7.3m^2 performance level C

   The vertical wall shall be 200mm;

b) Equipment or access to facilities to enable accurate recordings of air temperature, water temperature and wind velocity;

c) Fuel: 60 L of Avtur (Jet A_1) for performance level A tests
   100 L of Avtur (Jet A_1) for performance level B tests
   157 L of Avtur (jetA_1) for performance level C tests

d) Branch pipe, straight stream, air aspirating nozzle;

e) Suitable stop watch; and

f) Circular, burn back pot, measuring 300 mm (Internal diameter), 200 mm high, 2 L of gasoline or kerosene.

9.1.5.3. Preferable conditions:

a) Air temperature (degree Centigrade) ≥ 15

b) Foam solution temperature (degree Centigrade) ≥ 15 c

c) Wind velocity (m/s) ≤ 3

9.2. Complementary agents

Complementary agents have the capability of rapid fire suppression but offer a transient control and are particularly used on concealed fire such as engine fire, fire in aircraft freight holds and beneath the wings where foams may not penetrate and on running fuel fire situation

on which foams are ineffective. It is also necessary to apply a principal agent simultaneously or at least before flashback can occur in order to achieve permanent control.

It should be reminded that when a large amount of complementary agents are discharged a dense cloud of the agent may affect aircraft evacuation or rescue operation by limiting the visibility and affecting the respiration to those exposed to the effects.

9.2.1. Dry Chemical Powder: Dry chemical powder is finely divided powder of sodium bicarbonate or potassium bicarbonate or mono-ammonium phosphate etc. which are combined with additives to improve their performance and normally used against fire involving flammable liquids and those of an electrical origin. It can provide rapid knockdown of flammable liquid fire and some protection to operatives from radiated heat when used with foam in dual agent attack and delivered at suitable rate. The successful use of dry chemical powder is strongly dependent on the technique of its application. The application of dry chemical powder is also significantly affected by wind speed but use may be made of wind to augment the range of a powder stream and to influence its pattern of distribution. When selecting dry chemical powder for use with a foam as a dual agent attack, care must be exercised to ensure its compatibility with that foam.

9.2.2 ***Halogenated hydrocarbons.*** In line with the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, the production of halon 1211, 1301 and 2402 has been banned since 1994. The United States Environmental Protection Agency has evaluated substitutes for the ozone-depleting chemicals that are being phased out as part of its Significant New Alternatives Policy (SNAP). Halons may still be found in some aircraft fixed installations.

9.2.3 ***Carbon dioxide (CO_2).*** Carbon dioxide is traditionally used in aircraft RFF operations in two ways:

a) As a means of rapid knockdown for small fires or as a flooding agent in reaching concealed fires in areas inaccessible to foam. It should not be used on fires involving flammable metals; and

b) CO_2, is most effective at high rates of delivery, achieved through “low pressure’’ systems.

9.3. Conditions of Storage of Extinguishing Agents

The reserve of extinguishing agents shall be stored in the fire station and the conditions of storage should be:

- **Foam:-** Avoid extreme temperature and direct exposure to sunlight. Replace and seal the caps of any partly-used containers;
- **DCP:-** Maintain stock, replace and seal the caps of any partly-used Containers. The stocks of fire extinguishing agents should be stored and used in a consistent manner in accordance with manufacturers’ guidance. Consideration should be given to avoid prolonged or extreme storage conditions. It should be inspect and test in regular basis. This may require the keeping of log books and records of test to be assured of continual fitness for purpose. Inspector from the Department of Safety and Standards of Civil Aviation Authority of Nepal, may require to examine any evidence of this assurance from time to time.

Foam generating system shall regularly checked for induction accuracy. It is designed to induce at 6%, induction should be in the range of 5% to 7% at the optimum working conditions. For system designed to induce at 3%, the range is 3% to 5%, and for 1% systems, the range is 1% to 1.1%.

Chapter 10
Fire Station

10.1. Design, Construction and Location of Fire Station:

Properly constructed and located Fire Station may contribute the morale and efficiency of the rescue and firefighting services. In selection the location of the fire station prime concern is to meet the minimum response time and easy access to both the runways ends and the movement areas of the airport.

Following factors shall be considered in selecting and designing the fire station:-

- The location of the fire station shall be based on minimizing response time to areas where aircraft accidents and incidents may occur. At large complex aerodromes it may be necessary to consider the provision of more than one fire station to meet the response time in optimum conditions of visibility and surface conditions.
- Need to deal with structural fire.
- Location strategically in relation to the runway pattern.
- Possibilities of accidents and incidents occur on or close to the runways.
- Emergency fire vehicles should be direct access to movement area within the recommended response time.
- Access to the runways is direct with minimum number of turns.
- Vehicle running distance should be as minimum as possible in relation to runways.
- Ability of vehicles to reach the stand by point without delay.
- Widest possible view of airport areas from fire watch tower.
- Adequate accommodation for the housing of vehicles, and their maintenance.
- Domestic and personnel administrative facilities.
- Communication and alarm system.
- Appropriate storage and technical support facilities.
- Fire station apron or maneuvering area shall be strong enough to bear the weight of fully laden vehicles and should not be damaged when vehicles are driven away rapidly.
- The station apron should be adequately illuminated. Lights should be mounted so as not to adversely affect driver's vision or airport operation.
- There should be an exterior water connection or hydrant assembly for the refilling of vehicle water tanks.
- The provision of means to rapidly replenish foam concentrate tanks is desirable.

10.2. Fire Fighting Vehicle Housing

Following facilities and infrastructure shall be made available for the housing of fire vehicles:-

- Series of bays with sufficient space for each of the vehicle and surrounding areas for fire personnel to work around the vehicle. (at least 1.2 meters around each of the vehicle).
- Strength of bays floor should capable to hold the maximum weight of the vehicle. Surface should be resistant to oil, grease and foam and should be easily cleaned to avoid slippery.
- If doors are provided to the bays, they should be easily opened without delaying the movement of vehicles. Doorways shall be wide enough to enable a quick and safe exit by vehicles giving adequate clearance to ladders obstruction lights and aerials etc. which may fitted to vehicle roofs.
- Ceiling of the bays should be of sufficient height to the tops of vehicles so that inspection of foam tanks etc. may be conducted.
- Vehicle bay shall be provided with adequate lighting facilities. Electrical systems of appropriate design, shall be provided for engine heating, battery charging or other equipment.
- Series of bays with sufficient space for each of the vehicle and surrounding areas for fire personnel to work around the vehicle. (at least 1.2 meters around each of the vehicle)
- Strength of bays floor should capable to hold the maximum weight of the vehicle. Surface should be resistant to oil, grease and foam and should be easily cleaned to avoid slippery.
- If doors are provided to the bays, they should be easily opened without delaying the movement of vehicles. Doorways shall be wide enough to enable a quick and safe exit by vehicles giving adequate clearance to ladders obstruction lights and aerials etc. which may fitted to vehicle roofs.
- Ceiling of the bays should be of sufficient height to the tops of vehicles so that inspection of foam tanks etc. may be conducted.
- Vehicle bay shall be provided with adequate lighting facilities with appropriate design, shall be provided for engine heating, battery charging or other equipment.

10.3. Domestic and Administrative Requirements

Domestic facilities should include accommodation for personnel, consisting of a locker room, mess room, washroom, drying room, with consideration to administrative rooms (offices), training facilities, and fitness facilities.

The locker room should provide sufficient space for the personnel to change and store their clothing as well as other personal items seating should also be provided.

The mess room should be fitted with chairs and tables and provide facilities for the preparation of meals and food storage. Power to any cooking facilities including gas supplies should be automatically turned off on activation of the alerting systems.

A drying room should allow personnel to dry wet clothing quickly. The extent of administrative accommodation will depend on the range of technical control and administration duties to be performed in a particular fire station.

The lesson room should provide tables (desks) and chairs, a magnetic whiteboard (or blackboard), as well as appropriate library facilities relevant to the functionality. Consideration may be given to electronic resources such as data viewers, screens and computers. If facilities for fitness equipment are provided the area should be well ventilated.

10.4. Supporting Facilities

Following facilities shall be made available to the extent possible which are necessary to maintain the efficiency of the personnel, equipment and ultimately the service:-

- Well-equipped workshop for the repair and maintenance of the vehicle and the equipment.
- Hydrant and water source (may be well) for the test purpose and Drill.
- Electric or manual pump for the transfer of foam from containers to vehicle.
- The specific area for training purposes. The area is not required to be a separate enclosed room, although this may be desirable.
- The provision for proper exercise facilities.
- Secondary electrical power supply to ensure the continuous availability of essential equipment and facilities.
- Hose storage space should be provided including suitable racking and ventilation.

10.5. Fire Watch Tower

Fire watch tower shall be central point for the reception of emergency calls. The watch tower should be sited in a position which enables surveillance of as much of the movement areas as possible. The importance of prompt and clear communications is paramount. Therefore, each fire station should be provision of direct communication facilities with air traffic control, RFF vehicles, crew en route to, or in attendance at, an aircraft accident or incident. A direct telephone line to the local city fire brigade should be provided.

Double glazing and other sound proofing measures may be necessary to exclude excessive noise from aircraft. Facilities should be required to minimize the effect of direct exposure to the sun. Facilities should be provided for varying lighting intensity in the watch tower room to permit maximum external vision at night. The fire watch tower should be provided with a public address so that details of the emergency can be conveyed to crew members.

10.6. General aspects.

In addition to the particular requirements considered above there are a number of general items, applicable to all fire stations, which can contribute to their efficient operation and the well-being of personnel. Except where it may be necessary to elevate a watch room for operational reasons, it is desirable to provide all accommodation on one level. It is important, in preparing the original plan, to make some provision for expansion to correspond with the growth of the airport. If the plan meets this situation by providing the domestic accommodation to one side of the vehicle bays, an additional benefit will be the exclusion of exhaust fumes from this accommodation when the vehicles are running. Fire vehicle bays with access from the rear will aid the movement of fire vehicles by providing a drive-through facility. The parking of fire vehicles should be such that the failure of any one should not prevent others from making an immediate response. The high noise levels to which some fire stations may be exposed may

require some measure of soundproofing in the domestic accommodation in addition to the watch room. Additional attention to ventilation and climate control may also become necessary in ensuring the comfort and efficiency of the occupants. All fire stations should be connected to a secondary (standby) electrical power supply to ensure the continuous availability of essential equipment and facilities.

CHAPTER 11
Rescue and Fire Fighting Personnel

11.1. General Requirements

11.1.1. The total number of personnel, whether regular or auxiliary, required to deploy and operate the RFF service should be determined so as to meet the following criteria:

11.1.2. The RFF vehicles should be staffed so as to ensure their ability to discharge at their maximum designed capability extinguishing agents, principal or complementary, both effectively and simultaneously, at an aircraft accident/incident. Any control room or communications facility operated by, and serving, the RFF service can continue to provide this service until alternative arrangements to undertake this function are initiated by the airport emergency plan.

11.1.3. In addition, in determining the minimum number of RFF personnel required, a task resource analysis (ICAO DOC. 9137, Part 1) should be completed and the level of staffing documented in the Aerodromes Manual. During flight operations sufficient trained and competent personnel should be designated to be readily available to ride the RFF vehicles and to operate the equipment at maximum capacity. These personnel should be deployed in a way that ensures that minimum response times can be achieved and that continuous agent application at the appropriate rate can be fully maintained.

11.1.4. Consideration should be given for personnel to use hand-lines, ladders and other equipment normally associated with RFF operations. The responding vehicles should provide at least the minimum discharge rates specified in the tables. The remainder of the vehicles may be staffed by personnel not necessarily employed in close proximity to their vehicles but able to respond when the alarm sounds so as to reach the scene of the accident no more than one minute after the first responding vehicle(s) so as to provide continuous foam application.

11.1.5. All personnel (regular and/or auxiliary) provided for aircraft RFF duties, should be fully trained in the performance of their duties and under the direction of a designated chief of emergency crew. Selected personnel should receive special driving instructions in cross-country and soft-ground techniques. Where the response area of the RFF service includes water, swamps or other difficult terrain and suitable rescue equipment and procedures are provided for these locations, the personnel designated to respond should be adequately trained and exercised to provide a prompt and effective service.

11.2. Selection of Fire Fighting Personnel

RFF Personnel shall be selected an accordance with Civil Aviation Academy (CAA) Work Conduction and Training Directives, 2064 (with amendment, 2074), Basis ARFF Course and CAAN Rules and Regulations.

11.3. Selection of Fire Fighting Personnel for RFF Duties

Fire Fighting personnel should be:-

- Resolute
- Possess initiative
- Competent to carryout intelligent assessment of fire situation
- Well trained and fully qualified.
- Capable of sizing up the changing circumstances at an aircraft accident and taking necessary action without detailed supervision

- Must be free from any physical disability.
- Free from any trouble for wearing and using respiratory equipment.

11.4. Management of RFF Personnel

Fire Officers/Shift-in-charge/Crews are responsible assigned to subsidiary duties like fire prevention inspection or other activities in which they are appointed, maintaining constant contact with the fire station by radio. The airport emergency plan should provide for the alerting of all personnel who may contribute to the effective performance of post-accident operations in a support role to the RFF crews.

11.5. Physical and Medical Fitness for RFF Service

As nature of RFF operations involves periods of intense physical activity, all RFF personnel have to possess a minimum level of physical and medical fitness to able perform the tasks associated with these operations. Optimum physical fitness and medical fitness for RFF personnel would mean that a firefighter is able to carry out RFF activities safely, successfully and without undue fatigue. The physical and medical fitness of RFF personnel should be described in CBSOP.

11.6. Competent Area for RFF Personnel:

RFF personnel must be well trained and qualified in the ARFF field. They should be competent one of the following areas;

a) Fire Fighting,
b) Rescue operation,
c) Fire vehicle Driving/operation and
d) Watch tower operation.

11.7. Task Resources Analysis

Describes the stages that should be considered by an airport operator in carrying out a Task Resource Analysis (TRA) to establish justification as to the minimum number of qualified/competent personnel required to deliver an effective airport RFF service (RFFS) to deal with an aircraft incident/accident. If an airport operator requires the RFFS to attend structural incidents and road traffic accidents in addition to aircraft incidents/accidents, due regard must be given to the inability of not meeting required response times and robust procedures should be introduced accordingly.

11.8. Safety and Well-being of RFF Personnel

11.8.1. In the aftermath of an aircraft accident, it is often necessary to provide psychological treatment for the survivors. However, airport operators and RFF services must also not neglect the mental and psychological well-being of emergency responders such as RFF personnel who may suffer from post-traumatic stress disorders. Appropriate counselling of psychological therapy may need to be provided to RFF personnel who responded to such emergencies and who subsequently were not able to cope with the stress they faced thereafter. Such situations may arise from the gruesome sight of a crash scene making them unable to carry on with their normal lives. It will therefore be essential to also provide psychological treatment for RFF personnel after a major crisis both from a welfare perspective and also from a business continuity standpoint. Such treatment and counselling can be provided by other RFF or airport personnel who have undergone the proper training, or more likely, by external medical institutions. Arrangements for the latter should then be formalized in the form of mutual aid agreements or can be incorporated into the airport emergency plan.

11.8.2. The nature of the RFF job/role poses numerous potential hazards the risk of inhalation of carbon or smoke particles when extinguishing a fire, either during an incident or during training, is very high. Therefore, RFF services must provide all firefighters with the appropriate personal protective equipment (PPE) such as self-containing breathing apparatus (SCBA), helmets, boots, protective clothing, etc. In relation to day-to-day operations, the uniform worn by RFF personnel should also be of a suitable material depending on the local climate and conditions.

11.8.3. To ensure that RFF personnel are able to perform their roles effectively, thought needs to be put into designing an appropriate physical fitness program to condition them for the physical rigors of the job. In the process of designing any physical fitness program, due consideration must be given to individual human limitations. RFF management must also accept that not all personnel can perform at the same level of physical fitness standards. The key is to establish the minimum physical fitness requirements of a firefighter and design a program that can best replicate these demands.

11.8.4. Noise is an important human factor that is omnipresent in an airport environment and cannot be ignored. Most fire stations are located within close proximity of the runway and aircraft movement areas, thus exposing RFF personnel to constant loud noises. Besides posing as disruptive interferences during the transmission of messages, long term and regular exposure to noise can have serious implications on one's health (e.g. temporary, partial or permanent hearing loss). To address this issue, RFF services should issue and mandate the use of suitable hearing protection devices. In addition, personnel who are subjected to constant exposure to noise should be sent for regular noise induced deafness (NID) hearing tests.

11.8.5. Fatigue is one important factor that directly affects human performance and is greatly influenced by the shift system of RFF service. Besides the need to conform to local labour rules and regulations of individual States, there must be considerations to ensure that RFF personnel can have sufficient rest need to be on 24-hour operational readiness at most airports.

11.8.6. A leader is an individual whose ideas and actions influence the thoughts and behaviors of others. Through the use of motivation and persuasion, and an understanding of the goals and desires of the team, the leader becomes an agent of change and influence. Skilled leadership may be needed to understand and handle various operational, training and administrative situations. For instance, personality clashes within a team complicate the task of a leader and can affect both safety and efficiency.

CHAPTER 12
Emergency Organization

12.1. Airport Emergency Plan

In responding aircraft and airport emergencies including fire emergencies, Airport Rescue and Fire Services shall follow Airport Emergency Plan- AEP of concerned Airport.

12.1.2. On and off airport organizations involved in emergency situation

On Airport Organizations:-

- Airport Civil Aviation Office
- Airport Security Police
- Airport Rescue and Fire Fighting Service
- Concerned Airlines (In case of aircraft accident/incident)
- Nepal Army/Armed Police Force (whichever is available at the airport)
- Airport Vigilance (available)

Off – Airport Organization

- Nepal Police
- Nepal Army/Armed Police Force (whichever is available)
- City Fire service
- Hospitals/Ambulances/Red-cross.
- RFFS shall be activated as per the decision of EOC.

12.1.3 Role and Responsibilities of Agencies involved (in brief)

Civil Aviation Office

- Emergency Notification
- Coordination
- Activation of Emergency Operations Centre – EOC
- Closure of airport either wholly or partly if needed
- Issuance of emergency access permits

Airport Security Police

- Security Cordon of accident site
- Access control to the site
- Crowd control
- Re-route the normal traffic away from the route to provide congestion free road for the emergency vehicles.
- Crime prevention

Airport Rescue and Fire Fighting Service

- Attack with wind and knock down the fire.
- Control the fire with establishing and maintaining rescue path
- Secure the area to prevent re-ignition
- Arrange backup water and foam supplies
- Rescue operation begin on arrival, transport occupants into a bearable atmosphere
- Establishing collection area and medical triage area
- Conduct a complete overhaul i.e. a thorough inspection of the entire aircraft and crash areas to ensure that the aircraft is fire safe.

Concerned airlines

- Collect details information including aircraft type, number of POB, fuel on board, details of cargo, dangerous goods if any. Provide these information to ATS Tower and EOC.
- Provide facilities and logistics to the personnel involved in emergency
- Arrange transportation, accommodation and further journey of passengers.
- Clergy service.

Nepal Army/Armed Police Force

- Search and Rescue Operation
- Assist in rescue and Fire Fighting operation
- Armed intervention if needed and required by EOC.

Hospitals

- Provide first aid and stabilization.
- Establish Medical Triage and prioritize the injuries according to their seriousness.
- Dispatch injuries to the hospitals.

12.1.4. Command, Control and coordination

A command post shall be established at EOC. At TIA Kathmandu, EOC is located at the second floor of Airlines Operation complex. Whereas at domestic airports, chief of airport civil aviation office shall be responsible to establish EOC in proper location (that may be the office room of chief of civil aviation office)

Command post is represented by all agencies involved in responding any emergency situation as mentioned above. Command post is resided by person as described in concerned AEP.

A forward command post shall be established in the close proximity of accident/incident site. In the case of fire situation, chief of RFF service shall be the on-scene commander till the fire is suppressed. After fire is suppressed, chief of Fire Fighting service shall handover the command to the chief of concerned civil aviation office.

At TIA, Terminal Duty officer shall be responsible for emergency notification and coordination of emergency situation whereas chief of concerned civil aviation office or his designee shall be responsible for such notification and coordination in the licensed airports.

12.1.5. Rendezvous Point (RVP)

At TIA there are three RVPs- 1, 2 and 3, the location of these points are described in TIAAEP. In other airports, chief of civil aviation office in prior coordination with RFF chief and chief of airport security police shall establish RVPs.

12.1.6. Collection Area and Triage Area

Location of collection area and medical triage area depend upon the site of accident/incident. Collection area will be established by RFFS. Casualties from accident site will be transferred by RFF personnel in the collection area. This area should be safe for casualties. The triage area should be located at least 90 m upwind of the accident site to avoid possible exposure to fire and smoke. If necessary, more than one triage area may be established.

There will be a care area according to the priority base. A transportation area will be established for the recording, dispatching and evacuation of survivors. This area should be located between care area and egress road. Chief of rescue and Fire Fighting service in coordination with medical team and security agencies shall establish medical triage area and care area as required.

12.2. Aircraft Emergencies

To determine the level of services to be provided, aircraft emergencies are classified as follows:

a) Aircraft accident
b) Full emergency
c) Local Standby

12.2.1. Aircraft Accident

An aircraft accident which occurs on or in the vicinity of the airport (within 4kms from the airport perimeter fence) is known as aircraft accident. In case of aircraft accident, air traffic services (ATS) Tower shall immediately call Fire Watch Tower. The notification shall include following information according following priority order:-

- Type of aircraft
- Time of accident
- Number of occupants
- Fuel on board
- Aircraft Operator
- Dangerous goods on board if any including its quantity and location

12.2.2 Full Emergency

If it is known that an aircraft approaching the airport is, or is suspected to be, in such a trouble that there is danger of accident is known as full emergency. In case of Full Emergency, air traffic services (ATS) Tower shall immediately call Rescue and Fire Fighting Service Watch Tower (RFF Tower). The notification shall include following information according following priority order:-

- Type of aircraft
- Estimated time of landing
- Number of occupants including special occupants that is handicapped, immobilized, blind and deaf.
- Nature of trouble
- Fuel on board
- Runways to be used
- Dangerous goods on board if any including its quantity and location

12.2.3 Local Standby

When an aircraft approaching an airport is known or is suspected to have developed some trouble but the trouble is not such as would normally involve any serious difficulty in effecting a safe landing. In case of Local Standby situation, air traffic services (ATS) Tower shall immediately call Fire Watch Tower. The notification shall include following information according following priority order:-

- Type of aircraft
- Estimated time of landing
- No. of occupants including special occupants that is handicapped, immobilized, blind and deaf.
- Nature of trouble
- Fuel on board
- Runways to be used
- Dangerous goods on board if any including its quantity and location

Chapter 13
Aircraft Fire Fighting and Rescue Procedures

13.1. Operational Procedures

The rescue and firefighting services at an airport are under the administrative control of the concerned airport civil aviation offices. Airport Civil Aviation Offices and Airport Rescue and Fire Fighting Services shall be responsible for ensuring that the service provided is organized, equipped, staffed, trained and operated in such a manner as to achieve its objective that is rescuing affected persons by extinguishing fire effectively. In this context, Civil Aviation Authority of Nepal-CAAN Head Office Aviation Fir Division/Department shall play a positive role in making policy to fulfill its objective.

There are three shifts (morning, day, and night) at Rescue and Fire Fighting Service (Division) at TIA. Each shift has 6 hours operational duty. If the flight movement is continued after the end of third shift, the same third shift will continue till last movement of aircraft. Besides three shifts, there is another non-operational shift (night standby duty) i. e. Skeleton Shift for mid night to the beginning of morning shift.

At the domestic airports, there are two shift, second shift shall continue its duty till the completion of last flight. A skeleton manpower shall be deployed on duty in non-operational shift(night standby duty).

All the operational activities shall be carried out under the command, control and supervision of shift in-charge, whereas overall command remains in chief of fire station.

13.2. Responsibilities in particular

Roles and Responsibilities of RFF personnel including fire chief, Shift-in charge as per SOP.

13.3. Emergency Response Procedures

13.3.1. Common features to all emergencies:

- Constant observation of all flights and apron activities by airport fire station watch tower.
- Observation of taxiing of aircraft, ground observation of engines
- Availability of access routes
- Effect of weather conditions as a possible restrictions on movement of emergency vehicle
- On receipt of information from control tower announcing an aircraft emergency the required equipment shall be dispatched to the scene of accident/incident to the determined sand-by positions applicable to the runway.
- If the information is received other than ATS Tower, in that case ATS tower must be informed and verification of information is necessary.
- Rescue and fire fighting vehicles shall be positioned to provide the best possible coverage of the potential crash area.
- For emergencies involving gear malfunctioning and tire difficulty, there is possibility of aircraft veering off the runway and possibility of hitting the emergency equipment. In that case as precaution emergency equipment are to be located in touch down point.
- Broken fuel, hydraulic fluid, alcohol and oil lines should be plugged or crimped when possible to reduce the amount of spill and extent of fire.

- Use of aircraft windows for rescuing and ventilation

13.3.2. Aircraft Fire Classification

For the effectively responding and extinguishing the aircraft fire, some aircraft fire has been classified as follows:-

Class A Fire:

Fires involving cargo, upholstery and similar solid combustibles are Class A fire which requires cooling and quenching for extinguishing. If no flammable liquids are involved, water preferably water fog can be used.

Hot breaks and wheel fires:

The heating of aircraft wheels and tires presents a potential explosion hazard greatly increased when fire is present. Extra precaution should be taken to be protected from these dangers. Normally hot breaks will be cooled down themselves without using extinguishing agents. Fire fighters should approach the wheels with extreme precaution, never from the side in line with the axle. If extinguishing agents is required to be applied, then apply it in area to the break from Wheel solid stream of water may be used as last resort.

Rocket Engine Fire:

If fire surrounds around the engine of an aircraft equipped with rocket engine, precaution should be taken approaching the area. No attempt should be made to extinguish the engine if they should ignite. Water or foam may be used effectively to control the fire around the rocket motors, but they cannot be extinguished because of the self-contained oxidizer in the propellant. They burn very intensely for a short duration, however they will normally not contribute significantly to the damage, since their chambers are so well insulated that it takes several minutes of very intense heat to ignite them. This heat will normally have done irreparable damage or caused fatalities before ignition of the rocket engines occurs. If fire does not occur, igniters and ignition cables should be removed from unexpended rocket engines on the crashed aircraft as soon as possible to reduce the possibility of inadvertent ignition from stray voltage entering the ignition wiring

Confined Engine Fire (Piston):

If engine fire confined within the nacelle cannot be controlled by the aircraft extinguishing system, **Clean Agents** should be applied first as these agents are more effective than water or foam inside the nacelle. Foam or water should be used externally to keep adjacent aircraft structure cool. RFF personnel should be considered the increased heat of propellers even when rest.

Confined Turbine Engine Fire (Jet)

From the viewpoint of aircraft evacuation and other safety consideration the best way of controlling the fire confined to the combustion chambers of turbine engines, if the flight crew is in a position to keep the engine turning over. Fire fighters shall stand clear of the exhaust but may have to protect combustibles from exhaust flames.

Fire outside the combustion chambers of turbine engines and confined within the

nacelle is best controlled with the aircraft built-in extinguishing system. If the fire persists after the built-in system has been expended and the turbine is shut down, halon or dry chemical may be used to extinguish the fire.

Foam should not be used in the intake or exhaust of turbine engines unless fire is not extinguished by using other agents and appears to be danger of spreading. Foam or water spray should be used externally to keep adjacent aircraft structure cool.

RFF Personnel should stay at least **10 meters** away from the intake of an operating turbine engine to avoid being sucked in, and **500 meters** away from the rear to avoid the jet blast danger area.

Titanium Fire Control

If titanium parts of aircraft are ignited, fire cannot be extinguished with the use of conventional agents available to aircraft RFF Crews. If these fires are contained within the nacelle, it should be possible to allow to burn out without seriously threatening the aircraft itself as long as there are no external flammable vapor air mixtures which could be ignited by the flames or hot engine surface; and foam or water spray is available to maintain the integrity of the nacelle and surrounding exposed aircraft structures.

Fire situation involving rear mounted aircraft engines

Problem may arise in extinguishing the fire of aircraft engine which is mounted on the rear fuselage associated with vertical stabilizer, because of the height of the engine above ground level. In this case provision of ladders, elevated working platforms and extensible applicators for delivering suitable extinguishing agents may be required.

Magnesium Fire

- Use extinguishing agents specifically designed for flammable metal fires.
- Apply large volume of coarse water stream if large mass of magnesium is involved
- Attack of water stream is undesirable where the primary fire control technique is with foam as the water stream would damage the foam blanket.

13.4. Rescue Tactics and Associated Equipment Requirements

Rescue Tactics

First Phase:

- Identify the task to be performed
- Take the term “Rescue” to include the protection of the route to be followed aircraft occupants who are able to escape from the aircraft.
- Activities outside the aircraft may include:- Firefighting, blanketing of fuel of wetted areas adjacent to the aircraft, assistance in the effective use of emergency escape equipment and the provision of lighting to expedite the evacuation.
- Entry to the aircraft should not be made by any route used by escaping occupants during evacuation.
- Rescue of all aircraft occupants may be considered as the primary objective, the overall requirements is to create conditions in which survival is possible and rescue overall requirements is to create conditions in which survival is possible.

- It should also be considered that evacuation from the aircraft and any operation within fuselage may not be conducted effectively if fire situation exits in fuselage.

Second Phase

Arrangements shall be made to provide personnel and the equipment to rescue those occupants who are unable to make their escape without assistance. Maintain fire security inside and outside the aircraft which may entail the periodic restoration of the foam blanket on any fuel wetted areas.

Delivery of air within the fuselage may be required to provide a repairable atmosphere and for the provision of localized fire protection to rescue operations involving the use of hand or powered tools.

Third Phase (Fire Protection and Maintenance of Fire Safety)

Rescue and Fire Fighting must be taken together even if there is no initial fire, possibility of a sudden and disastrous outbreak cannot be ignored. Following precautions should be taken:-

- Blanketing of fuel wetted areas.
- Protection must be available when opening doors and windows of aircraft for entry or evacuation purpose to guard against the ingress of fire and to maintain escape paths if there is a sudden outbreak.

Ensuring the extinguishing Agents

- Primary requirement is to ensure the availability of adequate quantity of highly efficient firefighting agent and from the current range of foams, dry chemical powder and halogenated hydrocarbons, foam is most suitable.
- Number of crew in first vehicle should be sufficient to ensure the operation of the firefighting or fire suppression equipment and to provide some assistance at escape slides or other exit routes if evacuation is in progress.
- After arrival of other vehicle the crew of the first vehicle will become available to assist in other duties as demanded by the existing situation.
- After the major fire situation has been controlled or critical area around the occupied portion of the aircraft has been secured, it is essential fire rescue team, each team consisting of two person to assist occupants from the aircraft, to provide firefighting equipment within the aircraft capable of extinguishing or cooling cabin trim and furnishing materials which nay have become involved as well as to provide lighting and ventilation equipment within the aircraft.

Post-Accident Ventilation

After the fire inside aircraft cabin has been controlled, aircraft cabin may be filled up with smoke, it is necessary to create serviceable environment within the cabin. For this, effective ventilation is essential to create serviceable environment.

Rescue Equipment Requirements

- Adequate quantity of highly efficient firefighting agents preferably a foam.
- Lighting equipment- operated by portable generator, flood lights, smaller lighting which may be torches etc.
- Power Operated tools –Rotary saw, other cutting devices,
- Hand tools- wire and bolt cutters, screw drivers, crowbars, hammers, axes
- Forcing Equipment- hydraulic operated for bending /lifting which may be tubular shaft.
- Respiratory equipment- breathing apparatus
- Communications equipment- radiotelephone units, loudspeakers,
- Miscellaneous items- wedges/plugs for fuel lines/shovels/grab-hook/pike pole, ladders.
- Equipment capable of delivering water spray within aircraft fuselage.
- Equipment capable of a fresh air supply probably by means of powered fan unit.
- Medical first kits, Stretchers etc.

Coordination with flight crew

An effective coordination and understanding between flight crew and RFF personnel is necessary to reduce confusion on the part of all personnel concerned and their role in the handling of aircraft accidents or incidents on or near an airport. It is important that both flight crew members and RFF personnel must be aware with each other's duties and responsibilities in case of emergencies.

Role and responsibilities of flight crew members in emergencies

- Pilot in command is responsible to declare an emergency, its type or alert number in accordance to AEP (for the purpose determining the necessity of firefighting service, PIC also to indicate the nature of emergency such as power plant fire, bomb threat, cabin fire, and plan of coping with incident. Each of the pilots is familiar with regulations and procedures of the airports to be used.
- Flight crew should be trained and be aware with their duties to perform in cases of an aircraft accident or incident including emergency evacuation of aircraft occupants and directing them to a safe distance from the scene of the accident or incident. (Flight crew are responsible to make the final determination to evacuate from the aircraft and the manner in which the evacuation shall be carried out)
- Maintain personnel contact with RFF personnel.
- Be aware in case of fire following an accident or incident is of the dangers associated with the indiscriminate opening of doors or emergency exits which might permit entry into the fuselage of flames or noxious fumes or which might promote the progress of the fire to other parts of the aircraft.
- Ensure the availability of emergency equipment such as emergency evacuation slides and ropes and be aware to use these equipment. Also make sure the availability of lightweight steps or stairs as these are often required where the aircraft equipment has failed to operate or evacuation from the leading edge of the wing is necessary.

Role of RFF Personnel

- RFF personnel should not disturb aircraft evacuation slides in use unless they have been damaged by use or fire exposure.
- RFF personnel should stand by at the foot of the slides to aid exiting persons to their feet and direct them to a safe distance from the scene.
- Provide assistance to evacuees using over viewing exits for evacuation will normally slide off the rear edge of the wing or down the wing flaps to prevent leg injuries and direct them to a safe distance from the scene.
- Establish direct contact with flight crew members for the coordination of better evacuation procedures. Two way radio equipment is preferred to use for contact.
- Assist crew members in any way possible
- Crew member visibility is restricted, RFF personnel should make immediate appraisal of the external portion of the aircraft and report unusual condition to crew members.

13.5. Accident involving Dangerous Goods

Dangerous goods are articles or substances which are capable of posing significant risk to health, safety or property when transported by air. For the purposes of air transport they are divided into nine classes (in the Technical Instructions (Doc 9284)) reflecting the type of hazard they present to transport workers and emergency response personnel. The nine classes of dangerous goods are:

Class 1	Explosives
Class 2	Gases: compressed, liquefied, dissolved under pressure or deeply refrigerated
Class 3	Flammable liquids
Class 4	Flammable solids; substances liable to spontaneous combustion; substances which, in contact with water, emit flammable gases
Class 5	Oxidizing substances; organic peroxides
Class 6	Toxic and infectious substances
Class 7	Radioactive materials
Class 8	Corrosive
Class 9	Miscellaneous dangerous articles or substances during air transport, present a danger not covered by other classes. Examples: magnetized material; acetaldehyde ammonia; expandable polystyrene beads and lithium batteries.

In case if emergency occurs in flight, Pilot –in- command should inform the appropriate air traffic services unit for the information to RFF services of any dangerous goods on board. If situation permits PIC shall also include in the information the class, type and quantity of dangerous goods. If situation does not permit PIC to furnish all the details, these details shall be obtained concerned airlines ground personnel.

Firefighting personnel shall determine the extinguishing agent to be used in responding respective nature of dangerous goods. Firefighting personnel shall wear protective clothing

including breathing apparatus. As far as possible RFF personnel should stay upwards, out of smoke, fumes and dust. RFF personnel shall take following precautions to respond fire associated with following classes of dangerous goods:-

Explosives:- If situation permits , effort should be made to obtain the information about the class of explosives.(Normally only the type of explosives are carried in aircraft to board the blast and explosion effects are limited to the extent that they do not significantly hinder firefighting or other emergency actions.

Gases:- The risk of failure of gas cylinders carried as cargo would be no greater than that typically installed in the aircraft.

Radioactive Materials:- Foam, water or chemicals used to suppress fire , air current and fire itself can spread radioactive materials around the site. Protective clothing and respiratory equipment shall be worn.

Spills and Leaks:- Dangerous goods if damaged by aircraft fire or leaking on accident site may pose a risk or injury or adverse health effects to aircraft occupants and RFF personnel.

If possible pre- identified trained personnel (Possible source may be NAST, Ministry of Health, Quarantine, etc.) should mad available and their expertise advice should be taken.

Poisonous or infectious substances:- In the event of occurrences, food or drinking water which may have come into contact with poisons or other infectious substances should not be used. Public Health and veterinary authorities should be notified. Any person exposed to these dangerous should be removed from the scene of the occurrence and transported for decontamination as soon as possible to the appropriate medical facilities.

13.6. Post Accident Procedures

RFF personnel should be aware with local airport emergency plan procedures and at least following actions to be taken after the completion of emergency response procedures:-

- Removal of bodies of fatally injured occupants remaining in wreckage after fire has been extinguished or controlled under the direction of medical team.
- Area should be photographed for future reference prior to body removal activity.
- Wreckage should not be disturbed until released for removal by investigation authorities.
- If aircraft parts are to be moved in the course of rescue, record of their original.
- Position should be kept.
- Care should be taken to preserve all physical evidences.
- As far as possible mail should be protected and information should be given to local postal authority.
- As aviation fuels and hydraulic may cause harm to skin, it should be washed
- Thoroughly with soap and water if spilled to skin. Change wet cloths.

Chapter 14
Rescue Operation in Difficult Environment

14.1. Rescue Operation

Some Difficult terrains such as mountainous areas in the immediate vicinity of Tribhuvan International Airport Kathmandu. Other airports where RFF Facilities are available, such difficult terrains are also located in the immediate vicinity of Pokhara Airport. In Biratnagar, Simara, Bhairahawa and Nepalgunj Airports, where RFF Facility are available, difficult terrain of mountainous area are located approximately 10 km from the airport boundary.

In the rest of the domestic airports, where RFF facilities are not available and difficult terrains such as mountains and locations which are subject to heavy seasonal snowfall are present in the immediate vicinity of such airports.

With the consideration of above constraints, National Civil Aviation Security Program (NCASP) of Nepal and Airport Emergency Plan of respective Airports require Nepal Army to carry out Search and Rescue operation in such areas. (Nepal Army owns helicopters and trained personnel for the rescue operation).

Rescue Operations in difficult environment at the airport may be conducted by security agencies during the aircraft emergencies with prior agreements between CAAN and security agencies in which airports security service are available by Nepal Army, Nepal Police and Arm Police force Nepal. Civil Aviation Academy can be made available of Rescue Operations Training for securities agencies with prior agreements between CAA and security agencies. them. Civil Aviation Academy shall be taken approval from Civil Aviation Authority of Nepal (CAAN) before commencement of Rescue Operation Training.

14.2 Inter Agency Exercise

Respective airport authority shall conduct a joint exercise with all the agencies involved in emergency in accordance to the provisions of respective AEP.

Chapter 15
Training

15.1 RFF Training Program:

CAAN, Rescue and Fire Fighting Department shall prepare Training Program (RFFTP) and submitted to Director General of CAAN for approval.

15.2 Types of Training

Following types of trainings shall be included in RFFTP:-

- Basic Training for all RFF personnel
- Refresher Training for all RFF people
- Operational Tactics/Advanced Training for all RFF personnel
- RFF operation and for all lower level to upper level of managerial RFF Personnel
- RFF Management Training for middle and upper level of staff.

15.3 Major Areas of the Training

Types of Training	Subjects to be included
Basic	▪ Fire and Fire extinction ▪ Types of extinguishing agents to used ▪ Handling of equipment ▪ Care of Equipment ▪ Local topography ▪ Aircraft Familiarization ▪ Airport Familiarization ▪ Medical First aid ▪ Rescue Operation ▪ Practical Exercises ▪ Watch Tower
Refresher	▪ Refresher of short duration on basic, advanced and management training.
Operational Tactics/Advanced Training	▪ A brief introduction of all the subjects contained in Basic Training ▪ The approach ▪ Positioning of Equipment
RFF Management	▪ Subjects included in basic and operational tactics ▪ Fire Safety Management ▪ Emergency Management ▪ Crisis Management ▪ RFF Station Management (Managing Personnel, equipment, logistics, preparing budget etc.)

15.4 Curriculum

Following areas shall be included in curriculum at minimum:-

- Airport Familiarization
- Aircraft Familiarization
- RFF Personnel safety
- Emergency communication system including aircraft fire alarm.
- Use of appliances- hoses, nozzles, turrets, monitor, ladder
- Application of the types of extinguishing agents.
- Emergency aircraft evacuation assistance
- Fire Fighting operation
- Use of structural rescue and firefighting equipment for aircraft rescue and fire fighting
- Knowledge and extinguishing dangerous goods fire.
- Role and responsibility as stipulated in respective AEP.
- Use of protective clothing and respiratory equipment.
- Maintenance of Breathing Apparatus
- Emergency Fire Vehicle Driving/Operations
- Pressure Fed Fuel Fire
- Watch Tower Operations
- Accident/Incident Command and control techniques
- Fire Instructor Techniques
- Bulk fuel Fire Installation
- Incident Commander
- Helicopter Fire Fighting

Chapter 16
Aircraft Fuelling Practices

16.1. Introduction

The airport authority, aircraft operator and the fuel supplier each has responsibilities in respect of the safety measures to be taken during fuelling operations. Some guidance on these safety measures is given below. It is important to note that this material is not intended to replace fuel supplier operator procedures which are usually developed to meet requirements imposed by special equipment, national regulations, etc. The material includes the following subjects:

a) General precautionary measures to be taken during fuelling operations; and

b) Additional precautionary measures to be taken when passengers remain on board or embark or disembark during refueling operations.

16.2. General Precaution Measures to be taken during Aircraft fuelling Operations

The following general precautionary measures should be taken during aircraft fuelling operations:

16.2.1. Aircraft fuelling operations should be done outdoors; and

16.2.2. Bonding or grounding, as appropriate should be done.

16.2.3. Aircraft fuelling vehicles should be positioned so that:

- Accessibility to aircraft by RFF vehicles is not interrupted;
- A cleared path is maintained to permit rapid removal of fuelling vehicles from an aircraft in an emergency;
- They do not obstruct evacuation from occupied portions of the aircraft in the event of a fire; and
- The vehicle engines are not under the wing;

16.2.4. All vehicles performing aircraft servicing functions other than fuel servicing (e.g. baggage trucks, etc.) should not be driven or be parked under aircraft wings while fuelling is in progress;

16.2.5. Open flames and lighted open flame devices should be prohibited on the apron and in other locations within 15 m of any aircraft fuelling operation. Included in the category of open flames and lighted open flame devices are the following:

- Lighted cigarettes, cigars, pipes;
- Exposed flame heaters;
- Welding or cutting torches, etc.; and
- Flare pots or other open flame lights;

16.2.6. Cigarette lighters or matches should not be carried or used by anyone while engaged in aircraft fuelling operations;

16.2.7. Extreme caution should be used when fuelling during lightning and electrical storms. The fuelling operations should be suspended during severe lightning disturbances in the immediate vicinity of the airport;

16.2.8. When any part of an aircraft undercarriage is abnormally heated, the airport RFF service should be called and fuelling should not take place until the heat has dissipated; and

16.2.9. Portable fire extinguishing equipment suitable for at least initial intervention in the event of a fuel fire and personnel trained in its use shall be readily available, and there shall be a means of quickly summoning the rescue and firefighting service in the event of a fire or major fuel spill. It should be ensured by regular inspection and maintenance that this equipment is maintained in a fully serviceable condition.

16.3. Additional Precautionary Measures to be taken when Passengers Remain on Board or Embark/Disembarks during Refueling Operations

16.3.1. The importance of reducing transit times and security reasons, some States allow passengers to remain on board during refueling operations while others allow passengers to embark and disembark. However, an aircraft shall not be refueled when passengers are embarking, on board or disembarking unless it is properly staffed by qualified personnel ready to initiate and direct an evacuation of the aeroplane by the most practical and expeditious means available.

16.3.2. When aircraft refueling operations take place while passengers are embarking, on board or disembarking, ground equipment shall be positioned so as to allow:

- The use of a sufficient number of exits for expeditious evacuation; and
- A ready escape route from each of the exits to be used in an emergency.

16.3.3. The following additional precautions must be observed during refueling operations while passengers remain on board or embarking/disembarking.

- Passengers should be warned that refueling will take place and that they must not smoke, operate switches or otherwise produce sources of ignition;
- The illuminated “No smoking” signs and exit lighting should be switched on;
- Aircraft equipped with integral stairs should have them deployed, or if aircraft stairways are used, these should be positioned at each of the main doors normally used for passenger embarkation or disembarkation which should be open or ajar and free from obstruction.

16.3.4. If during refueling, the presence of fuel vapor is detected in the aircraft interior, or any other hazard arises, refueling and all cleaning activities using electrical equipment within the aircraft should be stopped until conditions permit resumption; and

16.3.5. Where passengers are embarking or disembarking during refueling, their route should avoid areas where fuel vapors are likely to be present and this movement should be under the supervision of a responsible person.

Chapter 17
Availability of RFF Information

17.1. General

17.1.1. In accordance with Annex 14, Volume I, Chapter 9, there is a need for the airport or appropriate authorities responsible for RFF services to make available to the appropriate air traffic services units and aeronautical information services units information concerning the level of protection normally provided at the airport for aircraft RFF purposes. Changes in the level of protection should also be reported.

17.1.2. The level of protection normally available at an airport should be expressed in terms of the category of the RFF services as described in Table 3-2 of this manual, in accordance with the types and amounts of extinguishing agents normally available at the airport. (Table 3.2).

17.1.3. Changes in the level of protection normally available at the airport for RFF (RFF category) should be notified to the appropriate air traffic services units and aeronautical information units to enable those units to provide the necessary information to aircraft using that particular airport. When such a change has been identified, the above units should be advised accordingly and as soon as practical to do so. A change in the RFF category may be the result of, inter alia, unavailability of extinguishing agents, unavailability of equipment to deliver the agents or unavailability of enough personnel to operate the equipment.

17.1.4. Notification of changes to the RFF category should be initiated even for short durations if it is known or likely to affect aircraft movements at the aerodrome.

17.1.5. Notification to industry should also include the hours of operations for an RFF service as well as any special services or resources, such as the availability of a water and difficult terrain rescue service, a dedicated emergency radio frequency

Chapter 18
Preventive Maintenance of Vehicles and Rescue Equipment

18.1 General

18.1.1. The most important aspects bearing on effective rescue in a survivable aircraft accident or incident is the training received and the effectiveness of the fire vehicles and associated equipment and the speed in which personnel and equipment can be deployed.

18.1.2. Annex 14, Volume I requires that a maintenance program, including preventive maintenance where appropriate, shall be established to maintain facilities in a condition which does not impair the safety, regularity or efficiency of air navigation.

18.1.3 Due to the ever increasing complexity of specialized aviation fire vehicles and their associated equipment, a program of regular and ongoing preventive maintenance is paramount to ensure availability and reliability. A robust maintenance program would also maximize the lifecycle of both fire vehicles and rescue equipment.

18.2 Preventive Maintenance

18.2.1. To ensure ongoing reliability and peak performance of any fire vehicle or item of rescue equipment is maintained and to ensure that rescue and firefighting (RFF) services are provided at the required levels, all RFF vehicles and equipment need to have regular preventive maintenance from mechanical team coordination with RFF Department.

18.2.2. To ensure that the maintenance can be conducted correctly, provision of the following is a necessity:

a) Maintenance personnel;
b) Maintenance procedures;
c) Defect reporting system;
d) Designated maintenance work areas;
f) Spare parts; and
g) Storage of maintenance records.

18.3 Personnel

18.3.1. All personnel conducting maintenance activities should be appropriately skilled, trained and equipped to undertake the designated and required maintenance activities they are tasked in accordance with their organizational safety management systems.

18.3.2. Working on modern-day RFF fire vehicles and equipment requires the following skill set or, as a minimum, a good practical working knowledge of:

a) Fire pumps and foam systems;
b) Complementary agent systems;
c) Hydraulics/pneumatics;
d) Automotive electrical system;

18.4. Maintenance Procedures

Maintenance procedures should be implemented to ensure a standardized manner in which fire vehicles and equipment are maintained. Maintenance procedures should cover:

a) Activities to be undertaken to ensure that disruption to RFF services are minimized. For example; bringing reserve fire vehicles into operational service to maintain category levels,

or conducting maintenance during breaks in aircraft movements where a vehicle may be taken out of service without affecting category levels;

b) The frequency of maintenance services;

c) Activities to be undertaken at each type of maintenance service as recommended by the original equipment manufacturer (OEM). For example, visual check, inspections & measurements;

d) Arrangements for technical support from the OEM or the OEM's local agent;

e) Spare parts should be held on site to enable regular maintenance to be conducted, for example, filters, belts, drier cartridges, lubricants, coolants, wiper blades;

f) Generically common spare parts should be held on site to minimize downtime, such as switches, light globes, relays, circuit breakers, bolts, nuts, washers, O-rings and seals;

g) Arrangements with OEM and local suppliers for all other parts to ensure downtime is kept;

h) Tire replacement requirements;

i) The method of reporting and documenting any defects that have been identified with the fire vehicles or equipment by operational and maintenance personnel.

18.5. Maintenance Work Area/special Tools

18.5.1. Provision of work area for maintaining RFF fire vehicles should consideration to the following:

a) A sufficiently large enough area to work on and around the vehicle;

b) Lifting/jacking equipment;

c) Wheel lifters/tire changing cages;

d) Storage areas for lubricants, spare parts and tools;

e) Storage of technical documentation; and

f) Storage of maintenance records.

18.6. Performance Testing- Fire Vehicles

18.6.1. RFFS fire vehicle may pass its initial acceptance test for compliance against its specification, there is no guarantee that it will continue to do so throughout its service life. All RFFS fire vehicles have parts that wear with time and as a result performance is lost. To ensure that the fire vehicle continues to have the ability to respond, discharge firefighting agents at required amounts, regular performance testing should be undertaken including quantitative checks of:

a) 0-80 km/h acceleration;

b) Braking;

c) Flow rate from high and low flow deliveries;

d) Foam admixing percentages;

e) Monitor throw; and

f) Compressed air foam systems.

18.6.2. Records of any performance tests undertaken should be retained, as it is a record of the fire vehicle continuing to meet the specifications, and allows future review if performance starts to deteriorate. Where multiple fire vehicles of the same type are stationed at the same location or operated by the same organization, it allows prediction of when the same performance deterioration may occur on other fire vehicles.

18.7. Rescue Equipment Requirements

Maintenance requirements for rescue equipment should be in accordance with original equipment manufacturer (OEM) requirements. However, due to the nature of firefighting, equipment can sometimes unknowingly become damaged. Consequently, it can also be beneficial to check the following:

a) All items — regular daily or weekly checks to ensure functionality;

b) Breathing apparatus sets — maintained after every use and checked regularly when not used for safe operation;
c) Short lines/long lines (rescue lines) — not frayed and are in good repair;
d) Portable fire extinguishers — full and charged with pressure;
f) Fire hoses — inspected and pressure checked on an annual or six monthly basis to ensure that the hoses do not leak and the couplings are functioning and securely fitted;
g) Nozzles/foam branches — inspected for damage;
h) Rescue tools — inspected to ensure that there is no damage to components. Under high forcing loads, damaged components can be very dangerous if they fail;
i) General tools — inspected to ensure handles are not broken or damaged;
j) First-aid kits — inspected at least weekly to ensure that items are maintained at the correct stock levels; and
k) Rescue tool box — checked to ensure all tools are present.

18.8. Maintenance Documents

18.8.1. A complete set of maintenance documentation should be delivered with the fire vehicle and rescue equipment during the procurement process. As a minimum this should include:
a) Operating procedures;
b) Maintenance procedures;
c) Fault diagnosis and troubleshooting;

18.9. Maintenance Record Keeping

18.9.1. A comprehensive set of maintenance records should be kept for each fire vehicles.
18.9.2. Keeping individual sets of maintenance records is also beneficial for each of the larger and more complex items of rescue equipment, for example, hoses, can be grouped together, however each item of equipment should be readily identifiable via a unique numbering system.
18.9.3. Keeping such documentation has several benefits:
a) Provides a historical record of the maintenance of the fire vehicle/equipment which may be an organizational requirement for legal or compliance reasons;
b) Provides evidence for any warranty claim that may be made against the OEM;
c) Can be referred to in the future (if a similar fault occurs); and
d) Provides evidence for any surveillance audit that may be undertaken for regulatory compliance.
18.9.4. Maintenance and calibration certificates should be maintained in a register for all special tools and test equipment.

18.10. Protective Clothing

18.10.1. Protective clothing normally includes, but is not limited to, turnout suits (jackets — overalls complete with suspenders), firefighting boots, gloves and helmet as a minimum. The proper care and preventive maintenance is normally the responsibility of the firefighter and the RFFS.
18.10.2. Protective clothing needs to be inspected for serviceability on a regular basis:
a) By the wearer prior to commencing duty;
b) After use; and
c) As required.
18.10.3. There are three levels of cleaning defined in National Fire Protection Association (NFPA 1851) routine, advanced and specialized:
a) Routine cleaning is performed after any fire-ground use where soiling has occurred and may involve brushing debris from the clothing with water and/or applying spot cleaning as required;
b) Advanced cleaning is more thorough with a frequency dependent on the use and condition of the clothing;

c) Specialized cleaning may need to be conducted by an external agency; and
d) Any cleaning should consider and comply with the manufacturer's instructions.

18.10.4. Minor repairs may be conducted at a local level, however, major repairs may need to be conducted by an external agency so that repair activities and/or materials do not compromise the protection standards of any protective clothing.

18.10.5. Storage of protective clothing is also a factor to be considered:
a) Storage should be away from direct light, especially sunlight;
b) Avoid contact with contaminants; and
c) Avoid storing near objects that could physically damage the protective clothing.

Chapter 19
Foaming of Runways for Emergency Landing

19.1. Benefits from Runway foaming

Following may be the benefits from foaming of runway in case of emergency landing:-

- Preventing aircraft damage – Foam will likely reduce the extent of aircraft damage which may be forced to make an emergency landing with wheels –up or where the nose gear is defective.
- Reduction in declaration forces – Foam will reduce the coefficient of friction of the runways resulted by emergency landing and helps to decrease the declaration force.
- Prevention of friction spark hazard
- Reduction in fuel spill fire hazard

19.2. Operational Problem

Following aspects shall be evaluated to determine the feasibility of runway foaming for emergency landing:-

- Actual nature of emergency – aircraft can lower its main gear or not, whether only one gear is down and cannot be retracted, number of tires and wheels damaged, nose gear is cocked or not, other related conditions.
- Time available for the preparation and distribution of foam for the purpose of covering, which may take time.
- Number and nature of available foam making appliances.
- Reliability of information on aircraft landing techniques under existing emergency condition.
- The foam making capability and adequacy of the equipment available on the airport for runway foaming.
- Foaming may affect other aircraft movement. Consider time to be taken for cleaning foam from runway.
- Feasibility of foaming under existing weather condition (In very cold weather condition freezing of water element draining from foam blanket could create serious breaking problem during emergency landing.
- As runway slope and runway surface temperature may affect the protein foam water drainage time, the length and surface condition at the time of emergency landing shall be considered.

19.3. Techniques of Runway Foaming

After the evaluation of factors as stipulated if decision is taken for foaming the runway, following techniques shall be used to accomplish the runway foaming:-

- Radio contact shall be established between Pilot-in-command and ground personnel coordinating the runway foaming.
- Primary RFF vehicles shall not be used for runway foaming as far as possible.
- Time shall be calculated to work out the scheduling of the foam laying operation and the vehicle reload requirements. Pre-planning and pre-arrangements shall be made to ensure the adequate quantity of foam compound for rapid vehicle re-servicing.

19.4. Water and Protein Foam Liquid Requirements for Runway Foaming:

Distance to Threshold	Malfunctioning Nose Wheel	2- Engine propeller	Wheel-up Landing 2-3 engine jet.	Wheel up Landing,4-engine propeller	4-engine jet.
Width of pattern	8 m	12 m	12 m	23 m	23 m
Length of pattern	450 m	600 m	750 m	750 m	900 m
Runway area covered	3600^2m	7200^2 m	9000^2 m	17250^2 m	$20200^{2\ m}$
Water Required	14400 Lt.	28800 Lt.	36000 Lt.	69000 Lt.	82800 Lt.
Protein Foam Required	432 Lt.	864 Lt.	1080 Lt.	2070 Lt.	2484 Lt.
3% Type	864 Lt.	1728 Lt.	2160 Lt.	4140 Lt.	4968 Lt.
6% Type					

Lists of Appendices

Appendix- A (1)

Civil Aviation Authority of Nepal

Aviation Fire Services

Daily Station Routine

First Shift (Morning Shift)

Time:	***Activities:***
06:00 – 06:30	Attendance and Duty deploy Equipment Checking/vehicle check up and run up
06:30 – 07.00	Reporting/debriefing; (vehicle commander to Shift In charge)
07:00 – 07:15	Break Time
07:15 – 08.00	Physical Exercise/ Sports
08:00 - 08:15	Refresh and changing
08:10 – 10:15	***Station Drills and other activities:***

Sunday – Station, Vehicles and Equipment cleaning, maintaining and Handling

Monday – PPE Donning + Breathing Apparatus Donning +Rescue Drills

Tuesday – Airport Surrounding Visit (Team With Fire Prevention Officer)

Wednesday – Hose Drill; Laying+ Rolling+ (Dry and Wet) +Hose Carry

Thursday – Table Top Exercise / Situation Drill (on different emergencies)

Friday –Fire fighting Practice on different situation)

Saturday – Games and other activities

10:15--10:30 - Debriefing

10:30-11:50 Lunch Break

11.50 – 12.00 - Handover and Takeover

Note:- Live fire drill should be done in every month

Appendix- A (2)

Civil Aviation Authority of Nepal

Aviation Fire Services

Daily Station Routine

Second Shift (Day Shift)

Time	**Activities**
12:00- 12:30	Attendance and Duty deploy Equipment Checking/vehicle check up and run up
12:30 – 13.00	Reporting/debriefing; (vehicle commander to Shift In charge)
13:00 – 13:15	Break Time
13:15 – 15:00	Station Drills and other activities:

Sunday – Hose Drill; Laying+ Rolling+ (Dry and Wet) +Hose Carry

Monday – PPE Donning + Breathing Apparatus Donning +Rescue Drills

Tuesday – Station , Vehicles and Equipment cleaning, maintaining and Handling

Wednesday – Table Top Exercise/Situation Drill (on different emergencies)

Thursday – Fire fighting Practice on different situation

Friday – Airport Surrounding Visit (Team With Fire Prevention Officer)
Saturday – Recreation and other activities

15:00-15:30	Debriefing
15:30-16:30	Tiffin/Lunch Break
16:30-17:30	Games / sports and other Activities
17:30 -18:00	Handover and Takeover

Note:- Live fire drill should be done in every month

Appendix- A (3)

Civil Aviation Authority of Nepal

Aviation Fire Services

Daily Station Routine

Third Shift (Night Shift)

Time	Activities
18:00-18:30	Attendance and Duty deploy Equipment Checking/vehicle check up and run up
18:30 – 19.00	Reporting/debriefing
19:00 – 19:15	Break Time
19:15 – 20:30	***Station Drills and other activities:-*** 1. Lighting System check and Test 2. Rescue equipment and ancillaries check and test 3. Airport surrounding area visit with fire prevention officer
20:30-21:30	Dinner Break
21:30-23:30	Discuss/lecture/fire related documentary/ film
23:30-00:30	Rest and handover to skeleton Shift

Appendix -B

Civil Aviation Authority of Nepal

Aviation Fire Services

Fire Vehicle Performance Form

Type of Vehicle: ……..

Acceleration : 80 km./hr. within ……..seconds.

Top speed : …….. km./hr.

Pump performance Test :

1. **Monitor :**
   a) Throwing Range - ……..meters at 14 bar
   b) Discharge Rate - …… L/min. at 14 bar

2. **Bumper Turret :**
   a) Throwing Range :…….. meter at 14 bar.
   b) Discharge Rate…….. L/ min. at 14 bar.

3. **Side Lines :**
   a) Throwing Range - ……..meters at 14 bar
   b) Discharge rate - ……..L/min. at 14 bar.

Remarks : ……..

Signature :…….
Operator Name : ……..

Signature : ……..
Shift-In-Charge Name :……

Note : The performance test will conduct on the monthly basis.

Appendix -C

Civil Aviation Authority of Nepal

Aviation Fire Services

VVIP/VIP Movement Record Form

Date: ……

Name of VVIP/VIP : …….

Flight No. : ……

Arrival Time : ETA :…….ATA……...

Departure Time : ETD :…….ATD……...

Initial Call Time : ……. Turn Out Time:…….

No. of vehicle used : ……..

Return back to station Time : …….

Signature…….

Commander Name:……..

Signature : ……..
Name of Shift-In-Charge

Appendix-D

Civil Aviation Authority of Nepal

Aviation Fire Services

Commander Report Form

Date …….

Information Received from :……..
From :……..
Time :……..

Type of Emergency : ……

ETA of Aircraft : ……..(GMT) …….(LT)

Runway to be used : …….

Aircraft Call Sign : ……

Type of Aircraft : ……

Accident site (In the case of ALERT 1): ……

Amount of Fuel On board : ……..

No. of Passenger and crew : …….

Any cargo of critical significance : …….
Location : ……
Quantity : ……

Turn-out Time :……..
No of used Vehicle :…….
Types of Vehicle:…….
Return back time to station. ……

Details of accident/incident
……
……
Remarks
……

Signature : ……..
Name of Shift-In-Charge

Appendix -E

Civil Aviation Authority of Nepal

Aviation Fire Services

Maintenance Report Form

Shift : ……

Date : ……

S. No.	Name of the equipment	Details of problem	Reporting Time	Remarks
Clearance action details: Clearing Section Name: Clearing Tech. Name:				
Facility outage:				

Reported by:

Signature……..
Name……
Designation…….
Division/Section…….

Report Received by:

Signature……..
Name……
Designation……..
Division/Section……..
Date and Time:

Signature…….

Shift In-charge……

Appendix –F

Civil Aviation Authority of Nepal

Aviation Fire Services

Drill Activity Report Form

Date : ……

S. No.	Drill Name	Time	Name of Crew member	Name of non-participator	Causes	Remarks

Drill Commander:

Signature :
Name :

Signature: ……

Shift In-Charge:……..

Shift

Appendix-G

Civil Aviation Authority of Nepal

Aviation Fire Services

Daily Operational Report Form

Date :……

The deputy-Director
RFFS Division

1. Details of Crew member of :

S. N	Name and Designation	Remarks	S. N	Name and Designation	Remarks
1			17		
2			18		
3			19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		
16			32		

2. Name of Drill Commander: ……
3. Total No. of Crew (Including Shift In-charge):..……
4. No. of staff absent: ……..
5. No. of staff on leave: ……
6. No. of staff weekly R/Off: ……..

7. Water level on overhead tank: ……Liters.
8. Water level on ground tank: ……Liters.
9. Details of RFF Vehicle and Ambulance in Operation :

S. N	Type of Vehicle	Condition	Remarks	S. N	Type of Vehicle	Condition	Remarks
1.				8			
2.				9.			
3.				10.			
4.				11.			
5.				12.			
6.							
7.							

10. Details of Watch Tower Equipment:

a) V.H.F. 118.1:…….. b) V.H.F. 121.90: ……
c) Inter-com. Telephone: …… d) Direct Telephone : …….
d) Siren. ……
e) f) P. A. : ……
i) Binocular: ……
11. Others : …….
12. Stress Important : …….
……..
13. CFR equipment inventory check list is attached herewith.
14. If there is any change in Airport CFR Category caused by shortage of man power or any technical problem of CFR vehicle, Shift in-charge immediately report the AIS Division.
15. Deployment of crew for CFR Vehicle, watch tower and Telephone:

Operator:

Commander:

Crews:

Watch Tower Duty:
Watch Tower Supervisor: …….

Watch tower operator: 1……

2……

Telephone Duty…….

Signature: ……..

Name of Shift In-charge: ……

Appendix-H

Civil Aviation Authority of Nepal

Aviation Fire Services

FAULT REPORT

SHEET NO. **Date**: .....

S.NO	Facility and Fault Symptoms	Date	Time Detected	Time Reported	Fault Cat	Tech. Ref. No.	Reporting To

Circulation

Blue -GM TIA
Pink - Flight Operation Chief
Yellow - Mechanical Chief / Radio / Electrical / Civil Maintenance
Red - Division Chief **Duty Officer**
White - O/C
Shift……

Appendix-I

Civil Aviation Authority of Nepal

Aviation Fire Services

FAULT CLEARANCE REPORT

SHEET NO. **Date**:..

.....

S.NO	Facility and Fault Symptoms	Date	Time Cleared	Tech. Ref. No.	Clearing Operations Name

Circulation

Blue - GM, TIA
Pink - Flight Operation Chief
Yellow- Mechanical Chief / Radio / Electrical / Civil Maintenance
.....
Red - Division Chief **Shift**
White - O/C