THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HOME AFFAIRS

FIRE AND RESCUE FORCE

STANDARD OPERATING PROCEDURE MANUAL

Second Edition

VOLUME VI

EMERGENCY RESPONSE OPERATION

2025

TABLE OF CONTENTS

SOP 1. WILDFIRE OPERATIONAL

This guidance has been produced to give fire and rescue Force personnel an additional understanding and awareness of the phenomenon of wildfire. It examines the hazards, risks and controls relating to Fire and Rescue Service personnel, the personnel of other agencies and members of the public at Incidents of wildfire. It also provides a point of reference for those who may be called upon to plan for wildfire events and for those incident commanders and personnel responding to such incidents

Purpose

To establish a functional set of procedures for Fire and Rescue Personnel during the incident response to dry vegetation fires ranging from small grass fires to forest fire deployments.

Scope

This scope will include the following items:

- First Arriving FRF team Duties
- Contributing Factors (weather, fuel, and topography)
- Tactics
- Safety
- PPE
- Tools and equipment

1.1 Procedure

First Arriving FRF team Duties

The first arriving FRF team shall establish command, name the fire, and direct the next arriving units. If possible, the first arriving can start fire operations while maintaining command.

The Incident Commander shall then:

- Identify the actual location of the fire.

- Size up the fire in acres (football fields), determine the rate and direction of spread, fire behavior, i.e., running, creeping, fast moving, describe the type of fuels, grass, brush, trees.
- Identify the best access points.
- Identify values at risk, i.e., homes, businesses, power and infrastructure
- Determine the need to evacuate people early.
- Direct in-coming units to operations or staging locations

1.2 Contributing Factors

Weather

- Consider Winds, Temperature, Relative Humidity (RH), Storm Fronts, Lightning
- Relative humidity is a major factor for the ability of a wildland fire to take place and when the humidity drops below 40% the danger grows.
- Strong winds along with the humidity can cause dangerous and unpredictable conditions, always be aware of wind direction during operations.

Fuel

- Consider Drought, Fuel Moisture, Fuel Loading, Fuel Type, Arrangement/Continuity. Most of the fuel made up of light contents and will burn very rapidly, these fires will be easily controlled but when mutual-aided or on deployment to surrounding jurisdictions be aware of heavier fuel loads.

Topography

- Consider Slope (Steepness), Aspect, Elevation
- Fire burns uphill much more rapidly than downhill and considerations of spot fires on the receding slope are a possibility.
- These topography concerns also make travel difficult and the incident command's size-up should consider access roads and possible exposures

Fig: shows contributing factors for wildfire

1.3 Tactics

- FRF attack the fire beginning at a safe anchor point, normally at or near the rear of the fire.
    - Work up the flanks to the head and pinch off the head.
    - Then, secure the line by thorough mop up.
- On large fires it may be necessary to identify where the fire can most easily be stopped, i.e., a road, stream, rockslide, etc.
    - In these cases, it might be better to allow the fire to burn to this control point and hold the fire there.
    - Be aware of spotting across containment lines.
- The plan of action is based upon on what fire engine and personnel are on scene or are arriving and NOT determined by what fire engine and personnel might be en route to the location.
- Always provide for the safety of the Public and Firefighting Personnel first.

1.4 Safety

- Always have two ways out to avoid being burned over or trapped.
- Apply Firefighting designed techniques to reduce danger to FRF personnel and increase firefighting efficiency.

- Walk rough terrain and whenever in four-wheel drive. Put the vehicle in four-wheel drive BEFORE going off an improved roadway. Avoid driving through heavy brush.
- Know who is near you and be sure you can talk (or communicate effectively by radio) to them.
- Advise Incident Command of all potential problems.
- Always have a lookout.
- Watch for spot fires, aircraft making water or retardant drops. Monitor weather conditions and report changes in wind direction, flame height, changes in fuels, etc.
- Be alert for downed power lines.
- Take frequent water/rest breaks if the firefight will be longer than an hour.
- NEVER go downhill to fight a wildfire. Come in from below the fire. Whenever possible attack the flames directly
- Consider leaving a 1/4 tank of water in the booster truck for safety

1.5 Personal Protective Equipment

FRF Personnel operating at wildland fire incidents or natural/man-made disasters shall adhere to Fire and Rescue Force SOP's and all personal protective equipment required All personal protective equipment should be brought on Type 1 engine deployments.

- Wildland Assignment
    - Nomex shirt or jacket
    - Nomex Pants
    - Department issued wildland boots
    - Helmet, goggles, gloves, and hearing protection (when needed).
    - All cotton undergarments should be worn under PPE. It is recommended that long pants and long sleeve cotton shirts be worn underneath the Nomex protective ensemble (especially with department issued brush pants), to double the protection from radiant heat.
- Structure Assignment-Current Fire and Rescue Force PPE and SCBA

1.6 Tools and Equipment

This section is a basic visual reference of the various tools and equipment used in wildfire response, as well as the most common use according to the different firefighting strategies. The different tools and equipment presented are hand tools generally manually powered while equipment normally have an integrated source of power or are vehicle mounted.

1.6.1 Hand Tools for Indirect Firefighting

McLeod tool

Pulaski tool

Rake

Spade

Gorgui

Scythe

Machete

1.6.2 Equipment for Indirect Firefighting

Chainsaw

Mechanical Grass Cutter

1.6.3 Equipment for Tactical Fire

Drip Torch

Leaf blower to direct intended fires

1.6.4 Hand Tools for Direct Firefighting

Extinguishing water back pack

Fire beater

1.6.5 Equipment for Direct Firefighting

Water atomiser for wildfire applications

Coupled water pump (vehicle mounted)

Motor water pump (as part of the primary intervention equipment).

Firefighting helcopte

SOP 2. SHIP AND MARINE FIREFIGHTING

2.0 Scope

Guidance on operational response, command and control in the event of fire or emergency in ships and vessels in the harbor area. Gives guidance on procedures for initial appraisal and subsequent attack for ships on fire or other related emergency and the subsequent rescue of persons onboard.

2.1 Purpose

To gives guidance on communications system between harbor authorities and FRF personnel, both alongside and offshore also provide guidance on the procedures for reinforcement and logistic support of incident of a prolonged or involved nature. It is imperative that regular visits and exercises are conducted on ships within port to confirm and enhance existing skills.

This SOP should also be read along with the following:

- SOP for Incident Command and Control
- SOP for BA Control Procedures
- SOP for Risk Assessment

For ships away from shore, in dock, or moored alongside, the Captain retains overall responsibility for the safety of his ship, including those occasions when his ship is undergoing repair or refit. In the case of fire, the Captain will transfer the responsibility for firefighting to FRF Incident Commander. The FRF Incident Commander of the operations shall, for so long as any appliances are made available to the Port Authority for the purpose of those operations, have full control over the manner in which it is used. The Captain, or in his absence, the Officer in- Charge of the vessel shall be responsible for bringing to the notice of the FRF any special circumstances affecting the safety of the ship or the conduct of the firefighting operations.

This will include any cargos, which will have a serious effect on firefighting tactics, and cooking processes onboard including the use of liquid petroleum gas cylinders. The Port Authority shall be responsible for bringing to the notice of FRF any special circumstance affecting the safety of port installations and for arranging, in conjunction with the FRF, that appropriate steps for the safety and efficient working of the installations are taken.
In the event of disagreement between the FRF Incident Commander and the Authority, the decision on the following matters shall prevail:

- Whether the ship, is to be moved, beached or scuttled and, if so, the place to which the ship is to be moved, or where it is to be beached or scuttled. This will be the responsibility of the Port authority to arrange.
- Whether the pumping of water into the ship is to cease to prevent capsizing or damage to the port installations.

2.2 Summary of Duties

The first fire engine crew will commence immediate fire and/or rescue operations onboard ship. The second fire engine crew will support and assist first fire engine crew aboard ship in these operations. The third fire engine crew will supply additional water from shore side to fire area. The Incident Commander as part of his dynamic risk assessment will request additional fire engine, including height vehicles and specialist units which will assist in his operational plan.

2.3. Initial Ship Firefighting

Although it is appreciated that varying circumstances may affect any predetermined plan, as a basis the following procedures will be used as guidance unless the Incident Commander instructs otherwise, i.e. where due to the limited size of smaller motor vessels an initial response with hose reels would be more appropriate.

2.4 Procedure for first crew attending

Where circumstances permit, personnel nominated as B.A. wearers on their appliance should don B.A. sets enroute to the incident but not go into air until instructed. They should ensure that their tallies are completed and cylinders are a minimum of 80% full. **All Crew Members must be in Full PPE**. The appliance should be parked as near as possible to the designated, or suitable gangway of the ship. Care should be taken not to obstruct free passageway alongside the vessel and leave clear area for operation of a Height Vehicle if requested.

The Incident Commander will board the ship taking 1 handheld radio, contact the Ship's Duty Officer, obtain information on the incident and take charge of firefighting or rescue operations until relieved. He must ensure relevant information is made available to his Command Support Officer, firefighting crews and FRF Control.

The crew including 2 personnel dressed in B.A. (sets not started up) will accompany the Incident Commander on to the vessel, taking with them the following equipment.

- 2 lengths 45mm hose + 1 hand-controlled branch
- 1 B.A. entry control board, B.A. surcoats and tallies
- 1 B.A. guideline
- 1 handheld radio

At a point selected by the Incident Commander and dictated by circumstances, the members of the crew will stand by with their equipment, whilst the Incident Commander, together with the Ship's Officer, proceeds to the location of the fire and decides the best course of action. During this assessment the Incident Commander should determine the perimeters of the incident Hot Zone. When this has been determined the crew will

commence firefighting operations, utilizing the ship's fire mains or other firefighting media which may be available.
B.A. control must be established and B.A. reserves available before B.A. operations are commenced. An emergency team of two wearers minimum must be formed and made available for a BA emergency in the first instance.

The Officer-in-Charge of second fire engine and crew, with 2 personnel dressed in B.A. (sets not started up) will on arrival, board the ship taking them the following equipment:

- 2 lengths 45mm hose
- 1 hand-controlled branch + 1 all-purpose line
- 1 controlled dividing breaching
- 1 handheld radio
- 1 pack of directional tape

The Officer of the fire engine will liaise with the Incident Commander to assist in setting up a B.A. control, provide B.A. reserves and lay additional hose lines, as deemed required for the needs of the incident. Consideration must be given to ensuring there is sufficient length on the hose lines to allow the firefighting crews to travel safely to the fire scene without hindrance or danger.

Where necessary and providing sufficient personnel are available, one person should be instructed to return to the **gangway to act as a Marshall for oncoming Officers and crews**. He may assume the role of Command Support or Sector Commander. A directional tape should be laid from head of gangway to the incident on ships other than dhows or small motor vessels.

NOTE: This directional tape is not to be used as a B.A. guideline but merely to guide crews through areas clear of smoke to the area on fire where normal B.A. procedures will apply.

2.5 Third fire engine

The crew will set the pump into the nearest hydrant/open water and lay one line of 65mm hose via a pump to a point nearest to the fire area using a suitable gangway by: -

- laying hose to a convenient point on the dockside for hauling on board by line
- completing the line with a controlled dividing breaching and this line to be charged on instruction of the Incident Commander.

The Officer-in-Charge of this fire engine will take charge of operations on the dockside until relieved. He will be known as the Dockside Officer and be identified by a red and yellow sector commander jacket. He will be responsible for:

- water supplies to the vessel
- siting of appliances
- control of crew members not engaged on board the vessel
- safe egress from the vessel (also an alternative means of egress)
- the setting-up of an effective incident control point

2.6 Developing Fire Situation

In the event of a serious fire situation developing where additional equipment and personnel will be needed it is vital that adequate logistic support is present and control of specific operations is exercised if firefighting operations are to be successful. For this, consideration must be given to nominating Officers for specific tasks. It is also imperative that as part of the analytical risk process consideration given to withdrawing crews if the risks outweigh the benefits.

Specialist Resources Include:

1. **Incident Support Team**

   Responsible for the effective operation of the Incident Support Unit

2. **Foam Officer**

   Responsible for ensuring adequate supplies of foam concentrate and efficient operation of foam producing equipment. When a major foam strike is envisaged, the Incident Commander will inform FRF Control who will then mobilize such foam

stock as may be necessary for use in the conventional manner, either from the dockside or on the vessel involved.

3. **Water Officer**

   Responsible for dockside operations in connection with water supplies and ensuring adequate supplies are available to meet firefighting needs.

4. **Liaison**

   It is essential in a serious fire situation that the Senior Fire Officer present maintains the closest possible liaison with the Ship's Officers/Agents and Police.

2.7 Fire Control Plans

In every passenger ship there shall be permanently exhibited by the owner of the ship, for the guidance of the master and officers of the ship, general arrangement plans showing clearly for each deck:

- The position of the control stations
- The sections of the ship which are enclosed by fire resisting bulkheads
- The sections of the ship which are enclosed by fire retarding bulkheads
- Particulars of the fire alarm
- Fire detection systems
- Sprinkler installations
- Fixed and portable fire extinguishing appliances and firefighter's outfits
- The means of access to the various compartments and deck in the ship
- The ventilating system including particulars of the master fan controls
- The position of dampers and identification numbers of the ventilating fans serving each section of the ship
- The position of all means of controls A duplicate set of the fire control plans shall be permanently stored in a prominently marked weather-tight enclosure outside the deck-house for the assistance of shore-side firefighting personnel.

2.8 Stability

Should a serious fire be apparent on arrival or requiring a number of firefighting jets to be brought into use, then the stability of the ship may be affected and must be considered during the early stages of operations. The information and guidance set out in this section together with the prime factors must be considered and introduced as necessary at serious incidents to counter and minimize any stability problems that may arise. Incident Commanders must not wait until the stability of the vessel is obviously affected before introducing these counter measures.

2.9 Use of Water and Effects on Stability

Due to the additional weight and free surface effect of water, the amount of water introduced into ships from firefighting jets must be strictly controlled at all stages. Water introduced at high levels in ships will have a greater adverse effect on stability and may cause a list to develop earlier than when water is introduced at lower levels.

Water introduced into large undivided areas of a ship, particularly in ship's lounges dining areas and between decks and sheltered decks (cargo ships) will have a greater effect on stability than in sub-divided areas such as cabins, due to the large surface area of the water and its ability to flow uninterrupted towards any inclined part of the ship, where it will accumulate and add additional weight

2.10 Stability

The officer in charge of firefighting operations must constantly bear in mind the stability of the ship. These can be affected by various factors, in particular:

- The amount and position of water put on board for fire fighting
- The amount and position of water pumped out from parts of the ship
- The movement of cargo etc., from one part of the ship to another. Stability is a complex subject and to assess precisely, the stability of a ship at any given time and the exact effects different actions have on it, involves complicated calculations.

The ship's officers are the experts, and the incident commander should liaise closely with them as they determine the relevant information on the weight of water and the area where it is acting, movement of cargo, ballast, fresh water and fuel oil. Filling a tank low

down in the ship may seem a good idea to lower the centre of gravity but will initially cause a loss in stability due to the introduction of free surface liquid.

Filling up slack tanks low down in the ship to remove free surface maybe a good tactic. When a compartment is partially filled and the ship has a list or loll, the surface of the liquid may not extend the whole width of the compartment, so the actual loss of stability is not as bad as theory would predict. However, the ship's officer's advice should be taken.

2.10.1 Longitudinal Stability

The ship's longitudinal stability will need to be borne in mind, especially if a large amount of water has to be introduced at one end of the ship, or there may be an excessive trim with the ship down by the head or stern, needing deeper water to remain a float.

2.10.2 Transverse Stability

The difference between heeling and listing should be understood. A **list** is the transverse inclination of a ship due to the distribution of weight within the ship. **Heel** is a transverse inclination Due to an External Force, e.g. wind or wave.

2.10.3 Immediate Counter-Measures

The following need to be considered by the Incident Commander:
Water sprays should be used where possible and so positioned to provide the maximum effect on the fire with the minimum use of water. Fire crews set to work to remove or drain down water to lower levels from accumulated areas by use of jet pumps or any other available means. For this, Breathing Apparatus may have to be worn.

Ensure that the ship's bilge pumps are operating as efficiently as possible Restrict firefighting operations involving the use of water to the absolute minimum necessary. Sprinkler installations operating. These to be controlled similarly as indicated above consider an alternative extinguishing media i.e. Hi-Ex/medium expansion foam or CO2 where practical.

2.10.4 Ship's Stability Indicators (Inclinometer)

The majority of modern ships are fitted with a device for indicating stability and angle of list, which when updated with certain information by a Ship's Officer, will automatically give an indication of the ship's degree of list.

2.10.5 Stability Measures and Procedures

Before positive decisions can be made in the initial stages on what other measures can be taken to reduce and correct a stability problem full information is required on the following:

- Total tonnage of water introduced into the vessel by firefighting operations
- State of the ship's tanks
- Tidal conditions prevailing

2.10.6 Stability Consultation and Further Action

Constant liaison needs to be maintained with Ship's Officer and agents, dock and harbor officials and any other representatives of interested organizations advising of:

- The amount of water that has been put aboard and the fire situation generally
- An estimate of the likely duration of the firefighting operations and further amounts of water likely to be put aboard

Having considered all the information available and following close liaison, the Incident Commander will decide on what further action is necessary to maintain or improve the ship's stability and what further resources will be required.

This may include:

- Further fire engine
- Specialist fire service personnel
- Specialist contractors
- Ship engineers

Special stability considerations are necessary for ships in dry dock and under repair or subject to major structural alterations. On these vessels the availability of ship's crews and officers may be reduced and information difficult to obtain. It will be necessary to

maintain a very close liaison with the ship's contractors responsible for repairs and alterations and obtain information on then general state of the vessel, including what machinery and services are operative.

The ship's bilge pumps may be out of action. This will permit excessive water to accumulate and difficulties may arise in the draining down. Bulkheads, both watertight and fire division may have been breached or removed resulting in larger undivided areas being present to allow large amount of water to accumulate.

2.11 Ventilation

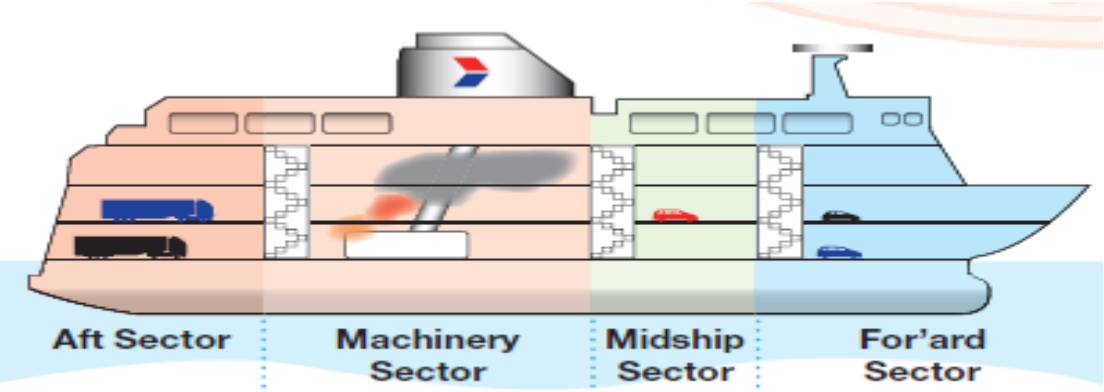
Ventilating a fire on a ship is both difficult and unless carefully monitored May cause further fire spread. If the ship has a ventilation system, the ship's officers may have already turned it off completely or, if it is possible, turned off that area covering the incident. It is generally a wise precaution to ensure that where installed, ventilation systems are turned off, certainly until the extent of the fire is determined. Ventilation may be required for the removal of smoke up to enable fire fighters to check more thoroughly for any hot spots.

In such circumstances, the incident commander will need to be sure that:

- Any residual heat and smoke will not be carried to unaffected parts of the vessel,
- That the venting system components or any trucking are not damaged,
- That he has sufficient personnel to properly monitor the venting,
- That the evacuation of a hot and smoke atmosphere will not induce a draught sufficient to cause any re-ignition.

Venting a fire on a ship in order to release heat and smoke may not be possible except perhaps for ships' holds, which are open to the main deck or machinery spaces through flue stacks. Much will depend on the type of cargo as to whether venting will assist firefighting or cause the fire to develop to unmanageable proportions. If after consultation with the ship's officers, the incident commander has any doubts it will be better not to ventilate. **The option might then be to starve the fire of oxygen and place fire fighters in position for boundary cooling.**

Options for Sectorization 1



2.12. Message from Ship

A typical message from a ship incident should include the following information:

- Type of vessel
- Name of ship
- Location of berth or positioning
- Tonnage (gross)
- Cargo type
- Location of fire
- Equipment in use
- Mode of operations

Summary

- The unfamiliar particulars of ship construction and terminology will cause significant hazards and operational problems for all crews.

- Full use of on-board firefighting installations should be utilized with the direct guidance of the ship captain, bearing in mind the ships stability.
- Specific and concentrated firefighting techniques should be employed and adhered to strictly by all crews.
- Normal communications will be tested severely and may well fail. Reliable, alternative means must be considered, preferably at the pre planning stage.
- It is vitally important that a robust, simple incident command system is in place and respected by all officers.
- Good and clear liaison with relevant, external sources will be essential to glean their expert knowledge in ship layout, goods, stability, etc.

SOP 3. AIRCRAFT RESCUE AND FIREFIGHTING OPERATION

3.1 PURPOSE

The purpose of this procedure is to establish guidelines for the response of Fire and Rescue Force personnel and equipment to aircraft emergencies. The procedure outlines responsibilities for an on airport and off-airport FRF personnel. It identifies and defines fire vehicles, aircraft fire fighting and rescue procedures, special services, emergency calls and procedures, key standards requirements for fire and rescue crew, human factor principles for optimum response and safety of person, alarm terminology, airport alert response, airport staging areas, Aircraft rescue and firefighting (ARFF) standby locations, general aircraft firefighting information, and the communication requirements.

3.2 OBJECTIVES

The objective is to save lives in the event of an aircraft accident or incident. This objective assumes the possibility of, and need for, extinguishing a fire that may occur immediately following an aircraft accident or incident, or at any time during rescue operations, including the suppression of cabin fires and rescue of aircraft occupants. It has to be able to reach the scene of an accident anywhere inside the airport boundary within three minutes, but preferably two minutes and to create conditions in which survival is possible.

3.3 GENERAL AVIATION FIRE FIGHTING RESPONSE PLAN

Since an aircraft crash can occur anywhere in the metropolitan area, off-airport units need to be informed of some basic tactical information and guidelines when dealing with aircraft crash incidents.

There are two types of aircraft crashes:

1. High Impact
2. Low Impact

3.4 CHEKS OF FIRE AND FIREFIGHTING VEHICLES

In additional to operational checks and daily repair work the preventive maintenance schedule of the FFR vehicles shall include specific checks and tests on maintenance and service duties as detailed in the instruction manual of the particular vehicle.

Daily operational checks of RFF vehicles prior to starting the engine are as follows:

a) Check engine oil level.
b) Check engine coolant level.
c) Check hydraulic steering reservoirs.
d) Check windshield water level.

After starting the engine:

a) Check operation of pump control and governors by discharging water out of monitors, hand-lines and nozzles (This check is to be performed at a designated location outside the fire station bay)
b) Check water and foam level
c) Check CO2 pressure on dry chemicals
d) Check for leaks of water, foam, extinguishing agents, air, hydraulic fluid and oil
e) Check cylinder air pressure on all breathing apparatus
f) Check all tools and mounted equipment such as power saws etc.

A complete check is made on the foam system every two weeks including Performance of proportioning system, metering valve setting and physical check for condition of foam and water tank. A complete check is made on dry chemical system every two weeks including all CO_2 cylinders, high pressure hoses and fittings. If there is a drop-in pressure, perform a soap bubble test on all pipes, joints and fittings. Discharge dry chemicals through hand-lines, blow out and restore system to operational condition.

Performance Tests:

Performance test on all Rescue and Firefighting vehicles is carried out by the Maintenance Staff.

once every month as follows:

a) Acceleration test with the vehicle full loaded and manned from cold start.

The test is made in presence of Fire Department personnel.

Tests are to be made on two runs in opposite directions, and measurement of speed is to be made at 25 and 45 seconds.

b) Brake test with the vehicle full loaded and manned on a dry pavement.

Brakes are applied to permit the vehicle to stop when traveling at a speed of 32 km/h (20mph), and measurement of the braking distance is to be made.

c) Monitor test

1. With the monitor in straight stream and maximum reach position Measurements are to be made of the jet stream distance and corresponding pump pressure.
2. Time monitor from maximum depression to maximum elevation.
3. Time monitor rotation through extreme positions on either side of straight ahead.

d) Check operation of monitor jaw.

e) Check monitor operation while vehicle is in motion.

f) Check RFF Vehicle lighting system (spot lights, side lights, head lights)

g) Check both wind shield washer and wipers

h) Check all mirrors

Response Time Test for RFF Vehicles

The response Time Test is conducted to ensure that all vehicles are capable to meet the response time of not exceeding three minutes from the Fire station to the end of each runway and it is conducted at least once per quarter of the year.

The Checklist:

This is done for up-keeping the crash fire tenders in good condition by checking and repairing it regularly as recommended and instructed by the manufacture for its good at most performance. The following are the checklists for RFF Vehicle

1. Form No. 1. Weekly inspection of Rescue and Firefighting Vehicles & Facilities
2. Form No. 2. Daily inspection and preventive record of RFF Vehicle
3. Form No. 3. Record of fire drill
4. Form No. 4. is for 3 monthly / 6 monthly performance test of Large Rescue and Firefighting Vehicles
5. Form No. 5. Monthly inspection of Fire Equipment
6. Form No. 6. Quarterly inspection Hangers and building

7. Form No. 7. Daily inspection of Rescue and Firefighting vehicle equipment
8. Form No. 8. for Daily inspection and record for miscellaneous equipment (FAFA, Etc.)
9. Form No. 9. Daily vehicle and equipment's fault report
10. Form No. 10. Hydrant record
11. Form No. 11. Quarterly inspection and test of pump and suction hose standard test
12. Form No. 12. Response time
13. Form No. 13. Maintenance of Rescue and Firefighting Vehicles

3.5 AIRCRAFT FIRE FIGHTING AND RESCUE PROCEDURES

3.5.1 Control-Room:

Constant observation of flight and apron activities is maintained from the airport fire station. In most cases, the information is from the Air Traffic Controller on duty on the subject and then the information relays to firefighters but sometimes vice versa.

If information is received from a person other than an air traffic controller on duty that an aircraft accident has occurred or appears to imminent then turn out in the same manner as if the call had been given by air traffic controller. The control-room is the hub of the fire station emergency system. The watch-room controller accepts all emergency calls and is responsible for initiating the alarm systems which will dispatch appropriate attendances to each incident.

On receipt of a call for emergency the control room attendant shall sound the station alarms and announce the type and details of the emergency over the public address system to save valuable seconds.

3.5.2 Communication System.

The efficiency of a rescue and firefighting service is significantly dependent on the reliability and effectiveness of its communication and alarm system.

Communication between Air tower control (ATC) and Fire Control Room.

Content of the message for aircraft consist of:

- Type of aircraft
- Airline operator
- Route
- ETA (estimated time of arrival)
- Nature of trouble
- POB (passenger on board)
- Amount of fuel
- Run way in use
- Additional report such as dangerous goods on board / name of captain

3.5.3 Fire Control Room Attendant shall: -

a) Read back the message to the ATC for clarity
b) Write in the log-book time of receiving the message
c) Write in the log-book time of disseminating the message to firemen through the public address or crash bell
d) Write in the log-book time and in series from the first fire tender left the station for standby at stages to the last or for any action
e) Notify the station commander on the incident

3.5.4 Safe Landing

If the aircraft lands safely; crash fire tenders shall go back to the station but one of them shall escort the aircraft to the parking point and remain on standby until all passengers disembark. Shift in-charge shall inquire some information from the pilot in command for his report.

3.5.4 Report of the incident

Shift in-charge shall sum up the incidence by writing his report under the following guidelines

a) What Happened?
b) When did it happened
c) Where did it happen (location in Grid Map Reference Etc?)
d) Who were involved?

e) Why did it happen?
f) Witnesses

3.5.5 Response Time:

This is a time between the initial call to FFR and the time when the first responding Crash fire tender is in position to apply foam at a rate of 50% of the recommended discharge rate at a certain category of an airport.

The operational objective of the Airport rescue and firefighting service is to achieve a response time not exceeding two minutes to any point of each operational runway, in optimum visibility and surface conditions. Any vehicles, other than the first responding vehicles(s), required to deliver the amounts of extinguishing agents are ensured continuous agent application and should arrive no more than three minutes from the initial call.

3.6. SPECIAL SERVICES

VIP's have a preferential treatment; FFR dedicates the eyes, ears and hands on them closely by minimizing response time in case of any incident.

3.6.1 Notification procedure:

a) Security in-charge VIP shall make notification to fire station on arrival and departure
b) Content of the message for arrivals shall include
    i. Title of the VIP
    ii. Estimated Time of Arrival (ETA)
    iii. Type of aircraft in use and if possible registration
    iv. Terminal Building to be used

3.6.2 FFR procedures for VIP on arrival

a) Shall position the crash fire tender in front of the fire station bay five minutes before with beacons lights on
b) Fire Tender shall escort the aircraft after landing to the parking for disembarking the VIP

c) The crash fire tender shall remain on standby until the VIP leaves the airport

Notification procedure on the message for departures shall have the following information:

a) Title of the VIP
b) Estimated Time of Departure (ETD)
c) Type of aircraft in use and if possible registration
d) Terminal Building in use

3.6.3 FFR procedures for VIP departure

a) Crash fire tender shall be dispatched to TB in use 10 minutes before ETD
b) Crash fire tender shall remain on standby until the aircraft starts moving for taking off.
c) Crash fire tender shall remain on watching the a/c simultaneously proceeding to the station waiting until it takes off.

3.7 Fire Cover Services.

3.7.1 Fire cover

Fire crew positions the crash fire tender, adjacent to an aircraft, while refueling with passengers on board and, while fire engine and bacons are on

a) Request for fire cover message is communicated to the fire station control room
b) Originator of request is from either Airline operator, Puma, Oil Com, Lake Oil, Air Traffic Controller on duty or The Duty Manager
c) Fire control room attendant fills form No. 3 and, given to crash fire tender crew who assigned for duty
d) After performing the work, the form is presented to the requester to sign for acceptance of the work.
e) Time - frame for charges is 0 up to 60 minutes =100 U S D=and, part of an hour thereafter is counted as an hour

3.7.2 Engine run-up

This is done by aircraft technicians after maintenance and done on open space. Fire crew positions the crash fire tender, adjacent to an aircraft, while the aircraft engines are running

a) Request for fire cover message is communicated to the fire control room
b) Origination of request comes from Airline operator
c) Fire control room attendant fills form No. 3 and, given to crash fire tender crew who assigned for duty
d) After performing the work, the form presented to the operator who is signed for acceptance of the work.

3.7.3 Fuel spillage

This happens during aircraft refueling; it may happen due to fault on appliances, negligence or miscalculations on amounts etc. Fire crew flashes the area with water or if necessary with foam.

a) Request for fire cover message is communicated to the fire control room
b) The request comes from either Airline operator or Duty Manager.
c) Fire control room attendant fills form No. 3 and, gives to crash fire tender crew who assigned on duty
d) After performing the work, the form presented to the requester who is signed for acceptance of the work

3.7.3 Fire salute

In such special occasions (e.g inaugurating new flight etc), customers may arise a request for saluting the aircraft. It is the obligation to FFR to attend the ceremony and display the saluting action.

3.7.4 Outside Calls

The fire station responds to different calls from outside of the airports; regarding humanitarian services such as for fire incidents and rescue operations if; fire protection level at airport operations is not interrupted.

3.8. EMERGENCY CALLS AND PROCEDURES

There are different types of emergencies affecting airport.

i. One involves aircraft accident on the airport, in flight, on ground, sabotage including Bomb threat, unlawful seizure etc.

ii. Other emergencies are structural fires, sabotage including Bomb threat to Terminal Building, Cargo Complex, Natural disaster, Dangerous goods, Medical emergencies etc.

3.8.1 Awareness

The Airport Emergency Plan (AEP) incorporates different agencies and also set out in a manual form the responsibilities and, required action roles to effect on Command, Communication and, Coordination when such emergencies occur. FFR is obliged to all aircraft emergencies/incidents within airport premises and those within 5 NM radius which threatens the safety of aircraft and that of passengers (specific on maneuvering area run ways, taxiways, aprons, terminal buildings, cargo terminal and other paved areas.)

3.8.2 Rendezvous (RV)

Emergencies occurring within airport premises which are deemed to incorporate other agencies, responders from outside shall report at Rendezvous Point (RVP) which is demarcated at fire station. During such incidents marshalling personnel with reflective jackets shall be positioned at different locations to lead the responders on directions of the scene. The Air Traffic Controller on Duty is the one to notify FFR and PABX on emergency.

3.8.3 Information to media

The Airport Director is the accountable to release summary information to the news media and participating agencies and if necessary assist news media visiting to the scene area.

3.8.4 Emergency on the airport:

a) An aircraft accident/incident or full emergency involving 0-10 passengers is handled by airport agencies

b) An aircraft accident/incident or full emergency involving above 10 (ten) passengers is handled by the airport agencies and outside responders

c) Communication for request of assistance from outside responders is done through the PABX
d) Communication for any request of assistance at the scene is done from the on-Scene Commander / Emergency Operations Centre (EOC) / Rendezvous)
e) An aircraft coming to land with information of technical problem that might jeopardize safety of it and passengers (e.g. one engine failure, undercarriage trouble etc.) needs a close attention during landing.

Fire-men works on minimizing Response Time**;** Locates the crash fire tenders adjacent to the Run way in use at determined stages considering safety of the aircraft and themselves

1) The determined stages are taxiways as seen in the Grid Map Reference.
2) If, the aircraft lands safely crash fire tenders go back to the Station and, one remains for escorting the aircraft to the parking bay.
3) If the incident; changes to accident; the fire-men performs rescue operations and firefighting.
4) Senior Fire Officer at the scene establishes a Commanding Post (CP).
5) Senior Fire Officer determines the Collection Area for victims whereas Triage is to be done. The area should be up-wind.
6) Victims are sorted according to priority I, II, III and IV.
7) Fire –men render humanitarian services e.g. first aid etc, before the arrival of doctors and nurses of airport dispensary. Incase need arises through the public address system at the airport premises an announcement is done for request from whoever of any assistance to report at the rendezvous point in order to be sent to the scene for the same.
8) The On-scene Commander communicates with the Emergency Operations Centre, for reporting the scenario and for any request of assistance.
9) Senior Fire Officer remains the On-scene Commander until relieved by Senior Officer Commanding Police at the airport.
10) The On-scene commander is overall in-charge of the operations and, on consultation with the team members he/she is accountable to declare the end of operations.

11) After the declaration to end operations firemen proceeds back to the station for replenish the crash fire tenders.

3.8.5 Emergency off an airport:

1) Is within 5 NM radius as described on the Grid Map Reference
2) FFR proceeds to the scene but not basing on Response Time.
3) FFR reports to the first responder and, have a brief then adjoin the operation activities
4) If FFR are the first responder, are to commence rescue activities, erect a Command Post and, the Senior Officer be the On-Scene Commander until relieved by Senior Fire Officer.
5) After the declaration to end operations firefighters proceeds back to the station for replenish the crash fire tenders.

3.8.6 Terminal Building Fire

a) Apart from duties of rescue and firefighting, the FFR at Airport staffs has the duty of educating other airport users on fire prevention. Fire Prevention, is a measure to reduce the risk of fire breaking out.
b) Ensuring that if ignition occurs communication on information to occupants is done and, active fire system be triggered as a sign for them to move to a place of safety before they are threatened by heat and smoke
c) FFR fights fire to contain to the smallest possible area limiting the amount of property likely to be damaged and the threat to life safety.
d) FFR fights fire to extinguish quickly and within minimum consequential damage to the building.

3.8.7 Firefighters on call for Emergencies:

All FRF staffs who are nearby fire station are subjected to be on call for emergencies in case need arises for back up.

3.8.8 Procedure for Handing Over:

a) Each Fireman in-shift after arriving at the station has to report to the in-charge to know his position for duty.

b) He /she checks, inspects the tools and submit the report to the shift in-charge for recording.

c) Any missing / fault reported to the on shift in-charge is logged in the occurrence / log-book at the fire watch room; if the matter is of urgent the report is reported to the operations officer for rectification or further procedure.

d) Whistle is blown by the in shift in-charge for fall in in-position to all firefighters of the two shifts.

e) The inward shift is positioned in a single lane and, the outgoing shift in another single line.

f) Satisfaction to the above makes the outgoing shift to parade in a single line and the inward shift in a single line for signing in and out together and disperse for the outgoing shift.

g) The inward shift remains in position for about five minutes for briefings.

3.9 KEY STANDARDS REQUIREMENTS FOR FIRE CREW

a) Firefighter on duty within airport premises; is in a uniform and display an airport pass always.

b) Firefighter stays at the station and, waits for instructions.

c) Firefighter is always on awareness of the surroundings on fire safety aspect.

d) Firefighter is not allowed to approach a jet aircraft / propeller driven aircraft while engines are operating.

e) Firefighter is not allowed to park or stand within 3 meters of any aircraft unless directly involved for duty.

f) Firefighter must remember an aircraft always have right of way over vehicles, equipment and pedestrians.

g) Firefighter is not permitted to allow media personnel to airside access at any time.

h) Firefighter fights fire aggressively but provide for safety first.

i) Firefighter initiates all actions based on current and expected fire behavior.

j) Fireman recognizes current weather conditions

k) Fireman ensures instructions are given and understood

l) Fireman remains in communication with crew -members, supervisors and, adjoining forces

m) Fireman determines safety zones and escape routes

n) Fireman establishes lookouts in potentially hazardous situation and, retains control at all times; stay alert, keep calm clearly and act decisively

3.10 Human Factor Principles for Optimum Response And Safety of Person

The human factors are of significant for optimal response and safety of fire personnel especially in a time of prolonged incident. Human factors such as fatigue, psychological disorder and stress due to operation/incidents.

There shall be provision of shift change while the rescue and firefighting operation on progress especially in a time of prolonged incident to ensure optimum response and safety of FFR personnel in both incidents on airport and off airport.

3.11 TACTICAL BENCHMARKS

Below listed are tactical benchmarks to consider for any type of aircraft accident.

1. The first arriving unit should assume command and determine if the flight crew has initiated emergency evacuation procedures. Fire Department personnel should make every effort to prevent an unnecessary evacuation by immediately contacting the flight crew and reporting exterior conditions to them.
2. If emergency evacuation is in progress, assist evacuation of passengers and/or provide them a path of egress, by discharging **Class B foam only**, from apparatus. Create a path through the burning flammable liquid from the escape exit door to a safe area. If **Class B foam** is not available, use large volumes of water. Protect the aircraft fuselage from direct flame impingement since fire can burn through fuselage within 60 seconds. Ensure your own supply line. Master stream appliances (Stang Guns) utilizing fog patterns; provide quick water in large volumes to protect passengers during evacuation.
3. Deploy an attack line to the aircraft's interior, without inhibiting passenger egress. Fire intensity will require the use of 1-3/4" or 2" hand-lines, utilizing fog patterns.

4. Provide interior ventilation as soon as possible inside the aircraft. Fatalities in survivable aircraft crashes are usually due to smoke inhalation. Use wide angle fog patterns from hand-lines to ventilate. Positive Pressure Ventilation (PPV) is beneficial, however may not be initially expedient. Pressurize from unburned area and provide ventilation exit in fire area. Ventilation should be started at the same time as the attack lines are put into operation, if possible.
5. Aircraft have common attic spaces, large open cargo areas (in belly), and sidewalls that can have running fires in these confined spaces. Consider using penetrating nozzles to reach fire in confined spaces or any location where interior attack lines cannot be deployed.
6. Use ladders at the aircraft at the wing or other accessible points. Some aircraft may require aerial ladders to reach access points.
7. Obtain primary and secondary all clears. Never assume absence of survivors.
8. Provide for interior lighting.
9. Request Police Department secures the scene and provides a holding area to assist in the control of the ambulatory passengers.
10. Establish both fire and medical sectors as soon as possible. Designate sectors for both sides of the aircraft to protect the escape routes and manage the evacuated passengers. Assign sectors to address scene lighting, extrication, treatment, transportation and site safety.
11. Consider establishing a branch level command system to address Fire and Medical Operations separately.
12. Ensure necessary amounts of foam extinguishing agents to amounts of flammable liquids on fire.
13. Maintain effective foam blanket to prevent ignition / re-ignition of fuel.
14. Maintain awareness of electricity generated by large aircraft, aircraft generate sufficient electrical and hydraulic energy to seriously injure personnel and/or ignite fuel sources.
15. Jagged metal from aircraft can cut through protective clothing and hose lines.
16. To gain access into the fuselage, use the wing area or a platform ladder truck to work from. The optimum place to cut is around windows and roof area. Hydraulic powered

tools (Hurst, Holmatro, etc.) and pry bars do not work well on aircraft metals due to the lack of solid supports to work against.

17. If saws are used for extrication or ventilation, arcing and sparking will need to be suppressed with water/foam from hand lines. Maintain integrity of foam blanket on flammable liquids. Be aware that aircraft have numerous high-pressure hydraulic lines that operate at 3000 psi; these can cause serious injury if cut or broken under pressure.
18. Ensure back-up crew/s with charged hose lines in place to protect all personnel who will be working inside the spilled flammable liquid areas. All personnel working in these areas shall be fully turned out with protective gear and S.C.B.A. face piece on.
19. Have traffic police secure a route of ingress / egress, to permit emergency equipment, particularly ambulances, unimpeded movement to / from the incident.
20. Do not allow any overhaul operations to take place until all investigative agencies are finished or unless needed to rescue victims or suppress fire.
21. Large aircraft have oxygen cylinders on board that can explode, become missiles, and/or accelerate the spread of fire.
22. Adopt a defensive mode of operation, as needed, to protect personnel and exposures.
23. Have an airline representative report to the Command Post along with the District 19 Chief, liaison from the Aviation Department, and any other agency that can assist with the incident.

FR:01

FIRE AND RESCUE FORCE

WEEKLY INSPECTION RFFS VEHICLES/FACILITIES

Vehicle Registration No……...

NO	ITEM	STATUS	REMARKS
1	**Foam system**		
	a) Foam gauge reading		
	b) Water gauge reading		
	c) Check form proportioned		
	d) Test at 6%		
2	**Turret (Monitor)**		
	a) Operates freely		
	b) In position		
3	Generator		
4	Power Saw (extra Blades)		
5	Co2 system		
6	Dry Chemical Powder System		
7	Foam tank (fill if necessary)		
8	Water Tank (fill if necessary)		
9	Axles, wheels and tires		
10	Four-wheel drive		
11	Six-wheel drive		
12	All wheel drive		
13	Plumbing for leaks		
14	Hose		
15	Hose Reels		
16	Nozzle – Positioned		
17	Fire Extinguishers		
18	Axes		
19	C.B.A. (Compressed Breathing Apparatus)		
20	Ladders		
21	**Miscellaneous**		
	a) Tool box and contents		
	b) Crash kit		
	c) All glass cleaned		

Inspector Name.....
Date.....

Signature.....
Date .....

Signature of Driver

Date .....

Signature of Duty Officer

Date.....

FR:02

FIRE AND RESCUE FORCE

DAILY INSPECTION OF RFFS VEHICLES/FACILITIES

Airport Name: ..... V. Registration No. .....

NO.	ITEM	STATUS														REMARKS
		MON		TUE		WED		THU		FR		SAT		SUN		
		M	N	M	N	M	N	M	N	M	N	M	N	M	N	
1	Engine and System															
2	Engine Oil Level															
3	Radiator water level															
4	Fan belt															
5	Fuel tank capacity															
6	Oil pressure gauge															
7	Wind shield washers															
8	Wind shield wipers															
9	Head lights															
10	Sidelights															
11	Horn															
12	Siren/Light															
13	Mirrors															
14	Instrument panel light															
15	Spot lights															
16	Compartment lights															
17	Battery water level															
18	Brakes foot and Hand															
19	Trouble light															
20	Pump and priming system															
21	Power Takes Off(P.T.O)															
22	Radio communication															
23	Public address															
24	Locker Light L&R															
25	Automatic Transmission &system															
26	Electric System															
27	Battery Hydrometer reading															
28	Power steering System															
29	Road test															
30	Transfer Case and System															
31	Water/Foam Bumper monitor/truck nozzles															
		MORNING									NIGHT					
		Driver Sign				DO Sign					Driver Sign				DO Sign	
	MONDAY															
	TUESDAY															
	WESDNEDAY															
	THURSDAY															
	FRIDAY															
	SATURDAY															
	SANDAY															

Head RFFS Sign ..... Date .....

RF:03

FIRE AND RESCUE FORCE

RECORD OF FIRE DRILLS AND EXERCISES

Date: …….

Sheet No: …… Nature of Drills/Exercises……

NO	PERSONNEL ATTENDED	INSTRUCTORS	DURATION	RAMARKS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				

Instructor's Name…….. Sign…….

Head of FFR Sign…… Date: ……..

FIRE AND RESCUE FORCE

AIRPORT FIRE VEHICLES 3-MONTHL/ 6-MONTHLY PERFORMANCE TEST
DATE OF TEST: _____VEH. REG. NO._____

WATER TANK CAPACITY: _____ STATION: _____

TYPE OF TESTS	**RESULTS**	**REMARKS**
Acceleration: 0 to 80 km/h in 25 seconds	_____ secs	
Top Speed: Not less than 105 km/h	_____ km/h	
Braking Distance: Not exceeding 8 meters from 30 km/h to	_____ m	
Foam Production: Expansion Ratio ¼ Drainage Time Foam Proportion	_____ _____mins _____ %	
Discharge Rate: Monitor discharge rate using water at 10.5 bar	_____ L/min	
Vacuum Test Maintain vacuum reading of 0.3 bar for at least 1 min using suction hoses of total length not Less than 7.2m		
Monitor Throw: The further distance monitor is capable of Projecting foam in Straight Stream Dispersed Stream		

Test conducted by…….. Sign……. Date……
(Representative of respective station)
Head of FFR sign…… Date……

FR:05

FIRE AND RESCUE FORCE

MONTHLY INSPECTION OF FIRE EQUIPMENTS IN FIRE TENDRE

Equipment Scope	Equipment Item	Required Item	Available
Forcible entry tools	Prying Tool (Hooligan, Biel type)	2	
	Crowbar 95 cm	2	
	Crowbar 1.65 m	2	
	Axe, rescue large non wedge type	2	
	Axe, rescue small non wedge or aircraft type	4	
	Cutter Bolt 61 cm	2	
	Hammer 1.8 kg Lump or Club type	2	
	Chisel cold 2.5 cm	2	
A suitable range of rescue/cut in equipment including powered rescue tools	Hydraulic/Electrical (or combination) portable rescue equipment	2	
	Powered rescue saw complete with minimum 406mm diameter spare blades	2	
	Reciprocating/Oscillating saw	2	
A range of equipment for the delivery of firefighting agent	Delivery hose 30m lengths x 50 & 64 mm diameters	22	
	Foam Branches (Nozzles)	3	
	Water Branches (Nozzles)	6	
	Coupling adaptors	3	
	Portable fire extinguishers CO2 DCP	3 3	
Self-Contained Breathing Apparatus – sufficient to maintain prolonged internal operations Note: Ideally one BA set per crew member	Breathing Apparatus (BA) set C/W facemask and air cylinder		
	BA spare air cylinder		
	BA spare facemask		
Respirators	Full faced respirators C/W filters	One per responding fire fighter	
A range of ladders	Extension Ladder, Rescue & suitable for critical aircraft	3	
	Ladder General Purpose – rescue capable	2	
Protective clothing	Firefighting helmet, coats, over trousers (C/W braces), boots & gloves as a minimum.	One set per operational fire fighter plus a % of reserve stock	
	Protective goggles	3	

Additional items for personal protection	Flash hoods	One per operational fire fighter	
	Surgical gloves	1 box	
	Blanket Fire Resisting	2	
Rope lines	Rope Line Rescue 45 m	2	
	Rope Line General Use 30 m	2	
	Rope Line Pocket 6 m	One per operational fire fighter	
Communication Equipment	Portable transceivers (hand held & intrinsically safe)	3	
	Mobile transceivers (vehicle)	One for each fire vehicle	
A range of hand held/portable lighting equipment	Hand held flashlight (intrinsically safe)	4	
	Portable lighting – spot or flood (intrinsically safe)	3	
A range of general hand tools	Shovel overhaul	2	
Rescue Tool Box & contents		3	
	Hammer, claw 0.6 kg		
	Cutters, cable 1.6 cm		
	Socket set		
	Hacksaw, heavy duty c/w spare blades		
	Wrecking bar 30 cm		
	Screwdriver set – Slotted & Phillips heads		
	Pliers, insulated Combination 20 cm Side Cutting 20 cm Slip Joint – Multi Grip 25 cm		
	Seat Belt/Harness cutting tool		
	Wrench, adjustable 30cm		
	Spanners, combination 10mm – 21 mm		
First aid equipment	Medical First Aid Kit	3	
	Automated External Defibrillator (AED)	3	
	Oxygen Resuscitation Equipment (ORE)	3	
	Stretcher	2	
Miscellaneous equipment			
	Chocks	1	
	Wedges – various sizes		
	Tarpaulin – lightweight	3	
	Thermal Imaging Camera	2	

INSPECTOR NAME: ……. **SIGN**: ……....

HEAD OF RFFS SIGN: ……. **DATE:** ……

FR:06

FIRE AND RESCUE FORCE

QUARTERLY HANGAR AND BUILDING INSPECTION
DISCRIPTION AND NUMBER OF BUILDING/HANGAR

1. MEANS OF ESCAPE ADEQUATE INADEQUATE
REMARKS ……
2. ESCAPE NOTICE ADEQUATE INADEQUATE
REMARKS ……
3. HOUSEKEEPING SATISFACTORY UNSATISFACTORY
REMARKS ……
4. R.F.F TELEPHONE NOTIFICATION ADEQUATE INADEQUATE
REMARKS ……
5. NO SMOKING SIGNS ADEQUATE INADEQUATE
REMARKS ……
6. FLAMMABLE LIQUID STORAGE STATE NUMBER OF DRUMS AND CONTENTS
REMARKS ……
7. WELDING OPERATIONS OBSERVED NOT OBSERVED
REMARKS ……
8. BATTERY CHARGING PRECAUTIONS ADEQUATE INADEQUATE
REMARKS ……
9. DOPING AND SPRAY CAUTIONS ADEQUATE INADEQUATE
REMARKS ……
10. CLEANING PROCESS PRECAUTIONS ADEQUATE INADEQUATE
REMARKS ……
11. FIRE POINTS ACCESS SATISFACTORY UNSATISFACTORY
REMARKS ……
12. KNOWLEDGE OF MEANS OF ESCAPE AND USE SATISFACTORY
UNSATISFACTORY
OF PORTABLE FIRE EXTINGUISHERS AND
HOSE REELS BY OCCUPIERS OF BUILDING HANGAR
REMARKS ……
14. EXTINGUISHERS LIST QUANTITY, DATE LAST INSECTED AND CONDITION
REMARKS……
14. HOSE REELS CONDITION LIST QUANTITY, DATE LAST INSECTED AND
REMARKS……
15. GENERALCOMMENTS
……
……
16. INSPECTING OFFICER …….. DATE…….
17. COPY OF REPORT TO OFFICER IN CHARGE OF BUILKDING/HANGAR
REPORT REFERRED TO HEAD RFFS

18. HEAD RFFS RECOMMENDATIONS ……
DATE…….

FR:07

FIRE AND RESCUE FORCE
DAILY INSPECTION OF EQUIPMENTS IN FIRE TENDER

NO.	ITEM		STATUS														REMARKS
		DATE															
		DAY	MON		TUE		WED		THU		FR		SAT		SUN		
			M	N	M	N	M	N	M	N	M	N	M	N	M	N	
LEFT – LOCKER NO. 1 (NEAR SIDE)																	
1.	Gun type branch																
2.	Hose reel																
3.	Power saw																
4.	Blower																
LOCKER NO. 2																	
1.	Branch																
2.	Sunction range																
3.	Spanner																
4.	Basket strainer																
5.	Metal strainer																
6.	Hose reel complete																
7.	Effective finishing foam making branch																
LOCKER NO. 1 RIGHT																	
1.	BA																
2.	Spear cylinder																
3.	Delivery hose																
4.	Collecting head two way																
5.	Touch																
6.	Key and Bar																
7.	Stand pipe																
8.	Chocks																
9.	Stair wood																
10.	Face mask																
11.	Back plate																
LOCKER NO. 2																	
1.	Branch																
2.	Pick up tube																
3.	Hose rubber																
4.	Adopter																
CABIN CREW																	
1.	Helment																

2.	Fixed public address																
3.	Fixed radio station																
4.	Boot																
5.	Fire suit																
6.	First Aid Kit																
7.	Fire blanket																
8.	Rescue knife																
ROOF SIDE																	
1.	Hard suction hose																
2.	Ladder																
3.	Spade																
4.	Stretcher																
5.	Fire hock																
6.	Hose lump																

	MORNING		**NIGHT**	
	S/SGT SIGN	**DO SIGN**	**S/SGT SIGN**	**DO SIGN**
MONDAY				
TUESDAY				
WEDNESDAY				
THURSDAY				
FRIDAY				
SATUDAY				
SUNDAY				

Head RFFS Sign:…… Date:……

FR:08

FIRE AND RESCUE FORCE

QUARTERLY INSPECTIONS AND RECORD FORM OF MISCELLANEOUS EQUIPMENT (FAFA)

DATE	LOCATION	TYPE OF FAFA AND SERIAL NO.	STATUS OF FAFA	REMARKS

Name of Inspector……Signature…….

Head of RFFS Sign ……..Date……

FR:09

FIRE AND RESCUE FORCE
DAILY VEHICLE AND EQUIPMENTS FAULT REPORT

VEHICLE REG. NO/EQUIPMENT. ……..
MAKE ……
Date: …….

Nature of Trouble/Faults

……
……
……
……
……
……
……

Remarks:

……
……
……
……
……
……

Reported by: Name…… Designation……..
Signature …….
Action Taken:

……
……
……
……
……
……

Date:

……
……

FR:10

FIRE AND RESCUE FORCE
FIRE HYDRANT RECORD

HYDRANT TYPE: _____ LOCATION: _____

OUTLET TYPE: _____ DIRECTION OF OPENING: ___

STATIC PRESSURE: _____ RUNNING PRESSURE: ___ (P.S.I FLOW/GPM)

SIZE OF MAIN: _____ INDICATOR: _____

DATE	STATE OF HYDRANT	ACTION TAKEN	SIGNATURE	
			INSPECTOR	HEAD - RFFS

FR:11

FIRE AND RESCUE FORCE

QUARTLY STANDARD TEST OF PUMP AND SUCTION HOSE

MONTH	TYPE OF TEST	RESULTS OF CHECKS/TEST	REMARKS	SIGNATURE

Test Conducted by …………………… Rank ………………….. Date …………….

Head RFFS Sign ……………………….. Date …………………….

FR:12

FIRE AND RECUE FORCE
RESPONSE TIME EXERCISE

1. TIME OF RECEIVING CALL:.....
2. WHERE IS THE CALL COMING FROM:.....
3. TIME OF SENDING MASSAGE TO THE FIRE FIGHTERS:.....
4. TIME OF DEPARTURE:.....
5. FIRE TENDER IN USE:.....
6. NUMBER OF CREW:.....
7. THE SCENE OR RUNWAY ON USE:.....
8. TIME OF ARRIVE TO THE SCENE AND APPLY EXTINGUISHING MEDIA (50%):.....
9. TIME USED:.....

INSTRUCTER NAME:..... SIGNATURE:..... DATE:.....

OFFICER INCHARGE:..... SIGNATURE:.....

Remarks: .....

FR:13

FIRE AND RESCUE FORCE

INSPECTION OF RFF VEHICLES FOR MAINTENANCE-SEMIANNUALLY

Airport Name: ..... V. Registration No. .....

NO.	ITEM	STATUS	REMARKS
1	Engine and System		
2	Engine Oil Level		
3	Radiator water level (COOLANT)		
4	Fan belt		
5	Fuel tank capacity		
6	Oil pressure gauge		
7	Wind shield washers		
8	Wind shield wipers		
9	Head lights		
10	Sidelights		
11	Horn		
12	Siren/Light		
13	Mirrors		
14	Instrument panel light		
15	Spot lights		
16	Compartment lights		
17	Battery water level		
18	Brakes foot and Hand		
19	Trouble light		
20	Pump and priming system		
21	Power Takes Off(P.T.O)		
22	Radio communication		
23	Public address		
24	Locker Light L&R		
25	Automatic Transmission &system		
26	Electric System		
27	Battery Hydrometer reading		
28	Power steering System		
29	Transfer Case and System		
30	Water/Foam Bumper monitor/truck nozzles		
		DATE:	**DATE:**
		DRIVER SIGN / **TECHNICIAN SIGN**	**MRFFS SIGN**

SOP4: ELECTRICAL FIRE INCIDENTS

4.1 PURPOSE:

This SOP will establish a standard approach and response to the report of power lines down and other responses to energized electrical equipment. Power lines can come in contact with the ground as a result of storm related activity, fire or vehicles striking power poles. In all cases, the potential for electrical shock/electrocution and secondary fire must be considered.

NOTE:

It is our policy to respond to reports of power lines down and other hazards involving energized electrical equipment (transformers, substations, electric vaults, etc.) for exposure fire control and public safety. It is the responsibility of the OIC to maintain that level of safety in collaboration with TANESCO.

4.2 ELECTRIC SAFETY AWARENESS:

Electricity will travel any conductive path that can seeks ground. A direct path to ground can occur when contact is made between something energized and a portion of your body such as your hand, arm, head, or other body part. An indirect path to ground occurs when you are holding something or touching an object that is in contact with something energized. This could include tools or other equipment you may be holding or when touching a fence, vehicle, or other object that may be in contact with something energized.

4.3 GRADIENT VOLTAGE (STEP AND TOUCH POTENTIAL):

When power lines are down, they will energize the ground around them. For Example: point of ground contact could be 7160 volts. This voltage will lessen as it radiates out from this point; for example, 6000 volts. If your feet are in areas where there is a voltage difference, you could complete the circuit and be the source to ground. This is called “step potential.” This danger could be indicated by a tingling sensation in the feet and serve as

a warning to back away from the area. Step potential is more severe when the ground is wet.

4.4 GUIDELINES/PROCEDURE:

1. Downed lines must always be considered energized with potentially lethal current. STAY AWAY!

2. Lines can reset and become “hot” or “energized” again by manual operation of a switch, by automatic re-closing methods (either method from short or long distances away), by induction where a de-energized line can become hot if it’s near an energized line, or through back feed conditions.

3. Electrical equipment is classified as:
    - Energized
    - De-energized (cannot be 100% guaranteed)
    - Dead (confirmed by utility representatives after grounding the line(s).

4. Use caution when spraying water on or around energized electrical equipment. Hose streams conduct current! Never spray directly into the power lines. Use a fog spray at the base of the pole in an emergency. Your primary responsibility is to protect the surrounding area. Short bursts of water are preferred methods to avoid being grounded. Never spray water onto electrical equipment until a utility representative has confirmed that the equipment is de-energized and dead.

5. You cannot tell the voltage of a power line by the size of the conductor. Most overhead conductors are not insulated.

6. Voltage can travel through both dry and especially wet ground for considerable distances.

7. Pad-mounted and overhead transformers can explode.

8. Until grounded, equipment can contain electric potential, which can cause severe injury or death.

9. Electricity can flow through the ground or other conductive objects, (fences) to point far from the scene.

10. PCB hazards: Smoke potentially fatal; avoid and contain pools of oil around transformers.

NOTE:

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste

4.5 **RESPONSE TO POWER LINES DOWN:**

1. Request Tanzania Electrical Supply Company (TANESCO) to respond.
2. Consider all down wires as “energized.”
3. Place Fire tender away from “downed lines and power poles” and out from under involved
4. Overhead lines that could fail and fall onto equipment or personnel.
5. Secure the area and deny entry.
6. Remember, some painted road markings may conduct electricity.
7. In the event of multiple lines/poles down over a large area, call additional resources.

4.6 DOWN POWER LINES ON VEHICLES:

1. Request TANESCO to respond expeditiously.
2. Do not touch vehicle.
3. Have occupants remain inside the vehicle.
4. Place Fire tender a safe distance away from down lines.

5. If occupants must leave the vehicle (fire or other threat to life) instruct them to open the door, not step-out! They should perform a “two feet jump”. Instruct them to jump free of the vehicle without touching vehicle and ground at the same time; they should walk away from the vehicle with very small steps.

4.7 TRANSFORMER FIRE:

1. Request TANESCO to respond immediately.
2. Clear the area.
3. Be aware of explosion potential.
4. Due to toxic by-products produced by Polychlorinated Biphenyls (PCB) fires, place fire tender in a safe location away, upwind from overhead power lines. If unable to place upwind any members operating in plume of smoke should be in a SCBA.
5. Protect exposures.

4.8 RESPONSE TO POWER POLE FIRES:

1. Request TANESCO to respond.
2. Consider all wires and poles as “energized.”
3. Place fire tender away from “down lines and power poles” and out from under involved overhead lines that could fail and fall onto equipment or personnel.
4. Secure the area and deny entry.
5. Do not make any fire attack until the TANESCO representative has verified that the electrical equipment has been de-energized and grounded.

4.9 SUBSTATION FIRE

1. Wait outside the gate. Do not make entry into the substation until the utility representative on location (TANESCO) has verified that the electrical equipment has been de-energized and deems it safe to enter, following the utility’s representative.

2. In Consolidated Substation, the Station Incident Commander will meet with TANESCO for more clarification and response to incident.
3. Due to toxic by-products produced by PCB fires, place fire tender in a safe location away, upwind from overhead power lines. If unable to place upwind any members operating in the plume of smoke should be in a SCBA

4.10 Distribution System

Distribution – See Example 1 & 2 Voltages reduced to 132 kV by transformers, then to 33 kV or 11 kV for large industrial consumers and to 230/400 V for commercial and domestic Consumers

Low Voltage – See Example 3

> 50V < 1000V AC or <1500DC

High Voltage

> 1000V AC or 1500V DC

Voltages over 50V A.C and currents in excess of 5 mA are considered Dangerous Always Look Out for Obvious Signage

1. Dangers from Overhead Lines are:

• Arcing

• Aerial appliances

• Conduction through firefighting media (e.g. Water or foam)

• Conduction through smoke

• Induction or residual current

Minimum safe distances

In the vicinity of electrical supply equipment

- Rescues 5m

  Not using hose
- Ladders/aerials 10m or 20m in training

  Using hose
- Hand held jets 20m corridor Monitors 30m corridor

Entering protected areas

- Electrical equipment should not be touched or even approached unless it is confirmed to be isolated and safe.
- The electricity company's 'authorized person' should be consulted before any entry to an enclosure is attempted
- No rescue of persons on live high voltage conductors should be attempted until full clearance has been obtained from an engineer of TANESCO or the owning electricity company. See Example 5.

Electrical Causes of Fire

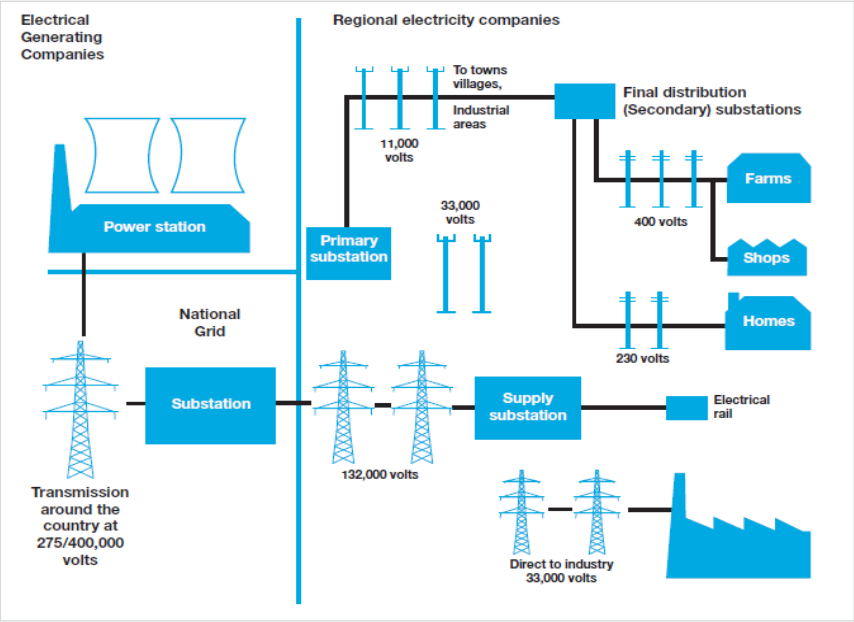
- Short circuits caused by insulation failure or work on system
- Overheating of cables or equipment due to overloading, inadequate ventilation, high resistance joints
- Ignition of flammable gases, or dust from sparks
- Electro-static discharge

Operational Procedure

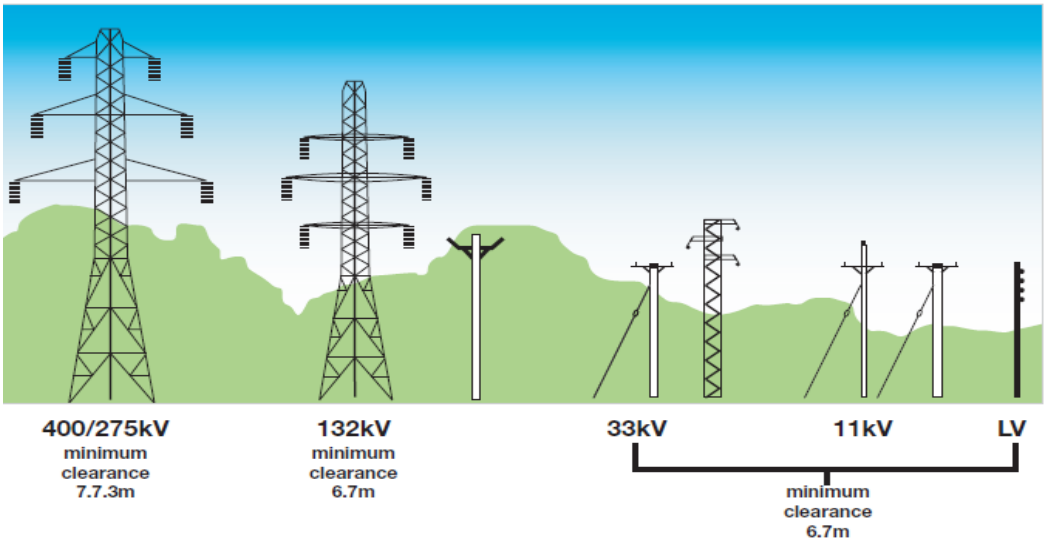
On initial attendance the OIC of first responder will inform the Operations Room (Control) that the incident is involving or adjacent to Electrical Hazard and TANESCO should be informed and requested to attend. A full Dynamic Risk Assessment should be carried out and **NO** actions taken by anyone before confirmation from the OIC of the first attendance. The incident may be headed by more senior officers, once an official hand-over has taken place and the DRA continues. All attending officers **MUST** be aware of the control

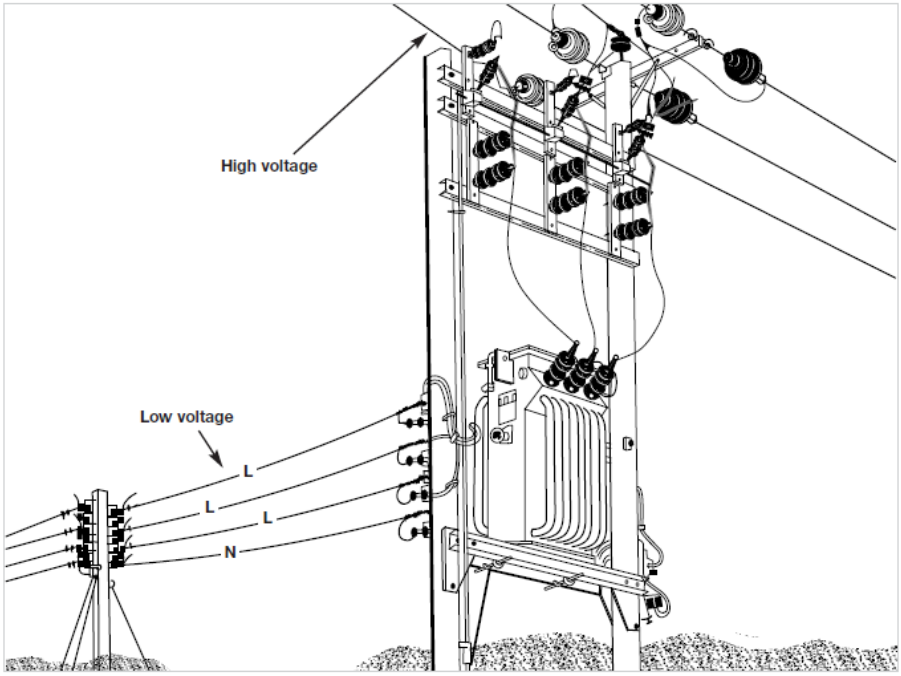
measures that are in place and should continue in the same vain of ‘safety first’. Cordons to be set up as soon as possible, with strict policing of who can or more importantly should not go into the inner cordon or ‘hot zone’. Try and gain as much information as possible as to the type of electrical hazard, i.e. high or low voltage, National grid or local distribution etc. and give this information to Operations control room as soon as possible so on-coming appliances and / or officers may be aware on arrival.

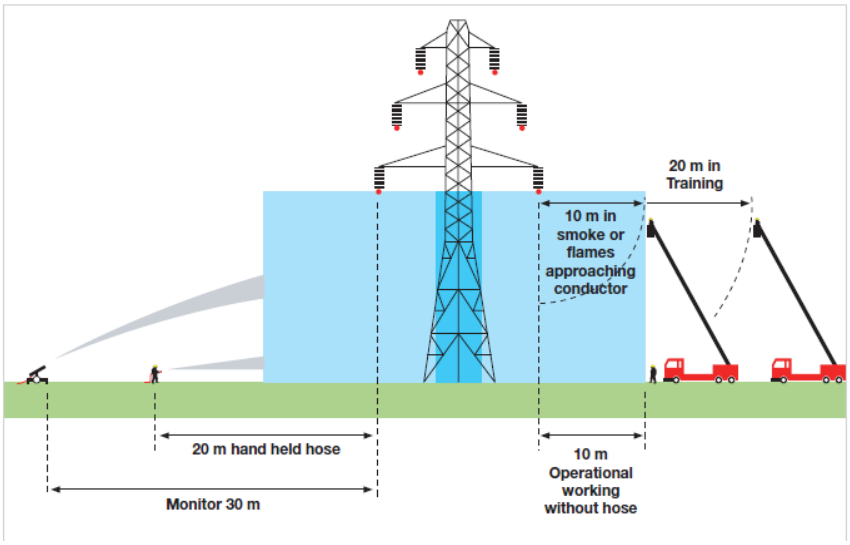
Example 1.0 Voltages reduced to 132 kV



Example 2.0: Overhead Line Hazards



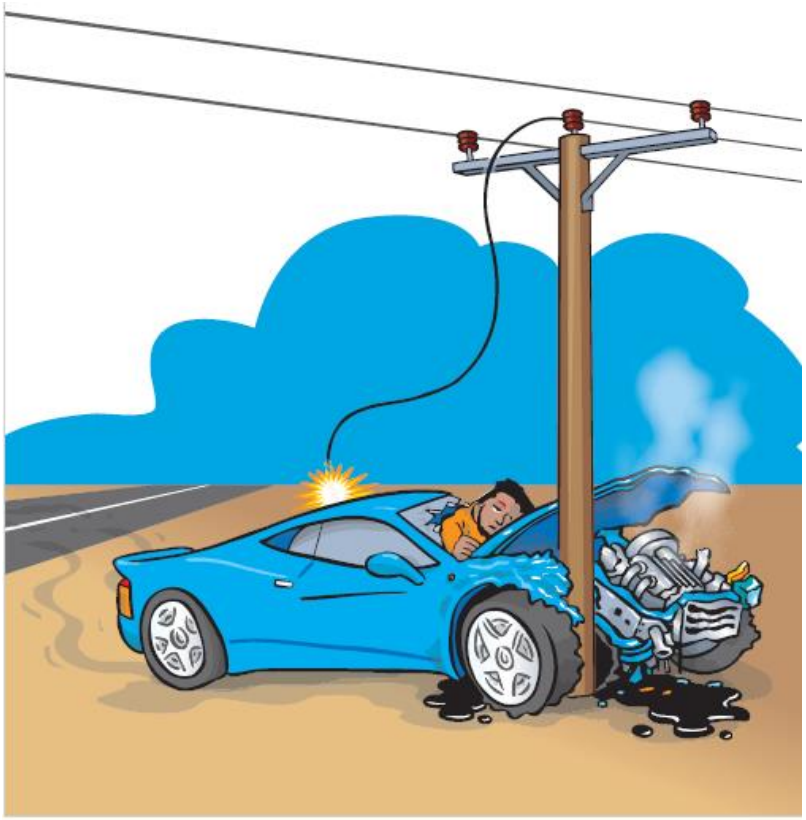




If driver is injured not able to escape:

• Injured driver should not be moved until electrical hazards are removed

• Maintain safe approach distance



4.11 Fires Involving Electrical Installations

FRF personnel attending incidents involving high voltage electrical equipment need to appreciate the dangers involved with live high voltage electricity so that operational decisions can be made which will not prejudice the safety of those personnel dealing with the incident or others in the vicinity.

Electrical Sub-Stations

Although the electrical circuit supplying any substation normally trips out when an explosion or fire occurs, the electricity company (TANESCO) generally assumes that any circuit trip is due to a routine fault or plant failure on the network that supplies the area and, unless they receive reports to the contrary, they may initiate remote control switching to restore the electricity supplies. There have been many occasions where firefighters and members of the emergency services who were attending a substation where a fire and injuries had occurred. Not knowing that they were there, the electricity company attempted to reenergize the circuit by remote control. This caused a second flashover

and explosion in the damaged substation equipment and caused injuries to the emergency services personnel in attendance.

All members of DCD and Rescue Services are reminded that it is essential to contact the local electricity control (TANESCO) centre on their emergency direct-line number before approaching or entering any substation or electrical roadside furniture, which they suspect has being damaged. This would be done by sending an urgent message to the Operations Control Room informing that there is an incident on / or in the vicinity of such a risk and to inform TANESCO that there are crews in attendance. There must be then a confirmation message that either the power to that facility is isolated and that it will not be reenergized until their officers are present and can directly liaise with DCD officer in charge. Appliances proceeding to an incident, should do so in accordance with DCD policy.

On Arrival

On arrival, appliances should be positioned in a suitable location to avoid exhaust fumes contributing to respiratory problems.

The OIC should consider the following;

(a) Appliances arriving first should be positioned to ensure that they do not compromise the positioning of other appliances, which may form the part of a makeup.

(b) Appliances should also be positioned to ensure that they do not become involved in the incident.

The OIC must carry out a dynamic risk assessment, before deciding on a plan of action. The risk assessment should be based on the safest method of tackling the incident, without compromising the safety of firefighters. The assessment should also include whether existing procedures are appropriate and whether DCD on site resources are adequate. The OIC should also ascertain from the ‘on site expert’, the following information;

(a) Are all persons accounted for?

(b) What materials are involved?

(c) Are there any specific hazards, e.g. is the sub-station still ‘live’. If there is no on-site expert when the first appliance arrives, then one should be requested through Brigade Control

Firefighting Operations

Under no circumstances will firefighting or rescue operations be carried out, while the sub-station is still ‘live’. Only after the power has been isolated and following consultation with an engineer or other competent person, will attempts be made to deal with the incident. If crews have to enter a sub-station, the minimum amount of equipment necessary to deal with the incident should be used. If it is necessary to use ladders, then the OIC should ensure that there are no ‘live’ overhead cables.

Personal Protection

Full standard issue PPE including electrical gloves, should be worn by all personnel working in or near to an electrical substation. Where there is potential for respiratory damage to firefighters, BA must be worn.

TRAINING

Stations and Watches should review procedures and familiarise themselves with this type of incident on a regular basis, especially where such facilities are present within the station area.

Operational Hints Incidents Involving Electrical Sub-Stations

The OIC of an incident involving an electrical sub-station should consider the following points:

- On arrival consider the positioning of appliances in terms of hazard and support.
- If there is no on-site expert available on arrival, request one
- Carry out a dynamic risk assessment and decide on an appropriate plan.
- Estimate level of assistance if required.
- Send urgent message to Operations

Control Room to pass on message to TANESCO for isolation and confirmation that power Will Not be switched back on until attendance of Engineers / Officers from TANESCO. Under no circumstances commit DCD personnel, until the sub-station has been isolated.

- Always use BA in a fire situation.
- Remember the need for effective communications.
- When using ladders be aware of the situation overhead and underfoot.
- Consider ventilation remembering the dangers of flashover and delayed flashover.
- Investigate the cause.
- Always remember the health and safety of DCD Personnel, other responding Emergency Services and members of the public.

SOP 5. COMPARTMENT FIRE INCIDENTS

"Compartment Fires" SOP attempts to address what firefighters need to know about compartment fires. It tries to summarize, without going into theory, what is understood about the early stages in the growth of a fire in a compartment, leading to a flashover and possibly back draught, and the effect of ventilation.

5.1 The Fire Plume

High gas temperatures cause a vigorous upward movement driven by buoyancy; this induces mixing with the surrounding air by a process known as entrainment. Low down in the plume, the centre will be rich in flammable gases and this will be surrounded by an envelope of flame. In the upper part of the plume, there is no flame. It is a rising column of smoke which consists of large amounts of entrained air, together with non-flammable products of combustion (mainly carbon dioxide and water), unburnt flammable gases and minute particles (soot). The flammable gases in the upper part of the fire are at too low a concentration to burn.

The upper part of the flame is basically unstable, producing the well-known flickering associated with fires. In general, though, the average flame height depends on the heat generated by the fire. The hot plume radiates down on to the fuel, heating it, and so permitting the generation of flammable gases to continue. In general, there will be sufficient heat generated for the fire to spread as long as there is fuel nearby.

However, during the early stages of a fire, it is not the main cause of fire spread. Nevertheless, the effect of thermal radiation can become more significant as the fire develops, as it is the cause of flashover.

5.2 Fire Growth

Rapid fire spread occurs when the flames come into contact with new sources of fuel. This fuel will then be raised to very high temperatures, will itself start to generate flammable gases very quickly and eventually ignite. However, until the hot gases in the plume have been cooled by mixing with sufficient cool air, they will also be hot enough to

cause fuel to start giving off flammable gases, if they come into contact with it. Thermal radiation from the plume is the main element in fire spread wherever there is no direct flame impingement.

Surrounding objects are heated until they in turn start to give off flammable gases. The heat from the plume also heats up the air in the compartment as well as the walls, ceiling, floor and contents. As little as one third of the heat from a compartment fire will leave the compartment as hot smoke. As the compartment temperature rises, less and less heat from the plume can be absorbed by the compartment's walls and contents. The plume gets hotter and this increases the efficiency of the combustion process. It also further heats the fuel, increasing the rate at which the gases are generated. Thus, increasing compartment temperatures will result in increased combustion, as long as there is an adequate supply of oxygen.

5.3 The Effects of Water

When any cold substance comes into contact with a hot one, heat is conducted from the hotter to the cooler. The important difference with cold water is that it gets changed from a liquid into a gas (steam) at 100°C. The amount of energy necessary to do this (the latent heat of vaporization) is far higher than is necessary to heat water up to its boiling point. This energy has to come from somewhere.

When water is turned into steam, large amounts of energy are absorbed from the hot gases and fuel in the fire, greatly cooling them. When water is turned from a liquid into a gas, another very important physical effect occurs it expands rapidly. If this were to happen in a sealed compartment this would cause a dangerous rise in pressure, but in a typical fire compartment, it causes a general outward flow of gases, driving the hot gases out of the compartment and preventing fresh air from reaching the fire.

This can pose a hazard to firefighters due to the risk of burns from the hot gases and scalds from the steam. These physical properties of water can be used to produce a wide variety of effects in a compartment fire. In some circumstances the application of water can have a detrimental effect on firefighting but, properly applied:

- water directly cools the fuel to reduce further generation of flammable gases;
- water is converted into steam in the plume and the hot gases at ceiling level, absorbing heat, so cooling them and reducing the radiation heating the fuel;
- once converted into steam, water limits the amount of oxygen reaching the flames, smothering them;
- once converted into steam, water expands rapidly driving the products of combustion out of the compartment; and water cools the rest of the compartment, increasing the amount of heat it will absorb from the plume, so cooling it further.

5.4. The Actions of Firefighters

Firefighters should keep low in fires, to stay below this boundary. It must be remembered that the insulation in Firefighters' clothing only serves to delay the time when they start to become uncomfortably hot and have to withdraw. If firefighters are to remain capable of working for any length of time inside a building on fire, they must avoid contact with hot gases whenever possible.

5.5. The Effects of Ventilation

The purpose of ventilation during a fire is to release the products of combustion from the compartment so as to prevent them causing further fire growth. Useful side effects of this are that, if the airflows are properly managed, air temperatures will be reduced and visibility will be increased, making the firefighters' job easier. However, the firefighter should be aware that the increased air supply might cause the fire to intensify. The basic principles of ventilation are:

- Whenever possible, hot gases should be released from high in the compartment, and the replacement fresh air should be allowed to enter at low level. This takes full advantage of the buoyancy of the hot gases, and minimizes mixing within the compartment.
- The two vents should be similar in size;
- The high-level vent should be down-wind of the low-level vent, to take advantage of airflows induced by the wind;

- If it can be achieved, roof ventilation will be most effective and should be carried out as close to the fire as safety permits;
- The high-level vent should be made before the low-level vent;
- If possible, the compartment should be vented from outside the building. Any back draught would then be directed outwards, with less risk to firefighters.

The initial fireball might be spectacular, so the risk of igniting the building's eaves and surrounding risks would have to be considered, and charged branches made available to cover them; and the hot gases in the compartment can be cooled to reduce the potential for a backdraught, and the hot gases coming out of the vent can be cooled to prevent their ignition.

Sprays and fogs have been found to be more effective than jets at this. However, water should not be directed in through the hot gas event, as this may prevent the gases from escaping and drive fresh air in, inducing a back draught.

5.6 Backdraft

In general, the hot gases generated in the plume will rise extremely rapidly and will draw air in towards the fire. If there is an adequate air supply, the fire will continue to burn and grow as long as there is fuel available.

If the air supply to the compartment is restricted, the oxygen in the air inside may be used up more quickly than it can be replaced. The net effect will be a progressive lowering of the concentration of oxygen in the gases in the compartment possibly combined with an increase in the temperature in the compartment. As the oxygen concentration in the compartment reduces, the flames will start to die down, but this will not immediately result in a reduction in the production of flammable gases. Although the radiated heat from the plume reduces, the compartment is still very hot, and nothing has happened to cool the fuel.

There may still be flames present, or they may die out altogether. Depending on the relative sizes of the fire and the compartment at this stage, sufficient flammable gases

may be generated to spread throughout the compartment. This requires only a new supply of oxygen caused for example by opening a door, for it to form an explosive mixture with potentially lethal consequences a backdraught.

5.7 Signs & Symptoms of a Backdraft

The first clue to the possibility of a backdraught is the history of the fire: if the fire has been burning lots of smoke which is now leaking out from the building, and has apparently died down without major areas of flame being visible from outside, the possibility is that it has died down from oxygen starvation.

When the building is viewed from outside, it is likely that the windows of the compartment concerned will be blackened with no obvious flames within. If part of a window is broken, it is possible that this will not provide sufficient oxygen to feed the fire. In this case it is likely that smoke will be pulsing out of the hole. Fresh air is drawn in as the fire cools slightly and the hot gases contract. This produces a local explosive mixture which burns, resulting in a mini-back draught. The expansion of the hot gases in turn drives some smoke out of the compartment.

This cycle repeats itself at a frequency which depends on the size of the hole and the location of the fire relative to it. If there is a gap under the compartment door, there may be smoke pulsing there due to the mini-back draught effect already described. There may be a whistling noise if air is being drawn into the compartment through very small gaps around the door, but this could be difficult to hear. The door may be hot on the outside. In particular, the door handles maybe hot if there is a metal rod linking it to the door handle on the other side.

If the compartment has been left long enough for it to cool down, air will no longer be drawn in, and the smoke pulsing effect will not be evident. However, if the compartment has not been ventilated and there are still flammable gases present, a back draught is still
possible.

If the decision is taken to open the door, there may be an in-rush of air as soon as the door is ajar, showing either that there is a shortage of oxygen in the compartment, or that the compartment has been much hotter and is starting to cool. Small flames may appear where the gases from the room are meeting the relatively fresh air outside, indicating that there are flammable gases in the room which are sufficiently hot to ignite given a source of fresh air, even without any other source of ignition. In either case, it may still be possible to close the door before sufficient air has entered the compartment to trigger any possible back draught.

5.8 Actions by Firefighters

Once the door has been opened on to a compartment with an oxygen starved fire and fresh air has been allowed in, there is little which can be done to prevent a back draught happening. It is far better to make appropriate decisions before the door is ever opened. When firefighters are faced with a closed door, and do not know what is behind it, they should check for any of the signs and symptoms described above before opening it, covering the door with a charged branch, should they decide to open it. If there is a build-up of smoke outside the compartment, the possibility of back draught can be reduced by spraying these gases before the compartment door is opened.

The firefighters should be ready to close the door quickly, if a back draught appears likely. This may not prevent the back draught but may direct its force away from the firefighters. If firefighters believe that opening a compartment door may lead to a back draught, opening that door must be as a result of a deliberate decision. As long as the compartment door is closed, firefighters have time to think about their actions. Once the door is open, they will only have time to react to events as they occur.

Whilst the decision about the timing of opening the door can only rest with the firefighters who form the firefighting crew at the scene, the consequences of that decision ultimately lie with the OIC of the incident.

However, the compartment will still have to be inspected at some stage. The priority is then to make it safe for the firefighters to enter. As already described, a back draught can

only occur when fresh air is permitted to enter the compartment. It is possible for firefighters to operate in a flammable atmosphere provided there is no opportunity for things to change and for fresh air to enter whilst the firefighters are inside. It is difficult to be sure -a window might shatter, someone might unwittingly open another door to the compartment.

The far safer solution is to remove the flammable gases from the compartment - ventilation. It is important to recognize that ventilation requires that fresh air should be let into the compartment. Thus, there is the possibility that a back draught may occur during ventilation, so appropriate precautions should be taken.

If it is decided that a compartment needs to be ventilated and once the method of ventilation has been selected by the OIC of the incident:

- Branches must be charged and in position prior to any ventilation being carried out;
- Firefighters must get down low, and well clear of the likely flame path back through the vent opening, should a back-draught occur; and
- It must be remembered that a back draught could be delayed several minutes and that it might have sufficient energy to break other windows in the compartment.

No compartment can be considered safe from a back draught until it has been opened to fresh air for some time. However, once the compartment has been properly ventilated, fire fighters can tackle the fire knowing that there is no longer any possibility of back draught.

5.9 Aide Memoire Back draught INDICATORS

- Dense smoke with no obvious sign of flame.
- Smoke blackened windows.
- Smoke pulsing from doors and windows.
- Signs of heat around the door.

5.10 Safety

- Ensure you are properly protected.
- Keep door closed and cover with charged branch.
- If possible, keep out of the room and ventilate from outside.
- Check escape routes are secure and, if necessary, protected.
- Cool and ventilate the outer compartment.
- Plan an escape route for the gases before releasing them.
- Stay low and to the side of the door.
- Open the door slightly and spray through, directing the spray upwards.
- Cool as much of the compartment as possible.
- Keep out of the way of the steam and hot gases.
- Only enter the room if you have to - there may still be flammable gases present.

5.11 Flashover

Previously we have described how a smoke layer will build up when smoke cannot escape from a compartment as quickly as it is generated. However, if there is unburnt fuel in the compartment, things will not stay stable for long. Initially, the flame in the plume will not reach the ceiling and fire spread will be limited to flammable materials close to the seat of the fire, ignited by radiated heat from the plume.

The flame height will increase until it reaches the ceiling. The flame will then start to spread across the compartment in the hot gas layer, with the flame appearing both at ceiling level above the plume, where air has been entrained, and at the boundary between the hot gas layer and clear air, as this is where the flammable gas in the ceiling layer can react with the oxygen. Once flame has started to spread across the compartment at the boundary level, this will greatly increase the thermal radiation from the hot products of combustion already built up there.

The other flammable materials in the compartment will now start to rise in temperature very rapidly. Not only are they being heated from the side by the plume, they are also being heated from above, where the flames and the hot products of combustion could be much closer, depending on the height of the boundary.

In large compartments with higher ceilings, flame and the hot products of combustion may spread at ceiling level without getting low enough to cause nearby fuel sources to start giving off flammable gases.

However, it may be that, at some distance from the fire, either a discontinuity in the ceiling causes the hot gases to swirl lower, or there is a high pile of flammable material. In either of these cases, the source of thermal radiation has been brought closer to the fuel, and ignition may result. By this mechanism, fire spread can cut firefighters off from their means of escape. As the hot smoke layer descends, and particularly if there is a low ceiling, all the remaining contents in the compartment will now be heated to the stage when they will themselves start to give off flammable gases. It is then only a matter of from above.

This will be felt by the firefighters as a rapid increase in the temperature in the compartment, and in the heat from the hot gases at ceiling level, forcing them down low. If they can see above them, they will be able to see tongues of flame running through the gas layer. In addition, other combustible materials within the compartment will be giving off visible smoke, and flammable gases.

5.11 Actions by Firefighters

As the main reason for a flashover is radiation from the hot gases and flames above them, the logical solution is to cool this area. This will have the effect of reducing the flames and radiated heat, and causing the smoke layer to lift.

Directing a spray at the ceiling will have this effect. However, too much water will cause the generation of large amounts of steam. Too much cooling will bring the smoke layer down, obscuring everything. In these circumstances, it will be most effective for the firefighters to attack the hot gases with **pulses of spray**, observing their effect and so judging when sufficient water has been applied.

Once the immediate danger of a flashover has been eliminated, the next steps depend on whether flashover conditions could re-develop before the fire can be extinguished. If this is likely, it is important to ventilate the fire as soon as possible. If the hot gases are

released faster than they are generated, the smoke layer will reduce, and the risk of flashover will reduce.

Built-in roof vents are designed to do exactly this, either automatically, or when operated by the fire service. However, it is important that the correct vents are opened. The further from the fire that the vent is, the further the hot gases have to travel, and the more the chance of fire spread.

Where there are no built-in vents, firefighters have the option of making their own. It must be remembered, however, that incorrect use of ventilation can result in increased fire-spread at high level as hot gases are channeled into areas they might otherwise have taken longer to reach.

5.12 Aide Memoire Flashover Indicators

• A rapid increase in compartment temperature and in heat from hot gases at ceiling level.
• Tongues of flame visible in the smoke layer.
• Other surfaces giving off fumes.

5.13 Safety

- Make sure you are properly protected.
- Ensure entrance covered by a charged branch.
- Check escape routes are protected.
- Check the outside of the door for signs of heat.
- Stay low.
- Use spray pulses on hot gases at ceiling level.
- Ventilate only when safe to do so.
- Be aware of the potential for flashover and backdraught.

5.14 Firefighter Awareness

Officers have the important responsibility of deciding whether to commit breathing apparatus teams inside a building. It is essential that they are aware of the potential for backdraughts and, where their occurrence is more likely, the outside of the building must

be checked for indications of a possible backdraught, and appropriate warnings must be given to the crews before they are committed.

5.15 Important Safety Note:

It is essential that, from the moment firefighters enter a building, they are constantly aware of the possibilities of backdraught and flashover, and that they stop, look and think before they open any door inside a building.

5.16 Tactical Ventilation

Ventilation is defined as "The removal of heated air, smoke and other airborne contaminants from a structure and their replacement with a supply of fresher air".

In firefighting, there are a number of additional terms, which are used: **Self Ventilation** occurs when the fire damages the structure so that increased ventilation occurs. **Automatic Ventilation** occurs when preinstalled vents are activated automatically, usually in the early stages of the fire, by the fire detection system or fusible link devices.

Tactical Ventilation requires the intervention of the fire service to open up the building, releasing the products of combustion and allowing fresher air to enter. This SOP is concerned with tactical ventilation, although many of the effects which will be described, will also occur during the other types of ventilation.

Tactical ventilation can only occur once the DCD attends a fire, and so usually occurs later than automatic ventilation. It can be used at various stages of a fire:

- After arrival of the fire service but before Control is achieved;
- After control but before fire extinction;
- After fire extinction.

When tactical ventilation is used before extinction, it can have an effect on fire spread. This can be either beneficial or detrimental, depending on the judgement and skill of the firefighters.

5.17 Smoke

Smoke is generally a mixture of fine solid particles, droplets of water and other liquids, and gases given off by the materials involved in the fire. It is generally toxic. The amount

of smoke generated by a fire is dependent on the size of the fire and the material being burnt.

Its behavior and movement depends upon its temperature. The fire will heat the air and smoke surrounding it and, since hot air is more buoyant than cold air, it will tend to rise very rapidly and with great force. When the hot smoke and air cools this effect will cease and the smoke will tend to for layers. Movement of the smoke will then be more influenced by air turbulence caused by the making of openings into the compartment, the movement of people and the use of branches etc than the temperature.

It is essential to remember two important features of smoke:

- It can burn. Some of the products of combustion may not be fully burnt because of a shortage of oxygen or the absence of a source of ignition. Given a new source of fresh air and a source of ignition, it can re-ignite, sometimes with explosive results a backdraught. If the smoke is hot enough, re-ignition can occur without a separate source of ignition.
- It can be hot. It may be sufficiently hot to ignite flammable materials with which it comes into contact. It will also be radiating heat, and this may be sufficient to ignite other sources of fuel in a compartment.

Two of the phenomena which can be caused by smoke, 'Flashover' and 'Backdraught', which has been described above, Tactical ventilation, is one of the techniques which can be used to prevent flashover and back draught, or to mitigate their effects.

5.18 The Value of Ventilation

Like any other tactical option available to the firefighter, tactical ventilation can make things worse if it is applied incorrectly. Properly used, it can have significant beneficial effects on firefighting:

- It can assist escape by restricting the spread of smoke, improving visibility and extending available egress times;
- It can aid rescue operations by reducing smoke and toxic gases, which hinder search activities and endanger trapped occupants;

- It can improve the safety of firefighters by reducing the risk of flashover and back draught, and making it easier to control the effects of back draught;
- It can speed attack and extinguishment by removing heat and smoke so that firefighters can enter a compartment earlier and, with improved visibility, make it easier for firefighters to locate and deal with the fire;
- It can reduce property damage by making it possible for the fire to be located and tackled more quickly;
- It can restrict fire spread by limiting the movement of smoke and hot gases.

5.18.1 When to Use Ventilation

Like any other technique available to the firefighter, tactical ventilation needs to be borne in mind when assessing how to tackle a fire. In the majority of instances, tactical ventilation should not be used until the fire has been located and, in all cases, an assessment must be made of the likely effects of ventilation. Often the fire's location can be determined from outside the building.

On occasions, tactical ventilation can be used to clear smoke to help locate the fire. In most cases, where ventilation is considered a suitable tactic, it is most effective if used in the early stages of firefighting. However, the uncontrolled movement of hot gases inside the building is the main cause of fire spread, so the decision to commence tactical ventilation must be as part of an overall strategy of controlling air movements within the building.

5.18.2 The Effects of the Wind

Wind strength and direction are usually the dominating factors in tactical ventilation. In most cases, it will determine the direction in which the smoke and hot gases will move within the building. It is unlikely to be possible to fight against the prevailing wind by using fans to force air into the building. The efficiency of this tactic will depend on the capacity of the fans, when compared with the wind strength. If the wind is too strong, it will still dominate.

5.19 Tactical Ventilation Techniques

All ventilation techniques depend on planning where fresh air will be allowed to enter the building, where hot gases and smoke will be allowed to leave the building and, if possible, the routes they will follow within the building. There are two basic options:

- Vertical or Top Ventilation - making an opening at high level (usually through the roof) so that the buoyancy of the hot gases and smoke enables them to escape vertically.
- Horizontal or Cross Ventilation – making openings in the external walls (for example using windows and doors) so that the wind assists in the removal of the hot gases and smoke. In both cases, it is possible to accelerate ventilation by the use of fans or blowers.

5.19.1 Natural Ventilation

Describes collectively the techniques of vertical and horizontal ventilation when they are not assisted by mechanical means. This includes the use of pre-installed vents, windows, doors etc. Forced Ventilation describes collectively the techniques of vertical and horizontal ventilation when mechanical means are used to assist in removing the hot gases and smoke, or in providing a supply of fresh air. It includes the use of both fans and water sprays when used to drive the flow of fire gases or of fresh air.

5.20 Operational Command

Ventilation can only be one element of the overall firefighting strategy. It must be coordinated with other activities to ensure that differing requirements do not come into conflict. The decision to use forced ventilation will have further implications both for safety and for resources. Sound tactical decisions, taken by officers responsible for the management of an incident, and effective fireground communications, are essential for the safe use of ventilation.

Any firefighters inside the building need to be able to inform the Officer-in-Charge of the conditions within the building, and are likely to be in the best position to advise on whether tactical ventilation is likely to be effective. In particular, they may be best placed to assess whether there are compartments where there is a risk of a backdraught. If the Officer-in-

Charge decides that ventilation will be initiated, the firefighters inside must first be informed. The Officer-in-Charge may decide to evacuate the building whilst ventilation takes place and until conditions have stabilised. Particular care should be taken of the safety of firefighters on storeys above the fire when ventilation is initiated.

If it is decided that the firefighters shall remain within the building, they will need to be able to inform the Officer-in-Charge when they are ready for ventilation to commence, and to report on the progress of the ventilation. These firefighters need a hoseline to protect themselves. Firefighters outside the building also need to have their activities co-ordinated. The firefighters making the outlet vent are likely to be out of sight of the inlet vent, but it is important that ventilation activities occur in the correct sequence. Whilst the fire is being fought, vents should only be opened as part of the ventilation plan. Care should also be taken to ensure that key doors are not accidentally opened or closed during firefighting operations. Once the fire has been extinguished, ventilation can be increased.

5.20.1 Assessing the Need for Ventilation

When the Officer-in-Charge is deciding on the overall strategy at a fire, ventilation is one of the factors which should be born in mind from the outset. Some situations cannot justify its use, particularly where the hot gases and smoke are not a serious problem, although it may still be necessary to ventilate after the fire has been extinguished, in order to remove residual smoke from the structure.

One critical factor may be the presence of built-in ventilation systems. These may be specifically designed for fire ventilation, but even then, it is important that they are used correctly. They may already have activated automatically, in which case any decision to reverse this by manual intervention with the system, is as critical as a decision to start ventilation. Built-in air conditioning systems can be equally important. If they are still operating, they may be supplying fresh air to the fire, and may be drawing the hot products of combustion into hidden ducts and voids, thus increasing the likelihood of fire spread.

Again, these systems can be used as part of tactical ventilation but only to provide a supply of fresh air, acting as an inlet vent. They should not be used to provide an outlet vent unless the Officer-in-Charge is certain that this will not lead to fire spread. If it is decided that tactical ventilation is required, the objective of its use should be identified before commencing operations.

The technique to be adopted will vary, depending on what is expected of it. In particular, the approach can be:

- Offensive - ventilating close to the fire to have a direct effect on the fire itself, to limit fire spread, and to make conditions safer for the firefighters; or
- Defensive - ventilating away from the fire, or after the fire is out, to have an effect on the hot gases and smoke, particularly to improve access and escape routes and to control smoke movement to areas of the building not involved in the fire. These two objectives can be met at the same time, for example to maintain a safe egress whilst offensive operations take place.

5.20.2 The Benefits of Ventilation

Ventilation can be useful whenever the removal of hot gases and smoke will make firefighting operations easier and safer. If there is the risk of a back draught, the compartment concerned has to be cleared of flammable gases in a controlled manner. If the compartment door is opened, that is the most likely route for the backdraught, endangering the firefighters in the vicinityof the open door. Properly applied, ventilation could release the gases externally, directing any flame or explosion away from firefighters and other fire risks.

If there is a lot of hot gas and smoke in a compartment, with flame travelling horizontally at ceiling level, there is a significant risk of rapid fire spread and possibly flashover. These gases need to be ventilated as close to the fire as safety permits, and preferably at high level. If the only possible vent is some distance from the fire, it must be expected that fire will spread along the route to that vent once ventilation commences.

If the escape route from the building contains smoke, and there are still persons in the building, ventilation can clear that route. If firefighters are hampered in reaching the fire because the route they have to follow is smokelogged, ventilation will help to improve visibility, speeding access. It may also be of benefit where sprinklers have operated and cooled the smoke, causing smoke-logging. If there has been a build up of hot gases within the building so that conditions for the firefighters are very arduous, ventilation can produce a much more tolerable environment, increasing a firefighter's working duration.

5.20.3 Assessing the Risks

The main risk in using offensive ventilation techniques is that the introduction of fresh air may result in fire growth and, perhaps, even backdraught. However, if a backdraught occurs, it is probable that the conditions necessary were already in being, and it would have occurred without the commencement of tactical ventilation. Provided that sufficient fuel is present, fire growth may occur in the area surrounding the fire, and/or along the route to the outlet vent. Hot smoke and gases may also ignite as they are vented and meet fresh air. For this reason, it is preferable to vent the compartment directly to the outside. The correct use of offensive ventilation can reduce the risk of fire spread by removing the hot gases whilst allowing fresh air in. However, offensive ventilation should never commence until appropriately protected firefighters are on hand with charged hoselines. This does not mean that the fire must necessarily be surrounded before ventilation commences. The initiation of offensive ventilation constitutes one of the elements in a major attack on the fire, but it cannot be treated as an attack in its own right.

The decision to ventilate offensively involves a balance between the risk of fire spread, and the improved conditions around the fire. The time and resources necessary to set up ventilation will also be factors which need to be considered. Smoke-logging can occur in parts of the building not involved in the fire. This can cause hazards both to occupants trying to escape, and to firefighters involved in tasks away from the fire, and can result in severe damage to property. The correct use of ventilation can reduce this risk, whilst its incorrect use can make it far worse.

The Officer-in-Charge should consider the possibility of withdrawing the firefighters from part or all of the building whilst fresh air is being let into the compartment, particularly if the fresh air route is likely to become the path for any backdraught. Where it is felt that defensive ventilation is more appropriate, the risks and benefits are proportionately less. It is, however, necessary to select an appropriate route for the air flow from the inlet vent to the outlet vent, to minimise the chances of this fresh air affecting the fire compartment.

Defensive ventilation does not have to form part of a major attack on a fire. It can be part of the build up to this attack, clearing escape and attack routes, or part of continuing operations once the fire is under control.

5.20.4 How Ventilation is to Be Achieved

This will always depend on the circumstances at the fire, but there are a number of guidelines to be followed. The principal decision is whether to use Horizontal Ventilation or Vertical ventilation, and secondly whether to adopt an offensive or a defensive approach. In both cases, the major factors to be considered are the design of the building, the location, size and severity of the fire, and the wind speed and direction.

Horizontal Ventilation may be appropriate where:

- Vertical ventilation is not possible due to the character of the building;
- It is not safe to commit firefighters to open a vent in the roof;
- The fire is not large enough to necessitate opening of the roof;
- There are windows and doors close to the seat of the fire;
- The fire and the products of combustion are not being carried into other floors;
- The fire has not entered structural voids or concealed spaces.

Vertical ventilation may be appropriate where:

- The fire is in, or has spread to, the roof space;
- Horizontal ventilation would be difficult, for example, in windowless buildings with few external doors;
- There are tall vertical shafts, such as light wells or elevators;

The fire has entered structural voids or concealed spaces. In general, the use of forced ventilation (e.g. fans etc.) will speed up whatever ventilation process is selected. Horizontal Ventilation is most effective where the outlet vent can be placed high on the downwind side of the building, and the inlet vent is low on the upwind side.

If the only suitable windows and doors are all on the same side of the building, the use of natural ventilation may not be very effective, as the pressure of the wind will act equally on the inlet and outlet vents. In these circumstances, the cool air will enter at low level, and the hot gases will come out at high level. Forced ventilation may offer some improvement where it does not result in flame being driven at the firefighters.

5.20.5 Forced Ventilation

Ventilation efforts should be in concert with existing atmospheric conditions, taking advantage of natural ventilation whenever possible. However, in some situations, natural ventilation may be inadequate and may have to be supplemented or replaced by forced ventilation to provide a tenable atmosphere and to facilitate rescue operations. Forced ventilation refers to the use of fans, blowers, water sprays or other mechanical devices to create or redirect the flow of air inside the building so that the fire gases are forced out of the building.

If forced ventilation is used to accelerate the effects of natural ventilation, it must be remembered that all the effects, both good and bad, may be accelerated. For this reason, it is essential that the Firefighters concerned have a good understanding of the principles of ventilation, and the behaviour of fire, before the use of forced ventilation is considered.

The main advantages of forced ventilation are:

- The ventilation objectives, i.e. smoke removal, restoration of a tenable atmosphere etc., are achieved more rapidly;
- It makes horizontal ventilation more effective, so reducing the need for vertical ventilation;
- It is less susceptible to erratic wind conditions, although it cannot overcome strong winds;

- It is a more controllable form of ventilation.

Its disadvantages are:

- It requires the use of a mechanical device, a power source and additional firefighters;
- It can increase the intensity of a fire and lead to unwanted fire and smoke spread if incorrectly applied;
- To clear large compartments, it requires a very large fan, or a number of smaller fans;
- It can take time to set up;
- In defensive ventilation operations, the limited airflow available means that systematic room-by-room clearance is necessary.

The main techniques of forced ventilation are:

- Positive Pressure Ventilation (PPV). PPV can be achieved by forcing air into a building using a fan. The effect of this will be to increase the pressure inside, relative to atmospheric pressure. PPV simply refers to blowing air in through the inlet vent.
- Negative Pressure Ventilation (NPV). NPV refers to extracting the smoke and hot gases from the outlet vent. This will have the effect of reducing the pressure inside the building, relative to the atmospheric pressure. It can be achieved by fans or water sprays.
- Heating Ventilation and Air Conditioning Systems (HVAC). Building HVAC systems can be designed so that, in the event of fire, they can be used as a smoke control system.
- Powered Smoke and Heat Exhaust Systems. Dedicated fans and other devices which, usually triggered automatically, provide a smoke control system.

The use of fans for NPV is better in the clearance of smoke-logged buildings once the fire is out, or where there is no prospect of hot or flammable gases reaching the fan. Hoseline Branches It is possible to use the air entrainment effect of branches used on a conical spray setting, to draw air out of an outlet vent. The conical spray should be directed out

through the outlet vent from within the building. To protect the firefighter who would otherwise have to remain in a hot environment, the branch should be lashed in position or mounted on a branch holder, rather than hand held. The spray to be set at a cone angle of about 60 degrees and located so it covers 85-90 percent of the outlet vent, to achieve the maximum air flow.

5.20.6 Positive Pressure Ventilation (PPV)

Positive Pressure Ventilation (PPV) is achieved by forcing air into a building using a fan. The effect of this will be to increase the pressure inside, relative to atmospheric pressure. PPV simply refers to blowing air in through the inlet vent. The most appropriate tactic for using a PPV fan will depend on whether the inlet vent is also to be used for firefighters' access to the building and whether there is smoke coming out of that vent.

It is essential to recognize that the use of PPV is simply an extension of the use of natural ventilation. The same fundamental principles apply to both. If PPV is used to accelerate the effects of natural ventilation, it must be remembered that all the effects, both good and bad, may be accelerated. For this reason, it is essential that firefighters have a good understanding of the behaviour of fire and the principles of ventilation, before the use of PPV is considered. The efficiency of PPV as a tactic is governed by the wind, the size of the fan, the proportion of the fan's air production which enters the building, the relative sizes of the inlet and outlet vents, the size of the compartment to be cleared, and the temperature of the gases in the compartment.

5.20.7 Basic Fan Performance

It must be remembered that fans can differ widely in performance. To be considered portable, the fan should conform to the guidelines set out in the Health and Safety Manual Handling Regulations. The amount of air which a fan can move is a function of the power available and the design of the fan blade. The shape of the cone of air which is produced is a function of the design of the fan blade and of the ducting fitted around the fan.

When a fan is first used to pressurize a compartment, the time taken to do this is governed by the size of the compartment. A small compartment will be pressurised in seconds. The

bigger the compartment, the more air which has to be driven into it to achieve the same level of pressurisation. If the outlet vent is the same size as the inlet vent, the maximum flow rate reduces to typically 4 cubic metres per second (140 cubic feet per second), but the internal pressure may rise to typically 15 Pascals (0.15 millibar).

If the outlet vent is half the size of the inlet vent, the maximum flow rate is typically 3 cubic metres per second (100 cubic feet per second), but the internal pressure rises to typically 30 Pascals (0.3 millibar). Thus, the relative sizes of the inlet and outlet vents can be used to trade off air flow against internal pressure. If the inlet vent is also to be used as an entrance, the fan may cause an obstruction unless it can be placed a little way back, to allow access. However, this will reduce the proportion of the fan's air production which enters the building. If the fan is set 2 metres away from the door, typically the air flow through that door will reduce by 20%, and the internal pressure will reduce by 10%.

5.20.8 Positioning the Fan

Once the inlet vent has been selected, several factors will determine the location of the fan: The over-riding consideration will be that of access: if firefighters or escaping occupants need to use the door, the fan has to be set back to avoid obstructing the route. A secondary consideration will be whether the fan is to blow directly into the fire compartment. If this is the case, and turbulent mixing of the hot gases and smoke is undesirable, it may be better to set the fan back from the doorway. This will direct air in through the whole doorway, rather than part of it, and provide a more uniform flow in the compartment.

Equally, if there is smoke but no fire in the compartment directly inside the doorway, it may be preferable to drive all the smoke into the building. Setting the fan back from the doorway will direct air in through the whole doorway, rather than part of it, and provide a more uniform flow in the compartment. If the fan is moved back from the doorway, there will come a stage where the cone of air it produces covers the whole of the doorway. This reduces the amount of air which is entering the building, but makes most efficient use of the air which does go in. It aims to produce a moving wall of air to sweep all the smoke and hot gases before it in the direction of the outlet vent. If there is no need to maintain

access through the inlet vent the most efficient use of the fan is to place it in the doorway and to block off the rest of the doorway.

5.20.9 Fighting an Opposing Wind

Wind strength and direction are usually the dominating factors in tactical ventilation. In most cases, it will determine the direction in which the smoke and hot gases will move within the building. Whenever possible, ventilation efforts should be in concert with existing atmospheric conditions, taking advantage of natural ventilation.

However, in some situations, natural ventilation may be inadequate and may have to be supplemented or replaced by forced ventilation to provide a tenable atmosphere and to facilitate rescue operations. The fact that a wind appears to be blowing in a particular direction out in the open, is no guarantee that it will be blowing in the same direction near buildings. They introduce unpredictable eddies, and local wind directions may reverse, and increase or decrease in magnitude significantly.

5.21. Size and Location of the Fire Compartment

In a small building, it is generally possible to get access to the outside of the fire compartment. This means that, unless the wind is opposing, it is generally possible to make an outlet vent in the fire compartment. This keeps fire spread to the minimum when PPV is started.

In larger buildings, it may be difficult or impossible to identify the fire compartment immediately and PPV operations have to be delayed until this is done. Even then, it may not be possible to create an outlet vent very close to the fire. In very large compartments, it may be difficult to locate the fire within the compartment. If portable PPV fans are used, they can only have a very limited capacity, and their effect will reduce drastically as the size of the fire compartment increases.

A typical flow-rate from a 24-inch blade diameter portable fan is 6 cubic metres per second (210 cubic feet per second). If set back from the door, perhaps only 5 cubic metres per minute will flow through the doorway.

- If air is flowing in through a doorway at a rate of 5 cubic metres per second, the air velocity through that doorway (cross-section of 2 square metres) will be about 2.5 metres per second.
- In a typical office corridor (cross-section 4 square metres), this will be reduced to 1.2 metres per second.
- In a typical workshop, hospital ward or small storage area (cross-section 30 square metres), the air velocity due to this one fan in the doorway will reduce to about 0.1 Vmetres per second (17 centimeters per second). This may be too slow to be an acceptable rate of ventilation.
- In a typical supermarket (cross-section 60 metres wide by 5 metres high, giving an area of 300 square metres) the air velocity due to this one fan will reduce by a further factor of 10.

It is not yet possible to be specific about the air velocity which is effective at clearing smoke. It is clear, however, that single fans will not have any significant effect in large areas such as supermarkets and warehouses, although they may have some effect locally in doorways and corridors. The most effective use of portable PPV fans is likely to be in clearing small compartments and corridors. Thus, they may be particularly effective in domestic and small commercial premises, or in pressurising staircase enclosures. In larger premises, a systematic room-byroom approach to smoke clearance will make best use of the limited air flow available.

5.21.1 The Effect of Opening Vents

Before it is opened up, the fire compartment will contain hot gases and smoke at ceiling level and, if these are very hot, they may have caused a pressure build-up inside the compartment. This pressure can be as high as 100 Pascals (1millibar) compared to the pressure of at most 30 Pascals which the fan can generate. For a short period therefore, if the inlet vent is opened too soon after the outlet vent is opened, hot gases and smoke may flow out through the inlet vent, until the pressure inside has been reduced.

Even then, it may not be possible to completely seal a doorway with the cone of air from a fan. Inevitably, the main flow from a fan is along its axis and, although it may feel as though the top of the door is covered, the flow there will be much less, and the hot gases

and smoke from the fire may be able to overcome it occasionally.

5.21.2 The Use of Multiple Fans

If the inlet vent is too large to be covered effectively by a single fan, or if a higher air flow rate is required, it is possible to use more than one fan in parallel (side by side). If a higher airflow is required through a doorway, two fans can be used in series (or stacked), with one placed in the doorway, and the second placed behind it to provide the seal around the door. This, however, will restrict access through the doorway.

5.21.3 Tactical Ventilation with PPV – Offensive - Post Fire Smoke Clearance and Damping Down

During smoke clearance and damping down operations in a building it is usually the case that there will be considerable residual heat, hot spots or bullseyes with steam and smoke still being produced. Such an environment can make conditions uncomfortable and/or oppressive for firefighters.

The use of positive pressure ventilation in these circumstances can help to relieve the above-mentioned problems considerably. The use of PPV in such circumstances does not necessarily mean that BA can be dispensed with, as smoke and gases may still be present in concentrations injurious to health. The advantages of using PPV during smoke clearance and damping down operations are:

- Rapid removal of smoke, steam and residual heat, improving visibility.
- Cooler and easier working conditions when turning over debris.
- Hot spots or bullseyes may become apparent due to the increased flow of fresh air. (Always have a hose reel or hose line available to deal with these)

The route the smoke/steam will take through the structure should be decided on before ventilation takes place. Any areas not affected should be isolated by closing relevant doors. The fan should be placed in position and started up only after other crew members have opened the exhaust vent. It is important that good communication is maintained between the fire ground commander, the fan operator and the crew at the exhaust vent.

The following sequence of operation should be followed:

- Isolate unaffected areas where possible.
- Position the fan.
- Instruct crew members to open the exhaust vent.
- Start the fan. Taking the desired route to the exhaust vent and does not spread to other areas.
- Continue to monitor the situation until PPV is discontinued.

In multi-compartmented buildings where, smoke has spread to rooms other than the fire room, it may be desirable to ventilate sequentially. In this case the doors to all compartments, except the one to be ventilated initially, should be closed and the process begun. When that room is cleared of smoke, the door to the next room to be ventilated should be opened and an exhaust vent provided. The exhaust vent from the first room and the door to that room should then be closed. The process is repeated until the building is cleared of smoke. It is advisable to commence operations in the compartment which was involved in the fire.

In multi-storey buildings, smoke clearance should commence at ground floor level, with the first floor being cleared next, and so on until the building is cleared.

5.21.4 Tactical Ventilation with PPV – Defensive - Domestic Premises

The airflows produced by portable PPV fans are eminently suitable for use in typical domestic premises if the wind is in the right direction. If the fire is on the ground floor and it is possible to create an outlet vent in the fire compartment, it is possible to use PPV to confine the fire to the fire compartment, whilst significantly improving conditions on the route from the inlet vent to the fire compartment. If smoke has spread through the rest of the premises, there may be sufficient spare capacity to apply systematic smoke clearance through the rest of the building. If the fire is on the highest floor, it may take longer to create an outlet vent in the fire compartment. It may be necessary to use a ladder. It may be possible to use PPV to clear smoke on the ground floor at the same time as the upstairs fire is being fought.

If the fire is in the roof space, the only option with PPV may be vertical ventilation. It would then be necessary to remove tiles to create an outlet vent, before starting the fan. In terraced or semidetached buildings, the partition walls in the roof space may not provide a good seal, so it may be necessary to remove sufficient tiles to create a trench before starting the fan, to prevent fire spread. The use of PPV will cool the roof space significantly.

5.21.5 Stairwells

Not all stairwells in multi-occupancy dwellings are pressurized. Where the stairwell has an open vent or window and is serving as the chimney for the hot gases and smoke, it is possible to use a PPV fan to dilute the gases in the stairwell by forcing a large amount of fresh air up the stairwell. It is important to avoid driving the hot gases and smoke out through some other route, so care must be taken not to pressurize the stairwell. This can be done by having as many outlet vents as possible above the fire floor. If a new outlet vent can be made for the hot gases and smoke closer to, or in, the fire compartment, it may be preferable to use the PPV fan to pressurize the stairwell, and to drive the hot smoke and gases back and out through the new vent. This is achieved by minimising outlet vents in the stairwell. This will not remove smoke from the stairwell above the fire floor, but there may be sufficient spare capacity from the fan to apply systematic smoke clearance.

5.21.6 Corridors

PPV fans can be used where it is possible to select the direction of airflow in a corridor. The wind may be a determining factor in this but, where it is not the fire ground commander has the opportunity to make the choice. If corridors link stairwells, it is possible to make one stairwell the outlet vent and to keep the other stairwell smoke-free.

5.21.7 Cellars

PPV fans are extremely effective at improving firefighting conditions in cellars, if it is possible to create an outlet vent. If there are removable pavement lights or stall boards, even on the up-wind side of the building, it may be possible to drive fresh air down the

cellar steps. This will have the effect of reducing or even eliminating the hot layer on the steps, making the firefighter's job much easier.

SOP 6. VEHICLES FIRE INCIDENTS PROCEDURES

This instruction gives guidance on the operational procedures to be adopted at fires involving vehicles. Crews must adopt procedures to safeguard themselves and others against the hazards of working at the scene of such incidents.

6.1 Crew Safety

Safety of personnel is of paramount importance; it is the duty of the Incident Commander to ensure the continued safety of all crew members by dynamic and analytical risk assessments.

- All personnel must wear full PPE as soon as is practically possible.
- Appropriate personal protective clothing should include surgical and protective gloves and the visors should be used in the absence of breathing apparatus. Preferably B.A. must be worn.
- Crews should dismount from the appliance on the safe side, away from road traffic.
- The Incident Commander should ensure that all crew members work within the defined warm or hot zone areas, and do not wander off into the traffic carriageways. Tape should be used to define the warm zone.
- The Incident Commander should consider the use of breathing apparatus to protect crew members from inhaling toxic fumes.

6.2 General Safety

The Incident Commander is responsible for the safety of personnel; however FRF firefighters must be aware of their personal responsibility. For multi-car fires a safety Officer may be appointed. At night or in poor visibility, consideration should be given to illuminating the rear of the appliances that are positioned in the fend-off position. Care should be taken to ensure that oncoming traffic is not blinded by such lighting.

The Incident Commander in his appraisal of the situation should note and inform crew members of the presence of special risks such as vehicles carrying hazardous

substances which may hinder firefighting operations. Where contact is likely with any body fluids, crew members must wear surgical gloves underneath their normal protective gloves.

6.3 On Arrival

6.3.1 Positioning of Fire Appliances on a Public Highway

At the majority of incidents, appliances should be positioned to protect the incident from oncoming traffic, thus creating a safer working environment for firefighters to function. At incidents involving vehicles with hydra pneumatic, hydra gas suspension systems or those using LPG fuel, Incident Commanders should be aware that these systems when involved in fire prevent an explosive and projectile hazard which could endanger crews. The positioning of appliances should take account of this but crew safety must not be compromised.

At incidents involving vehicles which use liquefied gas (LPG) for fuel, appliances should not be positioned in close proximity or at the rear of such vehicles. The gas cylinders/tanks are generally positioned in the rear compartment of the vehicle and thus create an explosive hazard which could endanger crews. Where it is safe and practicable, position fire appliances uphill of incidents. This should prevent the involvement of the appliance in a collision resulting from any

unexpected movement of the vehicle or a running fuel fire. Wherever practical, position fire appliances upwind of the incident. This prevents the crews from having to work in the path of the products of combustion (smoke, hot gases).

6.3.2 Positioning of Fire Appliances off a Public Highway

Appliances should be positioned as near to the incident as possible, having considered the dangers outlined above. Appliances should remain on hard standing ground to prevent the possibility of an appliance being bogged down.

6.4 Approach

The approach by an appliance or other FRF vehicle when nearing an accident should be slow and controlled, taking account of the following:

- weather conditions and visibility
- road conditions
- traffic congestion
- obstacles and debris
- opportunity to drop off a crew member with warning signs, if appropriate

6.4.1 Approach to Vehicles on Fire Considerations Engine Compartment Fires

Approach from a safe distance, applying suitable extinguishing medium, either water spray/foam. Await reaction of the fire to the initial application of the medium before closing in. Engine blocks may be constructed of magnesium alloy, which reacts violently and explosively to the application of water, thus posing a potential hazard to firefighters.

6.4.2 Vehicle Wheels

Magnesium alloy wheel hubs can be found on many makes of car and should be given due consideration and precautionary measures as outlined above.

6.5 Passenger Compartment

Firefighters should be continuously aware of the toxic products of combustion which are evolved from a fire involving polyurethane in car seats and upholstery. Breathing Apparatus must be worn.

6.5.1 Fires Involving the Petrol/Fuel Supply

Under no circumstances should the petrol/fuel tank be filled with water if a fire is being fed from the fuel tank of the vehicle through an impaired fuel supply pipe. It is probable that the fuel tank will have been heated considerably by the fire. Application of a water jet directly onto the super-heated fuel may result in a violent reaction causing the violent expansion of a burning vapour cloud, endangering the crews in the immediate vicinity.

6.5.2 Rendering the Vehicle Safe

Petrol/fuel tanks should not be filled with water. Batteries should be isolated by disconnecting the battery leads. In extreme circumstances where short circuiting presents an immediate ignition hazard, the cutting of battery leads may be necessary. If there is no potential fire hazard then the vehicle should be left intact to enable any further investigations by the Police.

6.5.3 Post Fire Considerations Fluoroelastomers in Motor Vehicles

Fluoroelastomers are synthetic rubber like materials, containing fluorine commonly used in motor vehicles for gaskets'' rings and seals. They are widely used on many types of automotive and mechanical equipment. The most common trade names for fluoroelastomers are Viton, Fluorel.

6.6 Operational Considerations

Fluoroelastomers, when exposed to temperatures above 400ºC, decompose. During decomposition the following product is produced – Hydrofluoric Acid. This is extremely corrosive and almost impossible to remove from the skin. If it is necessary to inspect a fire damaged vehicle, firefighters should look closely to ascertain whether any gaskets or seals have decomposed. If decomposition has taken place, they will appear charred or seen as a black sticky substance. If this is the case, neither seal nor equipment should be touched.

The Incident Commander should inform any persons involved in the removal of vehicle or equipment of the dangers associated with Fluoroelastomers (i.e. vehicle Recovery Company).

6.7 Medical Considerations

- Hydrofluoric acid can inflict destructive and extremely painful burns, these are apparent immediately in concentrated quantities. With dilute solutions, such as fluoroelastomers, the onset of injury is often delayed for a few hours.
- Symptoms commence as a dull throb which may build up to become an acutely severe and persistent pain, reddening of the damaged skin may be present.

- If during an incident any person is thought to have been contaminated, any affected clothing should be removed and the affected area of the body flushed with large volumes of running water. This process should continue for a minimum of 15 minutes.
- Contamination of the eyes is particularly dangerous and must be treated immediately by flushing for at least 30 minutes with clean water or a saline solution.
- Any affected person should be taken to hospital for appropriate treatment.

6.8 Provision of Sleeping Accommodation on Motor Vehicles

With the continued increase in the number of lorry drivers using the road network system for both long haul business and recreational purposes, it is necessary for personnel to be aware of the provision of sleeping accommodation in these types of vehicles. It is also worth considering that these vehicles will be used for rest purposes for the drivers, even if no sleeping facilities are incorporated and therefore the Incident Commander must consider this as part of his overall plan. This instruction provides general information and procedural guidance. It is impossible to account for each and every make of vehicle or differences in production specifications.

6.8.1 Long Haul Vehicles

- In view of the possible life risks at incidents involving vehicles equipped with sleeping accommodation within the driver's cab, the following guidance should be noted.
- Sleeping provision within a driving cab range from sleeping within the cab to an elaborate, purpose built sleeper cab.
- Sleeping facilities are mainly provided on long distance articulated vehicles.
- If a driver using the sleeping accommodation provided within the cab, it is likely the cab doors will be locked from the inside.
- The sleeping area can usually be distinguished by a small window positioned behind the cab door rear pillar. It is generally safe to assume that: Articulated tractors without a side window behind the cab door will not have sleeper bunks. Articulated tractors with a small side window (which may be curtained or blanked off), may have sleeper bunks.

6.8.2 Long Distance Coaches

Long distance coaches incorporate underfloor rest compartments. This underfloor accommodation is found in many continental manufactured coaches. The compartment is intended principally for driver's overnight accommodation, but it is possible that it may be used by a codriver or passenger whilst the coach is in motion. The Incident Commander will need to check whether such a compartment is occupied if a coach fitted with this is involved in a fire incident.

Sleeping compartments are generally large enough for one person only to lie down and may contain a mattress and other bedding. In compartments that are closed, there is normally an emergency exit through a small window. This exit has no external opening mechanism and requires the occupant to open from the inside by such means as a rip cord, hinged flap or complete removal of glass. These compartments are often not indicated as such, either internally or externally. Their presence needs to be established as a matter of priority.

6.9 Procedure at Incidents

The Incident Commander should ensure that a thorough check of the vehicle is undertaken to ascertain:

• If any sleeping accommodation is provided and if so, whether it is occupied.

• That any occupants are wakened. Incident Commanders should bear in mind that should the vehicle be involved in a fire, the occupant of a sleeper cab or coach compartment may have been overcome by smoke and fumes. The occupant will therefore be incapable of opening the cab doors from the inside. It is also conceivable that a fire may develop in the loaded trailer or elsewhere in the coach, unbeknown to the sleeping occupant.

6.9.1 Hazards from Trailer Brakes

Spring brake activators are fitted to the rear axle of most large trailers, they form part of the parking brake unit and are normally constructed from cast aluminium. In the event of a fire involving a vehicle trailer, it is possible that the spring retaining cap on the brake activator will melt, allowing the spring, which store considerable energy, to be released

violently. All personnel when dealing with an incident involving a vehicle trailer fire must be aware of the potential hazard presented by the trailer brakes and where possible, avoid approaching the trailer from the rear.

6.9.2 Hazards from Air Suspension Systems

- Air suspension systems are commonly used on commercial vehicles, trailers and passenger coaches.
- They have been introduced for a variety of reasons which include: -
  - The improvement of vehicle suspension and therefore passenger comfort.
  - The reduction in weight of the chassis if used in place of the more traditional
  - large leaf springs.
  - The reduction of damage to road surfaces

When fitted to commercial vehicles or trailers, air suspension bags are normally located behind the axle they support and are usually found in pairs. When fitted to passenger coaches, and in some cases commercial vehicles, they can be located to the front of the axles and can be found singularly.

The pressure contained within the air bag will vary according to the load on the suspension and will range from 0.5 bars to a maximum of 8 bars. The air supplied to the air bag is normally from the vehicle compressor. The air bag is normally constructed of nylon or similar man-made fibre, with a neoprene/natural rubber lining and outer layer. The basic construction is similar to a vehicle tyre and the risk of injury is primarily through an explosive force caused by the expansion of the compressed air within the bag when Involved in a fire.

6.9.3 Safety Precautions

- All personnel should be aware of the possible presence and associated dangers of such air bag devices within vehicles.
- When attending an incident at which a commercial vehicle or passenger coach is involved in fire, it must be assumed that air suspension units are present.
- If the fire is in the vicinity of such an air bag, spontaneous combustion will occur at approximately 360°C, causing the bag to fail within a short period of time.

- Personnel, when either applying extinguishing media or inspecting the situation, must take precautionary action and avoid standing or crouching in direct line of any air suspension bag which may be involved in fire.
- Personnel must ensure that visors are in the down position at incidents which involve air suspension bags.
- Where it has been identified that vehicle airbags are incorporated within any vehicle, crews must be aware of the presence of undeployed airbags and the risks from activation when they are in close proximity.

6.10 General Safety

The Incident Commander is responsible for the safety of personnel; however FRF firefighters must be aware of their personal responsibility. For multi-car fires a safety Officer may be appointed. At night or in poor visibility, consideration should be given to illuminating the rear of the appliances that are positioned in the fend-off position. Care should be taken to ensure that oncoming traffic is not blinded by such lighting. The Incident Commander in his appraisal of the situation should note and inform crew members of the presence of special risks such as vehicles carrying hazardous substances which may hinder firefighting operations. Where contact is likely with any body fluids, crewmembers must wear surgical gloves underneath their normal protective gloves.

6.11 Liaison with other Emergency Services

On arrival at the incident, the Incident Commander should liaise with the other emergency services. It is imperative that the Incident Commander liaises closely with the ambulance officer to ensure that the casualties are prioritized with regards their treatment, stabilization and extrication. No vehicles or any wreckage (including glass), should be removed from the carriageway unless it is preventing the rescue of casualties, without the prior approval of the Senior Police Officer present. If indiscriminate removal of vehicles or wreckage is undertaken, this may advertently destroy valuable evidence which may be required by the police in determining the cause of the fire/accident.

Preserve the scene, in exceptional circumstances where vehicles are to be moved, the Senior Police Officer present should be contacted, so that their position in the roadway can be marked prior to moving.

SOP 7. STRUCTURAL FIRES OPERATION

7.1 Basement Fire Operation

This Standard Operating Procedure details the precautions necessary when attending or dealing with Basement fires. First Responders and those crews are on the initial response should immediately carry out a 'Dynamic Risk Assessment' covered in SOP/Hazard Risk assessment.

7.1.1 Hazards

- Buildup of heat and presence of a heat barrier on stairs.
- Limited scope for ventilation.
- Contents of basement.
- Limited communications.
- Confined spaces.
- Heavy Smoke Logging.

7.1.2 Initial tactical considerations

- DRA – Dynamic Risk Assessment
- Consider early Make-up – Assistance possibly required for BA, Guide Lines, Protracted working and large amounts of Manpower
- When committing BA crews, OIC should ensure their tactics do not compromise the safety and egress of BA crews that are already committed – Close Control
- Rotate crews regularly – Minimal Exposure
- Consider using PPV if a suitable outlet for exhaust gases can be found – Think (Size Up).
- Use of fixed installations – Do not risk Life if Fixed System is working and NO Life risk inside.

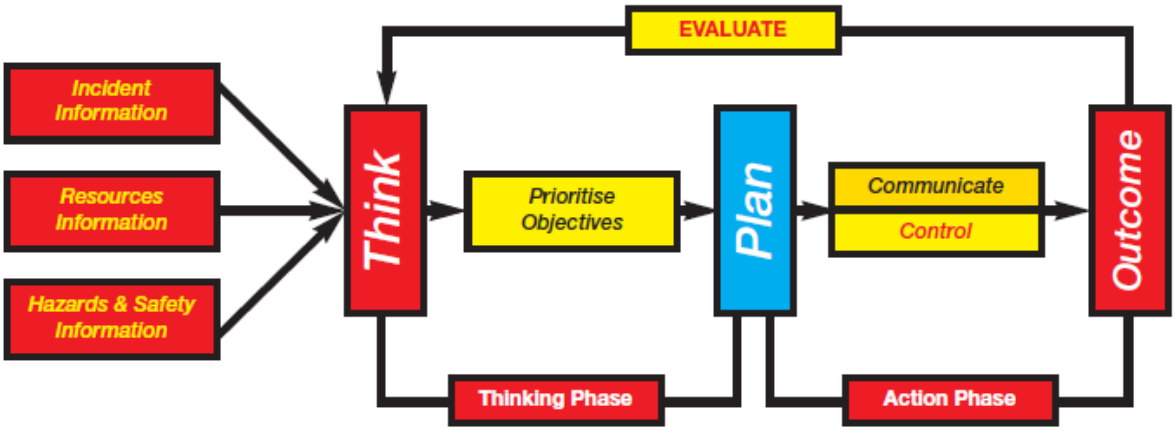
Remember – We risk a lot to save a lot and – we risk nothing to save nothing

7.1.3 Gather Information

In order to protect crews and prepare for what could be a protracted incident the OIC of the crews or IC should begin planning the tactics based on the following information planning:

- Best access and egress.
- Layout and number of levels of the basement.
- Location and nature of fire.
- Presence of built in ventilation.
- Beware of fire spread in shafts.
- Check for fire spread in other floors.
- Look for signs of Flashover and Backdraft.

Summary of Dynamic Risk Assessment Process



7.2 High Rise Operations

For firefighting purposes, a high-rise building is considered one containing floors at such a height or position, or design that external firefighting and rescue operations may not be feasible or practicable. As a general classification of what constitutes a high-rise building, the following is an accepted criterion when defining buildings by their height.

- Low Rise - Buildings up to 4 floors
- Medium Rise - Buildings from 5 to 7 floors
- High Rise - Buildings of 8 floors and above

FRF personnel and mutual aid agencies. This Standard Operating Procedure is prepared as a guideline to be followed by all Officers and Stations responding to any incident involving High-Rise.

7.2.1 Purpose

Standard Operating Procedures (SOPs) are required for high-rise Buildings because of the special challenges presented and the strategies and tactics that must be employed to perform safely and effectively in a high-rise environment.

7.2.2 Hazards and Risks

Hazards of high-rise firefighting are grouped under three headings:

- Building Height and Design
- Fire Behavior and Development
- Firefighting and Rescue Operations

7.2.3 Terminology

1. Design and Construction

   The design and construction of residential high-rise buildings is based on the structure being subdivided into floor sections, then into compartments; i.e. flats.

2. Firefighting Shaft

   A protective enclosure containing firefighting stairs, firefighting lobbies and, if provided, a firefighting lift together with its machine room.

3. Firefighting Lobby

   The protective lobby provides access from a firefighting stair. To the accommodation area.

4. Firefighting Stair

   The protected stairway communicates with the accommodation only through a firefighting lobby.

5. Firefighting Lift

   A protected lift and shaft, that communicates with the accommodation only through a firefighting lobby.

7.2.4 Structural Fire Protection and Fixed Installations

- Dry and Wet Risers
- Lift with Firefighter control switch
- Provision of Firefighting shafts
- Smoke vents (manual or automatic)
- Hose reels / Fire extinguishers
- Smoke stop doors

Integral hose reel systems in high rise properties are only intended for first-aid fire Suppression. These systems vary in performance, the maintenance and performance standards of an integral hose reel system cannot be guaranteed. Therefore, integral hose reel systems are not to be used by FRF personnel.

7.2.5 Operational Considerations

High rise firefighting is unique because of the many problems encountered that are not an issue in low-rise buildings, these can be summarized as:

- Difficulties with accessibility
- Ventilation of smoke
- Heat retention.
- Gaining access to the fire.

7.2.6 The decision that firefighters use stairwells or elevators should be assessed.

Sectorization of High-Rise Incidents is a vitally important for control and containment of a high-rise incident safely and efficiently.

- **Fire Sector**
  Main area of firefighting operations, consisting of the floor(s) directly involved in fire, plus one level above and one level below
- **Search Sector**
  Area of operations, in a high rise, above the 'Fire Sector' where search and rescue, venting and other operations are taking place
- **Lobby Sector**
  Area of operations from the ground floor lobby to the fire sector

- **Bridgehead**

  A formal Bridgehead is established to assist the crew commander in commanding fire and rescue operation. In such instances, the location of a Bridgehead **must** be at least 1 floor below the **Fire Sector** or at the complete discretion of the 1st responding officer or crew commander.

The Incident Commander must determine the status of all Heating, Ventilating and Air Conditioning (HVAC) systems in the building in consultation with the building occupier. Any systems that have not been automatically shut down may have to be manually shut down. Incident Commanders should consider the use of ventilation systems specifically built into the building to minimise smoke logging in areas outside the fire sector, or alternatively the use of positive pressure fans strategically located to prevent / limit smoke contamination outside the fire sector.

7.2.7 Dynamic Risk Assessment

The continuous process of identifying hazards, assessing risk, acting to eliminate or reduce risk, monitoring and reviewing, in the rapidly changing. circumstances of an operational incident. Dynamic risk management is carried out by all personnel at an operational incident. The **main** responsibility lies with the **Incident Commander** who must identify the hazards, assess the risks, then make professional judgments in order to use the available resources in such a way as to achieve an acceptable level of safety during work activities.

An important part of risk management at this **level is the post incident review**. This allows relevant information to be recorded and fed back into the Strategic decision-making process via the Systematic level in order that safety standards can be constantly improved.

7.2.8 Consideration Points for a Dynamic Risk Assessment

- Safety of Crews
- Extent of Fire / Smoke
- Access to Riser Outlets
- Access / Egress to the Bridgehead

- Space required for Personnel and Equipment
- Building Construction i.e. Fire Fighting Shafts
- Standard of Fire Safety Measures in Place
- Possible Escalation of the Incident
- Lateral Fire Spread
- Special Risk **(i.e. LPG Storage, Electrical sub-station)**

7.2.9 Lifts

The majority of multi-storey premises provide a lift, which is available for use by the FRS in an Emergency. Such lifts are fitted with a switch at ground floor level to enable FRS personnel to take control of the lift Some modern lifts have electronic safety devices, which prevent the lift car doors from closing unless contact is maintained on an operating button inside the lift car. This requires a member of a crew to remain with the lift car at all times. Initially this may not take place until supporting appliances arrive It is essential that the procedure for operating the fire switch be known by all personnel for premises within their respective station area.

If using a lift, crews should proceed to the floor below the Fire Sector As a precaution firefighter should wear breathing apparatus during their entering the lift, in case the lift carries them to the floor of the fire in error

7.2.10 Fire Fighting Procedures

Whilst it is not possible to format a procedure that will fit every eventuality, there are several factors that an Incident Commander needs to consider when determining a tactical plan.

- Type of premises - Domestic /Residential, Commercial / Industrial
- Design of, and access into buildings (including Firefighting shafts)
- Availability of resources
- Severity of any Fire
- Spread of smoke and locations of manual or automatic vents
- Additional hazards, e.g. provision of security gates, etc.

One of the primary functions of the Incident Commander is to examine the plans of the building, if available, to identify key factors associated with the building and to ensure that they are fully conversant with the layout. Some basic information such as the location of the fire, any serious life hazards, to what extent an evacuation has been implemented and the status of the lift system must be provided to additional personnel arriving on the scene

7.2.11 Tactical Plan / Incident Size Up

Upon arrival at the scene of a High-Rise fire, the Incident Commander must immediately make a size up of the incident.

- This would include:
- What Floor is the Fire on?
- How will access be attained?
- Lay-out of building
- Location of stairwells and elevators
- Risers / Standpipes, are they wet or dry?
- What equipment will be required to mitigate scene?
- Is ventilation attainable?

- Evacuation of occupants
- Search and Rescue, if required

The size up of a high-rise incident is an ongoing process, as the scene changes from one of an initial attack to extinguishments, the size up will also change.

7.2.12 Initial / First Response

The Incident / Crew Commander is to establish ‘field command’ and should relay the Following information to the central operations room as soon as practical.

- The initial Findings
- The number of floors
- The location & if Possible the floor involved in fire
- The type of building construction
- The nature of construction – (Residential, Commercial or multi occupancy)
- Approximate numbers of persons trapped
- Any Hazardous Materials involved

Consider any pre-plan that the building may have and follow the guidance. Once staffing allows, a crewmember with a radio should be detailed to take control of the lift by utilizing the Firefighters' switch. The crewmember, in conjunction with the IC, will ensure the required personnel and equipment are deployed to the correct scene of ops. The driver / pump operator will run out lengths of hose from the pump to the dry riser inlet. The lines to the dry riser will only be charged on the instructions of the Incident Commander. It is essential that good communications be established between the Incident Commander and Command Support.

Equipment that should be considered when initiating a first response to upper floors in a high-rise incident.

The following list is not exhaustive and may be increased or decreased depending on the circumstances: High-rise packs, including:

- lengths of flaked 45mm hose with attack branch
- Door forcing equipment
- Long Lines

- Hand Lamps
- Firefighters switch key and master keys
- Resuscitator
- CABA Rescue sets
- Hand held Radios
- Guideline

7.2.13 Command and Control

1. The mobilizing Officer reaching the incident has to:
   - Initiate the command structure
   - Define a location for command and control and officially announce it
2. The Second and more senior officer arriving at the incident should:
   - Take over the command and appoint the first officer as ‘scene’ operations commander
   - Establish overall command and liaise with the other agencies at the scene i.e. Police, Ambulance etc.
   - Communicate and discuss with the persons in charge of the building

Force able Entry

When there is a need to open/break a door, we must request the attendance of the police. A written permission should always be taken from the police, then the crew may forcibly open the door. Care should be taken to ensure that no body is behind the doors so nobody gets hurt. And then the site to be handed over to the police officer in the station.

Action to be taken by second responding crew

The crew Commander of the second responding crew should announce their arrival at the incident to the central operations room (control) and is responsible for ensuring the incident / crew Commander of the first responding crew has sufficient resources to deal with the incident. For Emergency protection of firefighters, and as soon as resources allow, an additional covering jet should be run out from the bridgehead to the entrance of the firefighting lobby / scene of operations If no contact can be made with the Incident / Crew Commander of the first responding crew, a further team of two breathing apparatus

wearers should proceed to the scene of operations to render any assistance necessary. Any additional crewmembers will assist with the water supply and check landing valves on the additional floors of the building to ensure these are in a closed position.

Action by any additional crews

Upon arrival, contact should be made with the Incident Commander through Command Support. The Incident Commander will determine where the additional crews / resources will be deployed. The Incident Commander should consider the need for crews to be deployed to the floors above the fire floor to verify the safety of occupants in this part of the building.

Arrival of the first Arial appliance (ALP)

Upon arrival, inform the Incident Commander and take instructions as to the tasks, these may include:

- Transport equipment to the upper floors
- Assist with ventilation equipment
- Securing the illumination means

7.2.14 Ventilation

Effective means are needed to minimize the possibility of serious contamination of the firefighting shaft by smoke. This is achieved having due regard to the configuration of each particular building via a number of means including:

1. **Natural ventilation**

Systematic removal of heated air, smoke or other contaminants by careful use of the wind, convection currents and other natural phenomena without the introduction of mechanical means.

2. **Pressurization System**

The use of a mechanical system for the purpose of creating a pressure differential within a structure.

3. **Positive Pressure Ventilation (PPV)**

Consideration should be given to the use of using PPV as a device to pressurize stairs to maintain egress (evacuation). In view of the differing methods of achieving ventilation within high rise buildings, crews should carry out site specific visits as part of the training programme to high rise buildings within the station area. Before operating any systems or undertaking ventilation the Incident Commander will need to consider any adverse effect on the fire development and ensure personnel in any affected areas are appraised of the proposed operation and where necessary withdrawn from the area before systems are operated.

The mobile operations unit

- On arrival at the incident report directly to the Incident Commander and be ready to locate in a safe and accessible position as directed
- Secure a wireless communication network
- Establish links with other emergency control units (share information)
- Relay all necessary messages back to the central operations room

The Breathing Apparatus vehicle should:

- Report arrival to the Incident Commander and take instructions from there as to the actions & duties
- Be ready with support equipment and Apparatus
- Initiate Firefighter rehabilitation and rehydration

Rehabilitation unit:

1. Check-in with the IC on their arrival to the incident, and get his orders and tasks.
2. Provide water and saline solution.

7.3 Confined Spaces

This Operational Tactical SOP has been produced to give guidance for Firefighting in Confined Spaces. The main purpose is to highlight Safety and Protection measures in

order to conduct Firefighting tactics for crews in a safe and controlled manner. Fires inside Buildings:

7.3.1 Firefighting procedures at incidents

1. Door Procedure

- Get in safe position prior to opening door
- Check conditions around door
- Set branch ready to operate when required
- Crack open door, check conditions inside

Apply water to:

- ✓ Check temperature inside compartment
- ✓ Cool Fire Gases inside doorway

Step 1

Step 2

Step 3

2. Temperature checks

Purpose

To check on the temperature and height of ceiling, above the team

Frequency

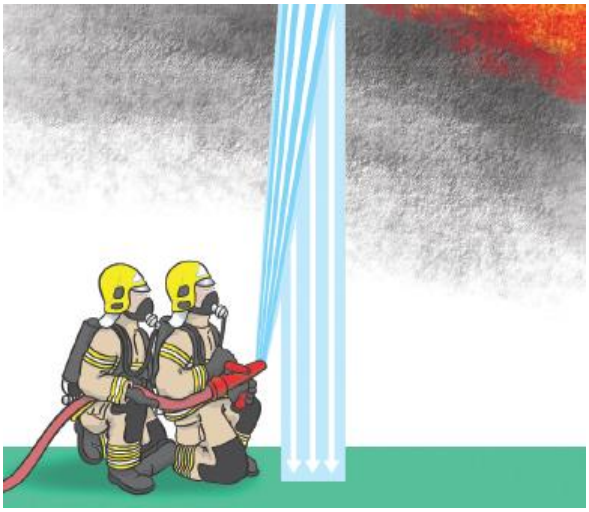
Prior to entering a compartment, Periodically in a compartment

Application

Single Pulsation’s of narrow spray aimed directly into the ceiling above the team

Ensure

Droplets of water are seen or heard on the floor



3. Observing Conditions

Whenever a team is inside a compartment, they must constantly check on their surroundings to ensure, Conditions are not deteriorating Flames are not passing overhead (ignition source) Combustion, paralysis is not occurring behind Team leader Observes above and in front No 2 Observes above and behind

4. Position of Firefighters

- ✓ Whenever firefighting inside a compartment.

- ✓ Constantly observe the conditions.
- ✓ Check to ensure it is a “safe” place to be.

Always consider:

- ✓ Maintaining position
- ✓ Withdraw
- ✓ Advance

5. Maintain position

Constantly observe the conditions. Apply water using indirect/gas cooling techniques to protect the team and attack the Fire Gases.

If the conditions deteriorate, withdraw.

If conditions improve, consider Advancing.

Position of Firefighters and Maintain position

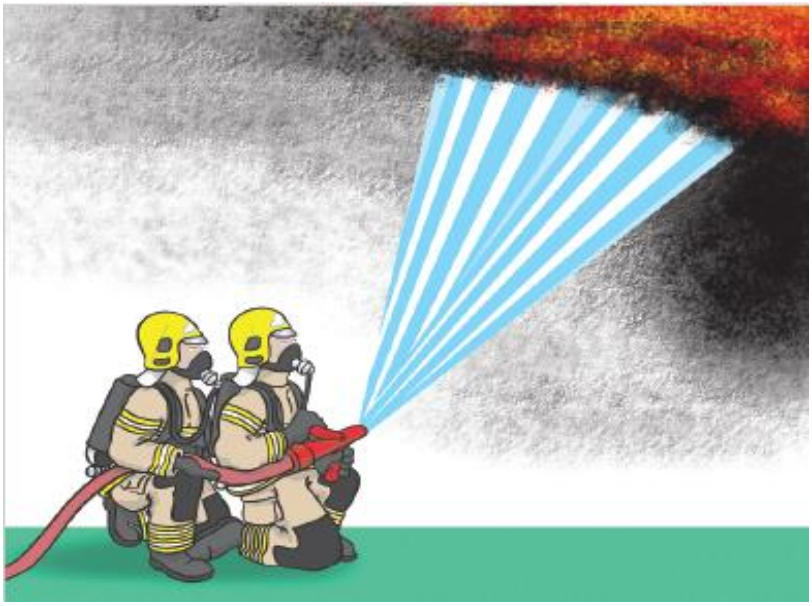
6. Withdraw

Always withdraw to a safe position.

If you cannot control the fire.

The amount of water required to control the fire, pushes the steam/neutral plane down on to the firefighters.

Your Water Source Runs Out.

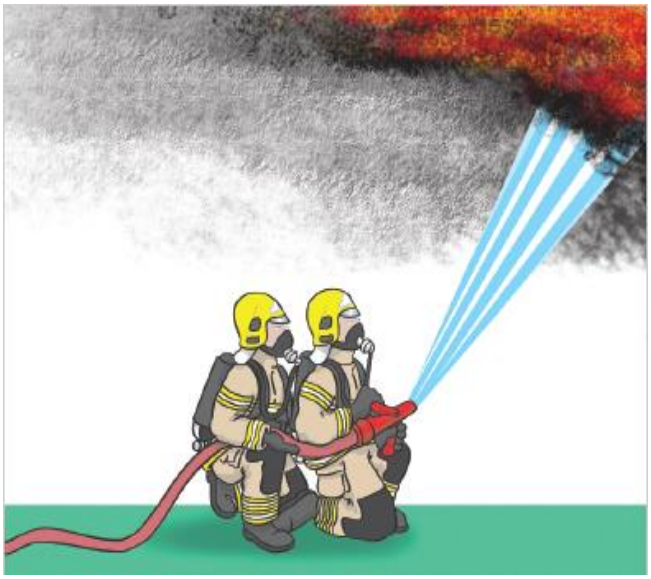


7. Advance

Constantly observe the conditions.

Apply water using indirect/gas cooling techniques to protect the team and attack the Fire Gases.

If conditions deteriorate, withdraw or maintain position



8. Moving into another compartment

Before opening the door

Ensure the compartment you are in is safe.

Cool fire gases with gas cooling technique.

Ventilate the fire gases to open air.

Spray droplets of water in the atmosphere.

Sprinkle water on any combustibles around the doorway and ceiling, to prevent paralysis'.

Before opening door

Cool Gases

Ventilate Compartment

SOP 8. DOMESTIC FIRES OPERATION

This instruction gives guidance on the operational procedures to be adopted at fires involving single occupied dwellings and buildings of four floors or below.

8.1 On arrival

On arrival the appliance should be positioned in a suitable location which will not block access for rescue operations or create a blockage for the attendance of other emergency services. The Incident Commander should also consider:

a. Initial attending appliances are positioned to ensure that they do not compromise the positioning of other appliances which may form part of a make-up.
b. Appliances are positioned to ensure they do not become involved in the incident.

8.2 Dynamic Risk Assessment

The Incident Commander must carry out a dynamic risk assessment in accordance with service operational policy, before selecting a system of work. The risk assessment should be based on the safest method of tackling the incident, without compromising the safety of firefighters. The assessment should also include determination that existing procedures are appropriate and whether additional resources are required.

This may include specialist or height appliances police for crowd control, or ambulance for casualty care. It is imperative that Incident Commanders clearly indicate to personnel the tactical mode of operations to be adopted as stipulated in service operational policy on Incident Command, i.e. offensive or defensive mode.

The Incident Commander should also ascertain at an early stage the following information: -

a. Whether all persons are accounted for.
b. The location, size and extent of the fire.
c. The presence of specific hazards, e.g. gas cylinders.
d. Location of services
e. Is sectorization required?
f. Is property occupied or derelict?

8.3 General Firefighting tactics

Once an initial system of work has been formulated and before crews are deployed following their briefing, the Incident Commander should consider the following:

a) Whether the risk of a flashover or back draught is significant and steps to be taken to limit this risk
b) Ensure that fire-fighters access and egress to the building is not compromised at any time.
c) Ensure that communications on the Incident ground and between the Command Support Vehicle and Fire Rescue Force Control are managed effectively.
d) Ensure the efficient management of water supplies and appropriate weight of attack on the fire. Sufficient hose should be laid out to allow crews to advance through the building without the future need to advance a length.
e) The appropriate and safe use of Breathing Apparatus as defined in the operating procedure document on breathing apparatus Command and Control.
f) The appropriate and safe use of ladders or aerial appliances to effect rescues. A dynamic risk assessment should consider if a height vehicle could be used instead of a ladder.
g) Damage Control operations should be carried out only on the orders of the Incident Commander.
h) During turning over and damping down operations, all personnel should be aware of the possibility of biological contamination from debris. To avoid contamination an appropriate level of PPE must be worn and all cuts/grazes covered.
i) When removing debris from the building, firefighters must ensure this is carried out safely and with minimal impact on the environment. Debris should not be removed unless on instruction from the Incident Commander, who must assess if the fire is suspicious and requires further investigation by police and Fire Rescue Force staff.
j) When considering the disconnection of services, the impact on any sensitive medical equipment e.g. kidney dialysis machines must be borne in mind.
k) The limitation of non-Fire Rescue Force staff into the hot zone.

8.3.1 Fires in buildings of four floors and below

There are a number of specific considerations that Incident Commanders must bear in mind when attending fire incidents at dwellings and blocks of flats. Where a block of flats

is involved in a fire incident, early consideration must be given to identify which properties are known to be vacated and those which still may have persons within. It is imperative that all flats are properly searched and confirmed as being unoccupied so that all persons can be accounted for.

If occupants are visible at windows and trapped by smoke, it is vital that once contact is made with the person it must be maintained. This is crucial for reassuring the occupant, and monitoring their circumstances in case it becomes necessary to rescue them via ladders or a height vehicle. All personnel who have had contact with, or have discovered the location of a trapped occupant must make this information known to the Incident Commander as a matter of priority.

When dealing with a fire situation in a block of flats, it is desirable to keep the communal stairwell clear of smoke mainly so that any occupants evacuating their flats emerge into a breathable atmosphere. If time permits, consideration should be given to creating a high-level vent within the stairwell prior to opening the door to the flat on fire. This can assist in ensuring that smoke entering the stairwell can ventilate readily.

Once the fire is extinguished the stairwell can then be rapidly ventilating, by the use of positive pressure ventilation fans if necessary. Tactical ventilation operations must be conducted only by crews trained in their safe operation, and on Instruction of the Incident Commander. Fire Rescue Force Control must be informed they are in use as part of a standard incident ground message.

8.3.2 Basement fires

If dealing with a fire in a basement consideration must be given to the unique problems that may be present. These include:

(a) Difficulty in access/egress.
(b) Limited scope for ventilation.
(c) Difficulty in assessing the nature of the fire.
(d) Potential difficulties with communications.
(e) The presence of a heat barrier.
(f) The increased risk of heat stress to firefighters.

The Incident Commander must consider what additional resources will be required, especially with consideration to breathing apparatus wearers' suffering from duress. Crews may be required to be rotated after twenty minutes.

8.3 3 Working on roofs

It is undesirable to have firefighters working on roofs, especially at significant height. Whenever possible an aerial appliance should be utilized; however, it is recognized that there will be occasions when it is unavoidable. In those circumstances all operations should be carried out with safety as the main priority and always ensuring that the part of the roof in question has not been affected by fire and is structurally sound. The Incident Commander should consider appointing a Safety Officer to oversee safe working at height operations as part of his strategic plan.

8.3.4 Additional safety and welfare considerations

a) Where roofs, floors, ceilings and staircases have been involved in fire there may be the potential for collapse.
b) The gas, electrical and other utilities serving the affected property should be isolated as soon as possible.
c) On all occasions when there is the potential for respiratory damage to personnel then BA should be worn.
d) Personnel should be aware of the stress that the involvement in incidents causes to members of the public and therefore should act accordingly. Police personnel should be resourced for dealing with householders and members of the public who are acting irrationally and aggressively toward firefighters.

8.4 Training

All personnel are to ensure that competency in attending these types of incident is maintained. This should form part of the ongoing station personnel training programmer.

8.5 Fires in dwellings

The following provides a brief summary of the main considerations:

- Position of appliances in terms of hazards and support

- Information gathering
- Dynamic Risk Assessment
- Safe System of Work
- Priorities Objectives
- Estimate level of assistance if required
- Formulate plan and Communicate
- Appropriate level of PPE
- Ensure effective communications
- Manage water supplies and breathing apparatus
- Use of Special appliances or equipment

Always remember the health, safety and welfare of colleagues and members of the public is paramount.

SOP 9. LIFT INCIDENTS

9.0 Scope

Healthcare premises are dependent upon lifts to provide an efficient and comfortable vertical transportation service for the movement of patients, staff, visitors, medical equipment and ancillary services items. All lifts are subject to strict statutory regulations which cover operational safety to ensure that passengers can be fully confident that the lift service is safe to use.

Travelling in a lift can be perceived as dangerous by persons of a nervous disposition, in several different ways, but mainly from the notion of being Isolated in a sealed box inside a vertical well which extends from the lowest ground floor level to the top floor of the building. A common claustrophobic fear is that of being trapped between floors without the means to communicate with persons outside to give warning of the predicament or to receive reassurance that assistance is at hand.

9.1 Safety applications

The legal responsibility for ensuring that lifts are properly maintained rests with the management of the premises in which the lifts are Installed. At present, while there is no legal requirement for new lifts to be tested before being taken into service, it is strongly recommended that all lifts should be examined and tested in accordance with an Internationally recognized Standard. Fire practice require that certain lift controls can be operated by the fire Emergency Crews so that firefighters can take immediate control of the lift for safety and fire-fighting purposes.

9.2 Functional overview:

9.2.1 Types of lift

1. There are two main types of lift generally installed in premises, these are:
    a. traction lifts;
    b. hydraulic lifts

a. Traction lifts

Traction lifts are most commonly used in high-rise buildings. They are Rope-driven where the drive is by an electric variable speed motor, through a gearbox. This type has a lift car which travels vertically up and down a lift well between the lowest ground floor and the top floor.

The lift car's weight is counterweight balanced throughout its full travel in the lift well. Magnetic brake systems control the lift car movements between landing levels. In the event of an over travel, the bottom of the Sitwell is cushioned by a buffer recoil mechanism.

The top is protected for the safety of maintenance personnel, by first and second over travel limit switches to give adequate top of car clearance. The traction lift is versatile and can be designed to operate at very fast speeds, such as is required in high-rise buildings. Passenger lifts can routinely carry up to 21 passengers (1.6 tones) at speeds of 0.5 to 3.5 metres per second (100 to 700 ft/min), depending on travel and duty.

b. Hydraulic lifts

Hydraulic lifts are suitable for applications in low-rise buildings, usually up to a maximum of four floors. They utilize less plant room space and, in general, the overall capital cost is lower than the traction lift. The hydraulic lift is powered by oil- operated ram(s). For the direct acting type, the rams are located below or to the side of the lift car and for the indirect action type it is usual to have a driving mechanism with a side jack arrangement.

The extended vertical length of the ram is physically limited and this in turn limits its suitability for low-rise buildings. Hydraulic lifts generally operate at a slower speed in the raise direction than for lowering. Lowering is by gravity, and is speed controlled by restrictors in the hydraulic oil return path from the ram(s) to the hydraulic pump reservoir tank.

9.3 Special lift designations

9.3.1 Fire-fighting lifts

The need for fire-fighting lifts in a new building needs to be determined by the design team, in conjunction with the Fire Safety Regulation and standards required for the building. The Lift machine room should be contained within the same protected shaft as the Lift well.

Where the Lift lobbies are pressurized, in the event of a fire the shaft should not be ventilated to the atmosphere. If the lobbies are naturally ventilated, due to being located on an outside wall, the lift wells should be ventilated directly to the atmosphere via a Louvre grille of not less than 0.1 m^2 free area. This will prevent the build-up of smoke at the top of the well.

9.3.2 Lifts and Machinery Rescues

The Fire and Rescue Force is the main service to deal with lift rescues. We may also be called to incidents where persons are trapped in machinery, in order to utilize the equipment and crews. Where members of the public are injured, the FRF Paramedic service is responsible for the patient's treatment.

9.3.3 Lift rescues fall into two categories

Where persons are marooned in the lift car and it has stopped between floors, or the door mechanism will not open. Where persons are trapped in the lift mechanism.

9.4 Lifts types

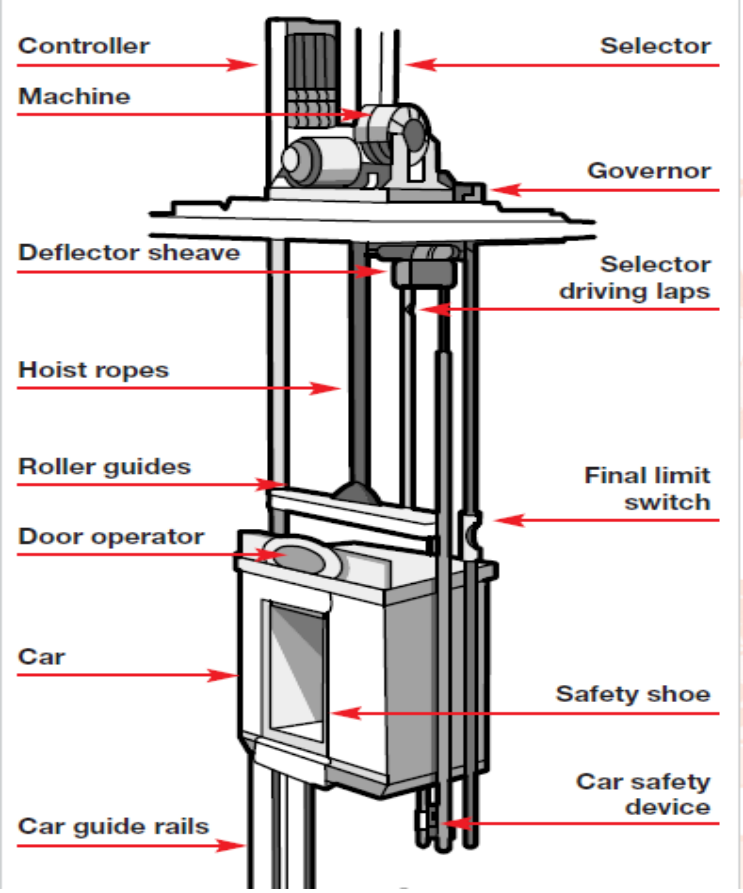
Lifts are categorized in two ways: electric and hydraulic. It is important to recognize the difference and firefighters will visit installations in their station areas, noting where each type of lift exists.

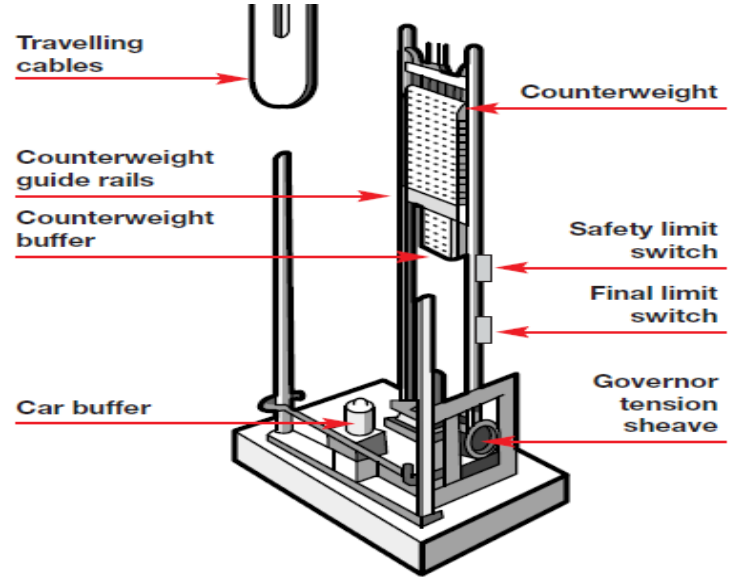
9.4.1 Electric Lifts

1. A passenger car, which is suspended by steel ropes from a winding mechanism.
2. The car runs in guides so that the car only moves in a vertical direction.
3. A remote control is necessary for control to be exercised by anyone in the lift car, or on any landing area.
4. A counterweight which balances the weight of the lift car plus 50% of the load.

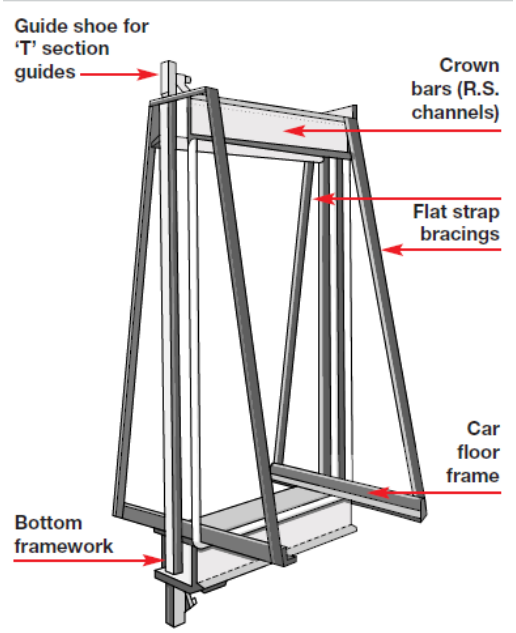
9.4.2 Driving Mechanism

The winding mechanism consists of an electric motor, gears, brake and a pulley wheel over which the wire rope runs. It is housed directly above the lift shaft.



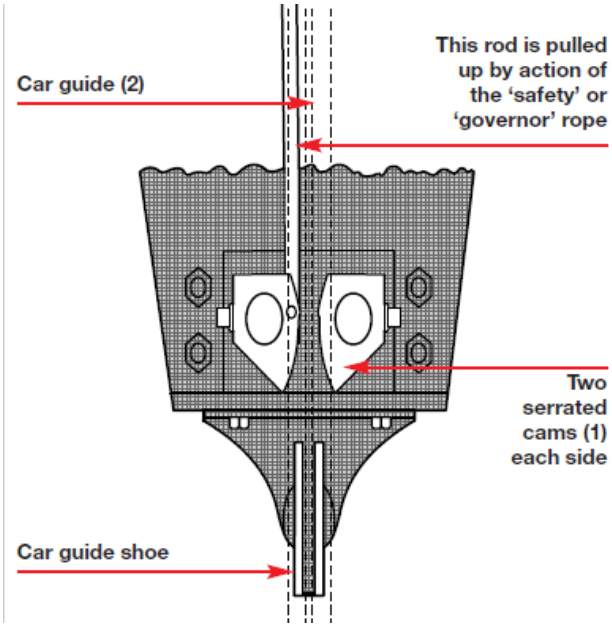


Lift Car



The lift car consists of the framework and the car bodies. The framework supports the Safety gear to each side, the lifting ropes at the top and the car bodywork on the inside. Some lifts have a trap door in the roof.

Safety Devices: Serrated Cam Type (Instantaneous)



These are designed to prevent any uncontrolled descent of the car and clamp the car to the guides. Once operated, a lift engineer is required to be in attendance on site to move the lift and return it to its operational state.

9.4.3 Gates, Doors and Keys

There are several different types of gates and doors, all designed to open only when the car is at a landing. Lift keys are special devices made to fit through a shaped opening in the outer doors, allowing them to open when the car is not at that landing.

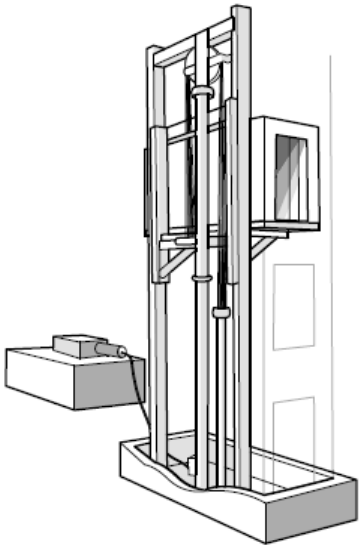
This is essential for firefighters when dealing with persons shut in a lift. Generally, lift keys are not held on fire appliances, but each premise will have one suitable for their system. They are not keys as such, but pieces of metal that will pass through the outer door to release the door latching mechanism.

9.5 Hydraulic Lifts

Occur in a variety of buildings of up to four floors and consist of:

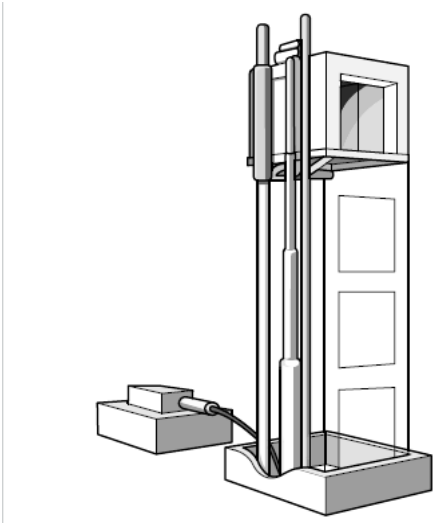
1. A car with a hydraulic ram fixed to the car framework (Direct) or via chains or ropes to the top of car (Indirect).
2. Guides so that the car can only move in a vertical direction.
1. A remote control that will open a switch to either the pump or to the exhaust line. This will be activated from the car or from any landing area.

Driving Mechanism: Direct Acting



This consists of an electrical controller, an oil reservoir, a motor and pump unit and a control valve. When the lift is required to rise, the controller starts the pump, which drives the oil into the cylinder, forcing the ram up.

Indirect Acting



When the lift is required to lower, the control valve will allow oil to return to the reservoir and the car descend under the influence of gravity. Direct hydraulic lifts do not have the safety devices of an electrical lift, but have pipe rupture valves at the oil inlet to the jacks. If one of these valves have operated, a lift engineer is required.

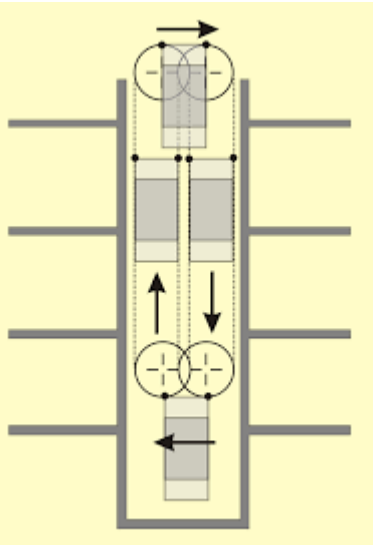
9.6 Escalators

Incidents involving escalators are rare but firefighters should familiarize themselves with systems in their station areas. If an incident occurs, top and bottom landings should be blocked off and the motor assembly accessed (usually on the upper landing). With the electric power isolated, hand winding can be initiated. The only reason for needing access would be if people were trapped by the escalator treads and could not free themselves.

9.7 Paternoster Lifts

These are rare and consist of a series of chains, which move continuously in a clockwise direction. Each car is suitable for two persons, and they provide up and down movement

at the same time. An emergency stop button is provided and can only be reset with a special key.



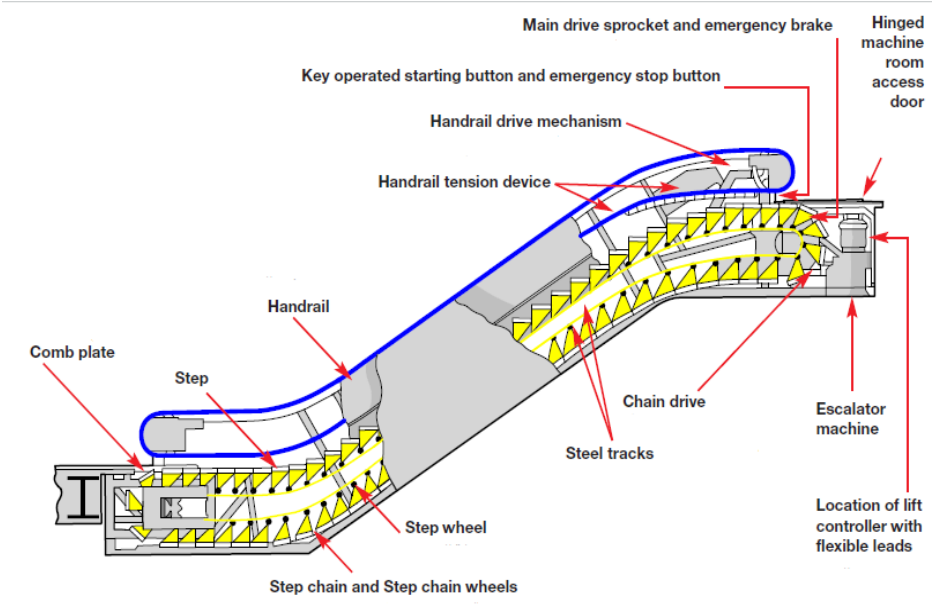
9.8 Rescue from Lifts

The type of lift needs to be identified, the motor room located and two firefighters will be sent to it. The electricity supply to the individual lift must be located and isolated by actuation of the main isolation switch. Good communications are essential between all the crew and hand held radios are ideal. The landing door above the car will be opened using a lift key and the cables can be assessed. If hand operation of the motor is possible, then it will be obvious which way to win the car. It is easier to wind a full car down and a lightly loaded car up. It will be immediately obvious to the person on the winding mechanism that is easiest (because of the effort involved).

Once a landing area is reached, the automatic door locks will allow the door to open and the occupants to be released. The system should always be left isolated until a lift engineer attend. Hydraulic lifts will usually be able to be lowered by operating a valve at the pump assembly. This is usually well marked and personnel should ensure that they know where it is and how to operate it.

9.9 Releasing persons trapped in machinery

Always ensure medical aid is summoned and then isolate the power to the system. The usual method of release is to operate the mechanism in the opposite direction to when being trapped. Care must be taken to ensure the correct direction of rotation is used. However, it is not possible to explain a definitive method of release in any situation. It will always be necessary to assess the position and form a plan to affect the rescue. It may be necessary to dismantle the mechanism and if possible, utilize the experience of a site engineer.



SOP 10. PRISONS AND CORRECTIONAL CENTRE

10.0 Introduction

The broad purpose of this standards is to develop a framework of acceptable fire Operations and fire safety precautions which can be sensibly applied within the constraints of fundamental security and operational requirements. It is not possible to make comprehensive and precise recommendations capable of Covering all situations due to the constraints mentioned and nature of the establishment. However, a reasonable degree of flexibility should be exercised to allow for realistic and rational solutions to difficult situations.

10.1 Scope

This SOP will specifically address the Operational Safety issues in dealing with incidents at prisons, detention Centres and correctional establishments. By the nature of these Centres the emphasis is on the security and integrity for the 'inmates' and will require a different plan of action in case of any incident resulting in the attendance of FRF crews and personnel.

10.3 Fire Intelligence

It is strongly recommended that FRF personnel visit such Centres in and around their station areas. As each particular site will have its own set of different issues and hazards to consider. Therefore, a 'Fire Intelligence' report should be made available for

a) the station who's area centre is in and;

b) the Operations Room for general viewing.

10.4.0 Initial Response & Operational Tactics

10.4.1. Operations Room

On receipt of a call to any incident at a Prison, Detention and / or Correctional Centres, as much information as possible should be obtained as to the nature of the incident, example: 'State of Alarm' and Security of the centre.

This MUST be immediately relayed to Senior Officers:

- Full Information
- State of the Alarm
- Security of Centre

10.4.2. First Response

Officers and crews responding to these incidents must be aware of the security nature and stability of such a security system put in place to keep individuals segregated and in certain cases individuals may be restrained and their individual movements could be controlled and restricted.

This obviously puts a new dimension on to a FRF operational roll and perhaps a new set of tactics will be required in order to deal with the situation.

- Initial Size-Up & Assessment
- Consider the Security Aspect of the Centre
- DO NOT Begin any Operations until discussing Tactics with Senior Officer in-Charge

Important Operational Consideration

'Officers in Charge' and *'Incident Commanders'* must be disciplined towards their actions and must be guided by the Correctional Officers at the site.

All efforts must be made so as to reduce the tension and lower the stress levels of individuals and / or inmates. For example, on approach to the site ALL vehicle audible & visual warning devices, i.e. sirens and flashing lights should be switched **off** on approach to the centre, so as not to cause any increase in the stress or excitement of the inmates. **Once in attendance, fire crews should remain seated in the fire engine and await further instructions from the *Officer in Charge / Incident Commander***

10.5. Operational Tactics

- The Officer in Charge or Incident Commander will assess the situation ***(Size-Up)*** carry out a ***Dynamic Risk Assessment (DRA)*** and direct his crews accordingly as the incident dictates.
- In case of Rioting, Uprising or Disorder, DO NOT send crews into any buildings, without close protection from Guards on duty, and in such cases the Incident Commander should discuss all tactical and operational options with the Senior Prison Official present and decide on a plan of action, always considering the safety of FRF crews.
- In the event of a non-violent incident and when assurances have been provided that there is 'Inmate Control' then entry may be possible for BA search and rescue and firefighting measures to be undertaken. But remember; always continue with the ***DRA*** in order to monitor any changing circumstances.

10.5.1 Entering the Building

When and if fire crews are requested to enter the building, for Firefighting and/or Rescue purposes, always wear full PPE, including BA and where possible a safety guideline should be used, to safely re-trace the steps to exit and safety.

10.5.2 Entering A Cell

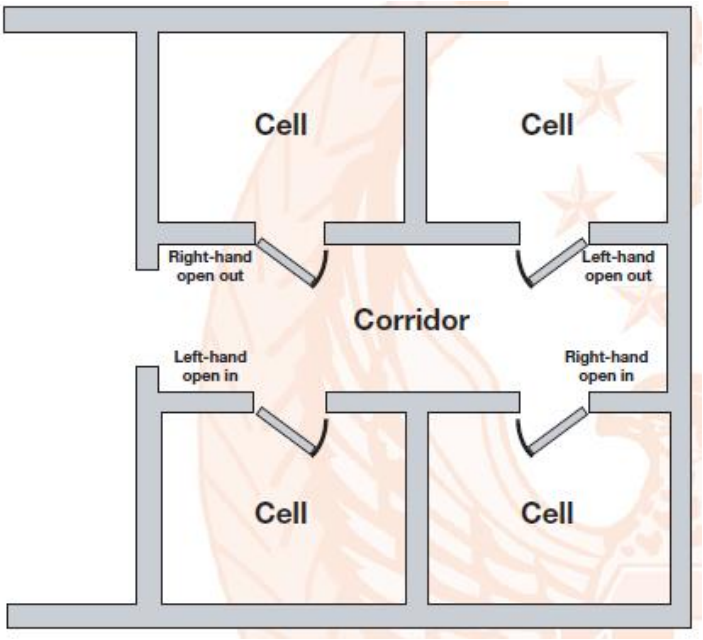
Never enter a cell without firstly shooting the lock, in the closed position, on the cell door. This will prevent the door closing and self-locking with you on the inside.

10.5.3 Operation

To unlock: *Turn key until stopped, then turn handle to withdraw main deadbolt. As the door opens, the release of the small stud bolt automatically retains the deadbolt in the withdrawn position.*

To lock: *Shut door. The action of shutting the door depresses the stud release bolt. This automatically releases the main deadbolt into the lock keep.*

Layout - Hand and opening of lock



Generally, the actual firefighting required is minimal under normal circumstances, with the effects of smoke being the largest threat. As normally in the accommodation blocks there is very little that will readily combust and lead to a more serious developed fire. Therefore, once any snatch rescue has been made, and conditions are appropriate for Ventilation procedures, they should be considered as early as possible in order to vacate the area from smoke.

This may have to be by a ‘forced ventilation’ method because the nature of the building and its construction. A gain this must be communicated from the Incident Commander to the Sector Commanders and the BA Control Officers, who will relay this information to the crews working inside the building.

Never begin Ventilation procedures without firstly checking the safety of the crews operating inside the building. Direct communications are preferred by means of *'TETRA'* however, in the absence of radio's **Do Not** assume things are safe.
Ventilation, especially forced ventilation can quite easily spread the fire and add to its development. For this reason, crews operating on the inside should always be prepared to protect against fire spread due to sudden ventilation tactics being applied.

In ***unusual circumstances*** the fire can be of course more serious and quickly become developed. In this case a proper ***'Risk Assessment'*** should be undertaken, with fire officers, and an informed decision made as to what ***'Tactical Mode'*** is to be entered into:

- **Offensive** – Committing Crews inside the building
- **Defensive** – Tackling the fire from outside the building
- **Transitional** – Standing by awaiting further instructions

In all of the above cases, clear information must be relayed to the Operations Room, so as Senior Officers may be informed accordingly.

10.6 Cordoning

The establishment and control of the Inner and outer cordons are particularly important with this type of incident because of the security element required. The Police should be responsible for the outer cordon, with a FRF Sector Commander in position for the Inner Cordon. Under NO Circumstances should non-official personnel be allowed to enter or exit these cordons without strict approval.

SOP11. ANIMAL SANCTUARIES AND ZOOS

11.0 Introduction

“Zoos and animal sanctuaries are unique because they have a wide range of issues to consider. Animal health and safety is important, and the health and safety of employees and guests are also very important, public safety at these Centres are also paramount.

“Animal enclosures are designed very carefully to meet all regulations and ensure that visitors are never endangered during their visit to the zoo. Enclosures are designed to appear as though animals are close to spectators, when in reality, there are fences, moats and many other tactics used to create this visual illusion.”

Overall, the safety and health of employees, guests and animals are critical in the zoo environment. A great deal of time, design and safety precautions must be taken to ensure that employees and guests return home safely, injury and illness-free to their families each day while animals remain safely in their enclosures. Unless you are a regular visitor to these such centres, then it is quite possible that little is known as to the type and nature of the animals and species kept within the facility. Obviously, each station with such a facility within its area should make a site visit so as to familiarize with the staff and make a note of any special requirements regarding Operational tactics and particular procedures required for any specific animal kept within the centre.

Designing new enclosures and upgrading older zoo facilities is key to successfully ensuring they are adequately equipped in the event of a fire emergency. Early warning fire detection and alarm systems are monitored around the clock, which allows for an immediate response by first responders. Automatic sprinklers also are installed in animal buildings and will activate to contain and extinguish fires, protecting animals and their enclosures.

11.1 Calls for Fire on Zoo’s and Animal Sanctuaries.

If smoke or a fire is detected, Base/Dispatch must be notified immediately that there is a “Fire Emergency” via radio or phone. A staff member may attempt to extinguish the fire if

it is contained and they are trained to do so. Everyone must avoid jeopardizing their personal safety or the safety of others.

The decision to evacuate all or part of the zoo/aquarium or will be decided by the Incident Commander. Base/Dispatch will notify 114 Fire and Rescue and send security officers to the affected area to assist the Incident commander and/or designated Safety Coordinators with crowd control, directing guests to exit locations, etc. until FRF arrive on the scene. Once a decision has been made to evacuate all or part of the zoo/aquarium, Base/Dispatch will announce the decision on radio (e.g., “Channel One” all-call) and give instruction using the PA system. It is especially important for employees to remain calm and helpful.

Visitors will be understandably concerned and will be influenced by the demeanor of employees. Calm reassurance by employees will help minimize the anxiety level of guests and facilitate a safe and orderly evacuation.

In most zoo and aquarium environments, the animals are confined within their space and may not be able to escape from exposure to smoke or fire. The intent of a fire safety inspection is to identify and minimize fire risks through actions such as limiting combustible materials, identifying and following proper storage methods, and in some cases developing alternate methods for certain work such as welding.

11.2 Response to Fire Emergency

Every Zoo and aquarium should take precautions to prevent fires, to detect fires if they arise, and to safely evacuate fire-affected areas if needed. Designated Safety Coordinators in each 50 department/area should establish the designated assembly point for each particular work area during the institution’s fire emergency awareness planning/training meetings. Employees should report any fire hazards to their supervisors and/or security. It is the responsibility of each employee to know the location of fire extinguishers, pull stations, and emergency exits in their work areas. For this example, “Fire Emergency” is the local zoo’s Fire Emergency code.

11.2.1 Operations Room

On receipt of a call to an incident at a Zoo or animal sanctuary, it is essential to get as much information as possible from the caller, so as to give a full and detailed brief to the Officer in Charge attending the incident.

- Known Type of animal / species
- Is the animal keeper present?
- Is there a 'lock down' in operation
- Is there a Veterinary Officer or animal Welfare Officer Present?
- Are there members of the Public present?

11.2.2 Base/Dispatch Communications

Base/Dispatch will facilitate and coordinate communications during the emergency, including required telephone notifications, contact with the Incident commander, directing external 51 emergency personnel to appropriate access points, coordinating the delivery of necessary resources (personnel, equipment, vehicles, etc.) to the site, etc. The Communications Coordinator/Base/Dispatch Officer will complete an emergency-specific incident report.

11.2.3 Initial Observer

- Any staff member detecting smoke or other signs of fire should calmly assess the situation and, if the fire can be easily extinguished in a safe manner without causing alarm or panic to others at the location, take immediate steps to extinguish the fire.
- The Initial Observer should immediately report smoke, other signs of fire, and all fires to Security/Base/Dispatch via radio or phone. They should announce their name, and the nature and the location of the situation, and request confirmation from Base/Dispatch. (e.g., "This is Sherry in Human Resources; I have a Fire Emergency in the mail-room in the Administration Building. Base/Dispatch confirm.")
- After Base/Dispatch confirms the communication, the Initial Observer should remain on the scene if it is safe to do so, and meet the Incident commander. If the Initial Observer determines that it is unsafe to remain in the building, they should report to the nearest pull station, activate the alarm, and exit the building.

- The Initial Observer should report to the designated assembly area for the location and stand by to provide Fire and Rescue Personnel with information regarding the source of the fire for the duration of the incident and post-fire investigation.

11.2.4 All Staff

- Once a Fire Emergency is announced over the radio, all routine radio traffic must cease in order to keep the radio free for emergency coordination. Only relevant radio transmissions should be aired. Keep all transmissions brief and to the point.
- The first radio responses acknowledging the Fire emergency call should be made by Base/Dispatch, the Incident commander, or the Communication Coordinator. Other necessary responses and acknowledgements should be held until these critical radio calls have been transmitted.
- To avoid causing confusion or delaying Fire and Rescue personnel en route to the location, no one should enter the area without instruction from the Incident commander.

11.2.5 Officer in Charge of 1st Response

First responding officers / Incident Commanders when attending an incident at a Zoo or animal sanctuary, must; before initiating any firefighting tactics or procedures, liaise with a senior warden or center official, so as to ascertain the type and nature of animal or species kept on the premises and to get confirmation as to the current status of any animals, i.e. locked away or secured etc. Then confirmations should be sought as to the location of particular animal welfare officers or general veterinary officers and in the case of marine life, a marine biologist.

- The officer in charge should carry out a Dynamic Risk Assessment (DRA) as soon as possible and a plan of action be drawn up. This should be done in consultation with the senior warden or Incident officer present at the centre, considering their own Emergency Plan for such an incident.

- Full P.P.E. must be worn at all times during the incident and cordon's established, with the Police strictly in control of the outer cordons and particularly the entrances and exits of the centre / facilities. The inner cordon should be manned by a sector

commander and a Breathing Apparatus Control Officer (BACO). Minimize the use of Flashing Lights and Hazard warning devices (Siren), so as not to spook the animals causing more stress.

- Following an initial ‘Size-Up’ and appraisal together with the senior warden or animal welfare officer, a clear definition of the incident and the status of the animals should be relayed to the Operations Control Room at the earliest opportunity.
- Do Not Underestimate the number of personnel that may be required to assist in any evacuation and control of any Animals from within the centre, unlike people who can make their own way when directed to a place of safety and to exits. The Animals will require personnel to evacuate if necessary, again under the strict supervision of the animal welfare officer.
- Remember, animals tend to get spooked and very stressed in the presence of smoke and / or fire. So, for the untrained handler this can be a difficult situation and may present a further hazard, which must be controlled accordingly.
- When you are considering ‘Cordons’ it may be necessary to arrange for a separate cordon for the movement and / or holding of animals (those that can be moved safely and securely). This holding or loading area should be away from the scene and any public gatherings. This is mainly a Police role; however, Sector Commanders together with the Incident Commander should also assist because it may be necessary to carefully remove
- animals or species, under the supervision of animal handlers or wardens to a clear area for evacuation by vehicles.

11.2.6 Incident commander

- The Incident commander must announce himself/herself clearly via radio and immediately proceed to the scene in a safe manner to communicate with the Initial Observer and/or the designated Safety Coordinator.
- Designated Safety Coordinators should be department managers or supervisors for the building or area.
- The Incident commander will proceed to the location to assist the safety coordinators in each area with evacuating the affected areas and reporting the information from the scene to Base/Dispatch.

- Staff members should not respond to the location—unless directed to by the Incident commander until the situation is resolved and the All-Clear is called. Only the Incident commander may make the All-Clear call.
- The Incident commander is the only person who may instruct others to enter the area of the emergency. This will avoid causing confusion or delaying Fire and Rescue personnel en route to the location.
- The Incident commander is responsible for convening all responding staff immediately following the emergency incident resolution to review and evaluate the event and response process, make any recommendations for improvement, and evaluate staff members' performance as a learning tool.

11.3 Fire in Buildings

If the fire alarm goes off, staff should immediately proceed to the nearest doorway. If a door feels hot to the touch, find an alternative doorway to use for exit. Base/Dispatch must be notified via phone or radio about the Fire Emergency as soon as possible, and evacuation should take place in a quick but orderly manner. Base/Dispatch will notify 114 Fire and Rescue, and send security officers to the affected area to assist designated Safety Coordinators with crowd control, securing building entrances, etc. until local fire authorities arrives on the scene.

Once everyone has left the area, employees should assemble in one predetermined "gathering place"/assembly area to perform a head count. This will allow the area Safety Coordinator (or "building fire wardens") or supervisors to check who is there and who might still be missing or in the building. Having one designated area to assemble in will also help emergency crews quickly determine if all employees and guests are present and accounted for at the assembly area.

As employees leave the building, staff in charge should check for other employees who may not have heard the alarm. Only staff members who are trained should attempt to extinguish the fire if it is contained. Staff should not jeopardize their safety or the safety of others.

As people leave the building, the doors should be left closed and unlocked to facilitate entry by Fire Department personnel. Each Safety Coordinator must account for all personnel working in their area. Note: Zoos and Aquariums should conduct annual fire drills to test the readiness of employees. All personnel are expected to participate, evacuate their workspaces, and gather at the predetermined location. It is also recommended that Zoos/Aquariums should work in conjunction with local Fire Departments and EMS.

New Employees should be given information on fire drills as part of the orientation process.

11.4 Guidelines for staff during a Fire Emergency:

Fires can be very dangerous to staff, visitors, and the animal collection. The following guidelines should be considered in any fire-related situation:

- Any employee detecting a fire in any building or structure should immediately activate the manual pull station and notify Base/Dispatch that there is a “Fire Emergency”.
- If the fire is small and contained, such as a trashcan fire, staff may attempt to put it out with an appropriate portable extinguisher, but should never jeopardize their own safety.
- If unable to contain the fire, employees must follow the instructions of their safety coordinator and evacuate the building. Staff must go directly to the predetermined gathering location. Before opening doors, touch the door near the top. If it is hot or if smoke can be seen, do not open the door.
- If a fire is discovered on the grounds (grass fires, trashcans, etc.), Base/Dispatch must be notified immediately with the fire’s exact location.
- Security should respond and request the fire department, if necessary.
- No employee or individual should attempt to save personal or zoo/aquarium property at the risk of injury to himself/herself.
- Base/Dispatch must notify other relevant staff including Curators, veterinarians, keepers, aquarists, operations/maintenance personnel, retail personnel, volunteer managers and other Managers of fires and/or evacuation orders.

- Pedestrian traffic must be diverted away from the scene until security or the local fire department arrives.
- Staff should not return to the area until cleared to do so by the appropriate authority (eg the Incident commander).
- All fires, no matter how small, must be reported to Base/Dispatch.

11.5 Health & Safety Note

As with any animal species, generally they are kept in isolation and would usually be handled by trained keepers.

1. In any event of DCD personnel being exposed to any animal or species full PPE should be worn and in any case of injury, especially if there happened to be any bite or skin tissue damage, this MUST be reported immediately to the Incident Support Commander, Sector Commander and / or the Incident Commander, who will immediately seek proper advice from the Centre staff. Do not wait until you return to station, some of these animals carry rare contagious disease when passed on to humans. And remember these animals are in a state of excitement and stress which means they may attack or bite anyone around them. Even the most passive animal that usually may be handled safely could turn aggressive. **So be aware, never** underestimate the passive look from an animal. Do Not Expose yourself to Danger.

2. On completion of the incident and on return to the station all personnel should completely clean and disinfect all PPE, especially footwear and gloves. Also, it is important to clean the appliances, wheels and footwells.

SOP12. ENTERTAINMENT VENUES

12.0 Scope

This Standard Operating Procedure (SOP) considers hazards, risks and control measures for FRF personnel attending incidents at Entertainment Venues.

12.1 Purpose

Entertainment Venues are considered places where large numbers of the public attend for the purposes of entertainment. Typical examples include:

- Sports stadium;
- Open air venues;
- Large night clubs; and
- Buildings that are primarily used for other purposes, such as schools, shopping malls, etc.

Public Entertainment Venues can be classified into 2 categories:

- Permanent venues; and
- Temporary venues.

12.1.1 Permanent Venues

Permanent venues include sports stadium, large nightclubs, cinema malls and entertainment complexes. These venues consist of permanent buildings or structures that host a variety of events. They will often be built around existing road networks and have their own access roads.

12.1.2 Temporary Venues

Temporary venues include events such as festivals where large arenas or sites are created using temporary structures like mobile caravans, marquees or large tents. Depending on where they are sited, temporary venues may not be fully accessible using existing road networks, and may rely on temporary road ways or unmade surfaces for access.

12.2.0 SPECIFIC HAZARDS & RISKS

12.2.1 Access

In normal circumstances the access difficulties at Entertainment Venues are similar to those associated with other large structures or venues, including:

- Remote locations
- Restricted approach roads
- Congested approach roads

However, access becomes more difficult during an event, and access to hydrants and/or other local firefighting facilities may be obstructed.

12.2.2. People

Where the venue accommodates a large number of people, there is a risk of injury arising from:

- Uncoordinated movement of crowds;
- Irrational behavior of people in crowds responding to an emergency;
- Potentially violent response of members of the public towards Developmental co-ordination disorder (DCD) Crews;
- Conflicting demands placed on DCD personnel by members of the public who may have different priorities;
- Limited access for disabled people

12.3 Noise

Event announcements, music or other sources of noise may obscure/hinder radio communications.

12.4 Fire

The fire load and fire hazard in public entertainment venues may be increased by the presence of fuel supplies, gas cylinders and other hazards such as pyrotechnics. The use of temporary generation and electrical distribution equipment may increase the risk of an ignition source causing a fire.

12.5 Unlicensed Events

Unlicensed events will not be subject to any safety checks, may utilize unsafe equipment, and control measures to reduce hazards may not be present. This may increase the risk and potential severity of hazards present.

12.6 Key Control Measures

12.6.1 Pre-planning

The operation commander will notify the control room on the significant events occurring within the jurisdiction.

This information should include:

- Location of the event;
- Type of event;
- Commencement time and completion time for the event;
- Estimated crowd attending;
- Emergency services rendezvous point;
- Best route to the venue;
- Routes where congestion may occur and alternative routes;
- Contact details for the event organizers.

Operation Commanders should ensure they are aware of all events occurring within their station area and that this information is communicated and available to operational crews. The information should include site plans (where appropriate).

12.6.2 Permanent Venues

Permanent Entertainment Venues should be subject to a site visit and, where appropriate, an Operational Tactical Plan (OTP) for identified specific incidents, which identify:

- Rendezvous points;
- Access routes;
- Water supplies;
- Fixed installations;
- Access arrangements;
- Specific hazards.

12.6.3 Temporary Venues

The Operations Control Room may have details of these events and will inform operational crews of any relevant information when mobilised. However, it is possible that events at temporary venues may be unlicensed, for example an illegal rave (music performing area) and information relating to the event may only be available when the initial crews arrive on scene.

12.6.4Training

Training officer should ensure that all operational staff undertake training and exercises at Public Entertainment Venues within their station ground that present specific or unique hazards. This training should involve members of the Site Management Team in order to validate existing arrangements for communication and cooperation during emergencies.

12.7 Operational Procedures

12.7.1 Mobilizing

Where the initial call is received from the Event Management Team, Operations Control Room should confirm the nature and location of the incident and which other services have been informed. Where the call is received from a member of the public, Operations officer will mobilize the crew to attend the incident.

12.7.2 En Route

En route to the incident crews should review any available information relating to the site. If this information is not available crews should contact Operations Control Room to confirm:

- The exact location of the incident within the venue;
- The access and rendezvous points;
- The procedures for contacting the Event Management Team;
- Whether any personnel are already in attendance e.g. in the event control room.

A silent approach should be considered within the immediate vicinity of the venue. Unless informed otherwise by Operations Control, initial appliances will proceed to the recognized access point or rendezvous point (where one has been identified). During their approach, crews should be aware of the potential for vehicles and large crowds

exiting the venue. All vehicles should approach at an appropriate speed in order to reduce the risk of collision.

12.8 On Arrival

The Incident Commander (IC) should attempt to contact the Event Management Team or responsible person. The IC should confirm:

- The nature and exact location of the incident within the venue;
- The type of entertainment event;
- Any hazards present e.g. generators, fuel supplies, pyrotechnics, etc.;
- Any actions already taken by venue staff;
- The best access to the incident (considering any security arrangements, e.g. locked doors or turn styles;
- If any site plans are available. The IC should then pass this information to Operations Control in order to inform oncoming appliances/personnel. The IC should consider utilising the Event Management Team (including Marshalls) to guide personnel to the scene of operations.

12.9 Additional Considerations

Cultural and Diversity Considerations

Events occurring in public entertainment venues may present specific cultural and religious issues affecting how an incident is resolved.

These may include;

- A lack of willingness to talk to FRF personnel;
- Restrictions on exposing skin or parts of the body in public;
- Restrictions or reluctance to interact with individuals of a different gender.

Where an Events Management Team are available on-site IC's should consider the use of event staff to assist firefighters. Events that include large numbers of youngsters, i.e. a rock concert, there may be large groups of publics in high spirits and ill-disciplined so,

Remember: The FRF is a disciplined Organization and should act in accordance with its code of conduct and is not there to control the public.

SOP 13: BUILDING COLLAPSE FIRE AND RESCUE OPERATION

Objective

This SOP outlines procedures for fire and rescue operations in collapsed buildings, ensuring the safety of personnel and the effective rescue of victims, while minimizing further damage to the structure.

Scope

This SOP applies to all fire and rescue personnel involved in responding to building collapses. It covers procedures for search and rescue, fire suppression, structural stabilization, medical response, and coordination with other emergency services.

Responsibilities

- **Incident Commander (IC)**: Oversees overall operations, establishes priorities, and ensures coordination between teams.
- **Search and Rescue Team (SAR)**: Conducts searches for trapped individuals and rescues them from the debris.
- **Fire Suppression Team**: Manages fire outbreaks, controls hazardous materials, and prevents secondary fires.
- **Structural Engineer**: Assesses building stability and advises on safety measures.
- **Medical Team**: Provides immediate care to victims and coordinates evacuation for medical treatment.
- **Safety Officer**: Ensures that all operations are conducted in a safe manner, monitoring hazards such as structural instability and hazardous materials.

Pre-Operation Preparation

Assessment of the Situation

- Conduct a rapid initial assessment to determine the extent of the collapse, location of victims, fire hazards, and structural risks.
- Identify any hazardous materials (gas lines, chemicals, etc.) that could pose additional risks.

Establish Command Post

- Set up a command post at a safe distance from the collapse zone.
- Assign roles (IC, SAR team leader, safety officer, etc.) and establish communication protocols with all teams.

Safety Briefing

- Conduct a safety briefing to inform all personnel of potential hazards, building layout, escape routes, and emergency procedures.

Personal Protective Equipment (PPE)

- All personnel must wear appropriate PPE, including helmets, gloves, boots, respiratory protection, and high-visibility clothing. Firefighters should be equipped with SCBA (Self-Contained Breathing Apparatus) if there is a risk of smoke or hazardous materials exposure.

Operational Procedures

Initial Actions

- **Secure the Scene**: Establish a safety perimeter around the collapse zone to protect the public and non-essential personnel.
- **Triage and Prioritization**: Quickly assess the location of the most vulnerable victims. Prioritize rescue operations for those in immediate danger of injury or death.
- **Fire Suppression**: If a fire is present, deploy fire suppression units immediately to control or extinguish the fire and prevent further damage to the structure.

Search and Rescue Operations

- **Surface Search**: Perform an initial search for victims on the surface of the debris. Mark known or suspected locations of victims with standardized signals (e.g., paint, flags).
- **Canine Search Units**: Deploy trained search dogs to locate victims trapped beneath rubble.
- **Technical Search Equipment**: Use specialized equipment (thermal imaging cameras, listening devices, search cameras) to locate victims who may be trapped in voids or under debris.

Rescue Operations

- **Structural Stabilization**: Before entering the collapse zone, stabilize any unstable portions of the structure to prevent further collapse. This can involve the use of shoring, bracing, or hydraulic supports.
- **Extrication of Victims**: Safely remove trapped victims using tools such as cutting equipment, jacks, or lifting devices. Ensure that SAR personnel work in pairs or teams to minimize risk.
- **Medical Stabilization**: Provide immediate medical care to victims on-site before extrication if necessary. Victims with serious injuries should be prioritized for evacuation to medical facilities.

Fire Suppression and Hazard Control

- **Control Secondary Fires**: Extinguish any secondary fires that may have started due to broken gas lines or electrical faults.
- **Hazardous Material Containment**: Identify and control any hazardous materials at the scene (e.g., gas leaks, chemical spills) in coordination with hazardous materials (HAZMAT) teams if necessary.

Structural Integrity Monitoring

- **Ongoing Assessment**: The structural engineer must continuously assess the stability of the building during operations. If further collapse is imminent, all personnel should retreat to a safe zone until the situation is stable.

Post-Operation Procedure

Debriefing

- Conduct a debrief to review the effectiveness of the rescue operation, discuss challenges encountered, and document any lessons learned for future incidents.

Medical Evaluation

- Ensure that all rescued victims are handed over to medical teams for further treatment and that all responders undergo a health check to identify any injuries or stress-related issues.

Equipment Check and Maintenance

- Inspect all equipment used during the operation for damage. Clean and service tools, PPE, and vehicles to prepare them for future use.

Site Handover

- Once operations are complete and all victims have been rescued or recovered, hand over the site to appropriate authorities (e.g., police, structural engineers) for further investigation or clearance.

Safety Protocols

- **Structural Stability**: Continuously monitor the collapse site for signs of further structural failure. Stop operations immediately if new collapses are likely.
- **Personal Safety**: Personnel should not enter unstable areas without structural support and backup. Always have a rapid evacuation plan in place.
- **Air Quality**: Monitor air quality for dust, smoke, or toxic fumes. Ensure that all personnel wear respiratory protection when required.
- **Communication**: Maintain clear and constant communication between all units. Establish backup communication systems in case primary systems fail.
- **Hazard Marking**: Use clear signage and markers to identify dangerous areas, such as unstable debris, exposed electrical wires, or gas leaks.

Contingencies

Secondary Collapse

- If there is a risk of secondary collapse, evacuate all personnel to a safe distance. The structural engineer and safety officer will reassess before operations resume.

Hazardous Materials

- If hazardous materials are found at the site, evacuate the immediate area and deploy specialized HAZMAT units to contain the situation.

Weather Conditions

- In the case of adverse weather (e.g., high winds, rain, extreme temperatures) that could affect the structural stability or safety of personnel, operations may be paused until conditions improve.

Training and Certification

- All fire and rescue personnel involved in building collapse operations must be trained in structural firefighting, search and rescue techniques, hazardous materials awareness, and medical response.
- Periodic refresher courses and simulations should be conducted to ensure that personnel are up-to-date on the latest techniques and technologies.

SOP 14: Rescue Operations During Landslides and Mudflows

Objective

To define the procedures, roles, and responsibilities for conducting safe and efficient rescue operations during a landslide and mudflow.

Purpose

This SOP ensures that all agencies, responders, and resources work in tandem to minimize casualties and facilitate quick recovery during landslides and mudflows. Regular drills, awareness programs, and preparedness measures are key to the success of such operations. This document can be adapted based on specific regional risks, resources, and organizational structures.

1. Preparedness and Pre-Operation Stage

1.1. Early Warning and Monitoring

- **Install early warning systems**: Establish systems to monitor rainfall, soil moisture, and seismic activity in landslide-prone areas.
- **Community Awareness**: Regularly educate communities on landslide risks, evacuation routes, and emergency contacts.
- **Establish Evacuation Zones**: Pre-identify safe zones, evacuation routes, and shelters.
- **Stockpile Resources**: Store rescue equipment (ropes, shovels, stretchers, medical kits) and arrange for vehicles (earthmovers, ambulances, helicopters).
- **Train First Responders**: Conduct regular training for local disaster management teams, firefighters, paramedics, and community volunteers.

1.2. Coordination

- **Activate Emergency Response**: Set up a command and control center as soon as the landslide warning is issued or triggered.
- **Deploy Rescue Teams**: Dispatch search and rescue (SAR) teams to the affected area with appropriate equipment.
- **Establish Communication Links**: Ensure seamless communication between local government, emergency services, and rescue teams using radios, satellite phones, and internet tools.

2. Initial Response

2.1. Safety Assessment

- **Site Survey**: Upon arrival, the SAR team leader will assess the stability of the area, look for secondary slides, and ensure no immediate dangers exist.
- **Secure the Area**: Cordons should be established to prevent unauthorized access to dangerous zones.
- **Evacuate Survivors**: Prioritize evacuating injured or trapped individuals who are visible and in reachable areas.

2.2. Resource Allocation

- **Assign Tasks**: Break SAR teams into groups (medical, logistics, search teams) and distribute tasks based on team expertise.
- **Deploy Equipment**: Use drones for aerial surveys, heavy machinery for debris clearance, and sniffer dogs or specialized devices for locating trapped victims.

2.3. Establish Safe Zones

- **Set Up Medical Triage Area**: Create a triage zone close to the site for immediate medical assistance.
- **Transport Evacuees**: Shift rescued individuals to nearby shelters or hospitals based on the severity of injuries.

3. Rescue Operations

3.1. Search and Rescue

- **Manual Search**: Start with a manual search in areas with visible signs of victims or possible void spaces where victims may be trapped.
- **Use of Equipment**: If needed, use thermal imagers, sound detectors, and drones to locate buried individuals.
- **Debris Removal**: Carefully remove debris using heavy machinery while ensuring the safety of rescuers and potential survivors underneath.

3.2. Medical Care

- **Immediate First Aid**: Administer immediate medical assistance for injuries such as fractures, wounds, or dehydration.
- **Triage System**: Follow triage protocols (red, yellow, green, black) to classify injuries and prioritize care.
- **Transport to Hospitals**: Coordinate with ambulances and helicopters to transfer critically injured individuals to hospitals.

3.3. Managing Deceased

- **Body Recovery**: Mark areas where bodies are found, document details, and arrange for proper handling and transportation of the deceased.

4. Post-Operation Procedures

4.1. Recovery and Rehabilitation

- **Ongoing Surveillance**: Continue monitoring the area for secondary slides or environmental hazards.
- **Debriefing**: Conduct a post-mission debrief with all rescue teams to evaluate what worked well and areas for improvement.
- **Rehabilitation Support**: Coordinate with local agencies for long-term recovery, including psychological counseling for survivors and rebuilding efforts.

4.2. Documentation and Reporting

- **Incident Report**: Prepare a detailed report including the timeline of the event, response activities, challenges faced, and casualty figures.
- **Lessons Learned**: Capture lessons for improving future preparedness, training, and response procedures.

5. Communication and Coordination

5.1. Public Information Management

- **Press Briefing**: Designate a public relations officer to handle media inquiries and release accurate information to avoid panic.
- **Community Updates**: Regularly update affected communities on the status of rescue operations and recovery efforts.

5.2. Coordination with Agencies

- **Local Authorities**: Work closely with police, military, and government disaster management agencies to ensure cohesive action.
- **International Aid**: If necessary, coordinate with international agencies for specialized support in rescue, medical aid, and reconstruction.

6. Safety Protocols for Rescue Teams

6.1. Personal Protective Equipment (PPE)

- **Equip Teams with PPE**: All responders should be equipped with helmets, gloves, boots, eye protection, and face masks.

6.2. Risk Management

- **Regular Check-Ins**: Ensure team leaders check on rescuers frequently to monitor fatigue, stress, and overall well-being.
- **Emergency Exits**: Establish multiple escape routes in case of further landslides or other dangers.

7. Demobilization

- **Stand-Down Orders**: Once the area is declared safe and operations are complete, demobilize teams in a coordinated manner.
- **Rest and Recovery**: Provide psychological support and rest for exhausted rescue personnel.

SOP 15: Earthquake Rescue Operations

Objective

To establish procedures for efficient and coordinated rescue operations in response to an earthquake, ensuring the safety of victims and responders.

Purpose

This SOP ensures a structured, efficient, and safe response to earthquake rescue operations, aimed at saving lives, minimizing harm, and preparing for long-term recovery. Regular updates, drills, and community involvement are critical for enhancing response capacity. This SOP can be tailored based on specific regions, resources, and organizational structures.

1. Preparedness and Pre-Earthquake Stage

1.1. Training and Capacity Building

- **Train Rescue Teams**: Regularly train specialized teams (firefighters, medical personnel, urban search and rescue teams) in earthquake rescue operations.
- **Simulated Drills**: Conduct regular earthquake simulations to familiarize responders and communities with evacuation routes and safety protocols.
- **Pre-positioning Resources**: Stockpile emergency supplies, including rescue equipment (cutting tools, ladders, stretchers), medical kits, food, and water in high-risk zones.

1.2. Early Warning and Monitoring

- **Seismic Monitoring**: Set up seismic stations to monitor earthquake activity and relay real-time information to emergency response teams.

- **Community Awareness**: Raise public awareness on earthquake preparedness, such as "Drop, Cover, and Hold On" safety measures, evacuation routes, and emergency numbers.

1.3. Coordination Plans

- **Emergency Response Plan**: Develop a clear response plan outlining roles and responsibilities of local authorities, emergency services, and communities.
- **Emergency Communication System**: Establish redundant communication channels (radio, satellite phones) to maintain contact between command centers and rescue teams during disasters.

2. Immediate Response After Earthquake

2.1. Activation of Command and Control

- **Activate Emergency Operations Center (EOC)**: Immediately activate the EOC to coordinate rescue operations, information dissemination, and resources allocation.
- **Deploy Rapid Assessment Teams**: Send teams to assess the extent of damage, prioritize rescue zones, and identify safe entry points.

2.2. Search and Rescue (SAR) Teams Deployment

- **Team Mobilization**: Activate SAR teams, first responders, and medical units, directing them to the most affected areas based on initial damage assessments.
- **Deploy Equipment**: Mobilize necessary equipment such as hydraulic cutters, thermal cameras, sniffer dogs, cranes, and earth-moving machinery.

2.3. Ensuring Safety for Rescue Teams

- **Personal Protective Equipment (PPE)**: Ensure all rescue personnel are equipped with helmets, gloves, boots, and masks to prevent injury from debris.
- **Assess Structural Integrity**: Prior to entry, assess the stability of collapsed or partially damaged buildings to avoid secondary collapses during rescue operations.

3. Rescue Operations

3.1. Initial Search Operations

- **Manual Search**: Begin with a surface-level search of collapsed structures, using visual and auditory clues to locate trapped victims.
- **Mark and Identify**: Mark areas where victims are found and prioritize high-probability areas based on signs of life or void spaces in collapsed structures.
- **Aerial and Drone Surveys**: Use drones to conduct aerial surveys of affected areas, identifying trapped victims, potential hazards, or blocked access routes.

3.2. Advanced Rescue

- **Urban Search and Rescue (USAR) Techniques**: Use specialized techniques, such as breaking through walls, lifting debris with cranes, or tunneling to reach deeply trapped survivors.
- **Use of Rescue Devices**: Deploy technical devices like thermal imagers, acoustic sensors, and fiber optic cameras to locate victims beneath the rubble.
- **Cautious Debris Removal**: Carefully remove debris using machinery, ensuring minimal disturbance to avoid further injury to survivors.

3.3. Medical Assistance and Triage

- **Triage System**: Set up a triage system at the disaster site to classify victims by injury severity (red, yellow, green, black), and provide immediate care to the most critical cases.
- **First Aid Administration**: Provide immediate medical attention on-site for fractures, wounds, and dehydration, ensuring the stabilization of victims before transportation.
- **Transfer to Hospitals**: Arrange transport for seriously injured individuals to the nearest medical facility, using ambulances or helicopters when necessary.

3.4. Managing Deceased Bodies

- **Body Recovery**: When deceased individuals are found, document and properly handle the bodies for identification and handover to authorities.

- **Temporary Morgues**: Set up temporary morgue facilities near the disaster site if required, ensuring dignity and proper identification procedures.

4. Post-Rescue Operations

4.1. Structural Safety and Risk Management

- **Secondary Hazards Monitoring**: Continuously monitor the area for aftershocks, gas leaks, electrical hazards, or unstable structures that might pose additional dangers.
- **Evacuation of Unsafe Zones**: Evacuate individuals from buildings that show signs of severe structural damage and have a high risk of collapse during aftershocks.

4.2. Family Reunification and Victim Identification

- **Missing Person Registry**: Set up a missing persons registry to help families locate loved ones and reunite survivors with their families.
- **Victim Identification**: Work with local authorities to identify bodies using available records, fingerprints, and DNA testing if required.

4.3. Community Support and Rehabilitation

- **Temporary Shelters**: Establish temporary shelters for those displaced by the earthquake, ensuring access to food, water, and medical care.
- **Psychological Support**: Provide counseling and emotional support services for survivors dealing with trauma and grief.
- **Long-Term Recovery Planning**: Coordinate with government agencies to plan long-term reconstruction, resettlement, and rebuilding efforts.

5. Communication and Coordination

5.1. Media Management and Public Information

- **Designate Spokesperson**: Appoint a public relations officer to handle media inquiries and provide accurate, timely information to the public.

- **Regular Updates**: Use various channels (radio, social media, TV) to provide regular updates on the status of rescue operations, shelters, and safety instructions for the public.

5.2. Coordination with Stakeholders

- **Local Government**: Coordinate closely with local authorities for assistance with resources, road clearances, and legal issues.
- **International Support**: If needed, request assistance from international rescue organizations, relief agencies, and neighboring governments for specialized support and resources.

5.3. Ensuring Chain of Command

- **Unified Command Structure**: Ensure all operations are conducted under a clear command hierarchy, avoiding duplication of efforts or confusion in rescue operations.

6. Safety and Security Protocols for Rescue Teams

6.1. Personal Safety

- **Continuous Monitoring**: Ensure rescue teams have continuous safety briefings on potential hazards like unstable buildings, gas leaks, and aftershocks.
- **Work in Shifts**: Rotate rescue teams to prevent exhaustion, ensuring responders have enough rest and hydration.

6.2. Health and Hygiene

- **Infection Control**: Provide hand sanitizers, masks, and gloves to reduce the risk of infection and disease spread in disaster zones.
- **Psychological Support for Responders**: Offer mental health support and counseling services to rescuers who may experience psychological strain during operations.

7. Demobilization and Debriefing

- **Stand-Down Procedures**: Once the rescue phase is complete, ensure an organized demobilization of teams and equipment.
- **Debriefing Sessions**: Conduct thorough debriefs with all rescue teams to assess challenges, successes, and areas for improvement.
- **Report Generation**: Prepare a detailed incident report, including operational timelines, response effectiveness, and lessons learned for future improvement.

Commissioner General, Fire and Rescue Force
P.O.BOX 1509, 1 Zimamoto Street, 41102 VIWANDANI, DODOMA Tel: 255-26-23200243 Fax: 255-26-23200243
Email: fire.rescue@zimamoto.go.tz Website: www.zimamoto.go.tz