




Lightning Management Plan

Health & Safety

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1. Purpose and scope

The purpose of this plan is to maintain safe working conditions by ensuring that the risks of lightning and lightning strikes are identified, assessed and were possible controlled.

This Lightning Management Plan provides mandatory requirements to support implementation and conformance with Roy Hill Operations Performance Standards 08 – Extreme Operating Conditions

This Plan applies to all persons entering Roy Hill operations or any area which Roy Hill has accountability.

2. Planning

2.1 Lightning Detectors

Roy Hill has subscribed to a commercially provided lightning detection network that has the capability of detecting 95% of lightning strikes to within 200m of accuracy. Alert GIS boundaries have been created and provide near real time lightning alerting capabilities. Email distribution lists have been created for all alerting GIS boundaries and the interface is available through the applications tab on the Intranet. Lightning detection will detect the presence of lightning and/or thunder storm activity by sensing emissions from lightning strikes and determining the distance to the detected strike. Distances are measured in three ranges and enable tracking of approaching lightning activity.

The three levels of alert which are

- 1) Red Alert – Lightning detected within 0 -10 kilometres Alarm No one should be outdoors
- 2) Yellow Alert – Lightning detected within >10 - 18 Kilometres Warning Threat is nearby.
- 3) Blue alert – Lightning detected within >18 - 30 kilometres Caution There is a potential threat.

These distances are a guide only and should be used in conjunction with information from weather forecasts and warnings.

2.2 Recognising Imminent Lightning Activity

SOUND: If thunder is heard, lightning strikes are occurring. Thunder intensity is a very approximate guide to the strike distance. Very loud thunder implies a strike is in close proximity.

VISUAL: If you see lightning

VISUAL and SOUND (Flash/ Bang method): If a lightning flash is seen, a thunder interval of less than 30 seconds indicates that lightning is occurring within approximately 10km.

The approximate distance of lightning can be determined by remembering that for every 3 seconds counted between seeing a flash and hearing thunder will equal 1 kilometre. i.e.

- 30 Second Flash to thunder 10 kms
- 15 Second Flash to thunder 5 kms
- 6 Second Flash to thunder 2 kms

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2.3 Monitoring Lightning Activities

All Area Managers shall ensure that lightning monitoring happens regularly. Actions shall be based upon the intensity, speed and direction of travel of the lightning activity as determined through observation and weather reports and warnings from storm tracking equipment. Actions shall be communicated to employees and contractors by the quickest and most reliable possible means.

Work areas shall be evacuated when directed by the Senior Site Officer (SSO) **or delegate**. Actions shall take into account all currently occurring operational work practices within the area. Consideration shall be given to additional hazards associated with fire, high winds and accompanying heavy rainfall and actions designed accordingly.

2.4 Minimum Actions based on Lightning Distance

Blue Alert	Yellow Alert	Red Alert
<ul style="list-style-type: none"> • Lightning within 18-30km • <u>Threat may exist</u> • Threat Alert announced over site wide communication system. • Continue all activities with awareness • Drill and Blast crew should commence their safe procedures • Hazardous substance processes to be made safe <ul style="list-style-type: none"> ○ Explosives ○ Fuel Distribution • Broadcast Alert every 30 minutes 	<ul style="list-style-type: none"> • Lightning within 10 – 18 km • <u>Threat is nearby</u> • Threat Alert announced over site wide communication system • Blast guards and/or bollards positioned where required, personnel to move beyond blasting clearance zones • All refuelling activities should now cease • Drill rigs, Cranes and Manitou's to lower their mast/ booms and cease operations (unless exemption has been granted) • Broadcast Alert every 15 Minutes 	<ul style="list-style-type: none"> • Lightning within 0 - 10 km • <u>Storm is local no one to be working outdoors</u> • Threat Alert announced over site wide communication system • All outdoor activities to cease. • Personnel can only remain in equipment that is fully enclosed • All personnel to seek their nearest safe shelter location and remain until the Alert is downgraded • Moving between safe shelters or vehicles should be restricted. Where necessary, move promptly from one location to another using the least distance as possible to reduce your exposure • Broadcast Alert every 15 Minutes

Table 1- Threat Overview

The following action levels may be used as a guide for more specific detail against each role see Appendix 1.

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Level 1 – Blue Alert – Lightning has been detected within **18 – 30** kilometres

Monitoring Centre;

- To monitor lightning detection network and advise respective Site Supervisors of potential for lightning activity.
- After consultation with respective Site Supervisor, announce that the Blue alert phase is being implemented over the production radio channel for the affected alert zone.
- Broadcast alert every 30 minutes over the operational radio channel for the affected alert zone until such time as it is cleared or changes
- Hazardous substance processes to be made safe;
- Explosives, and
- Fuel distribution.

The Area Manager will determine the course of action dependent on;

- Intensity, speed and direction of travel of the storm, as determined by direct observation, weather reports and observations warnings from storm tracking equipment;
- If personnel are working in open areas;
- If explosives are present in the work area
- The likelihood of other severe weather associated with thunderstorms
- The need for potential evacuation of the work area.

The decision must take into account all work activities and any additional energy sources associated with fire, tyre explosions, high winds and accompanying heavy rain. Controls shall be implemented to mitigate exposure to any identified hazards.

Level 2 – Yellow Alert – Lightning has been detected within **10 – 18** kilometres

Monitoring Centre;

- To monitor lightning detection network and advise respective Site Supervisors of potential for lightning activity.
- After consultation with respective Site Supervisor, announce that the Yellow Alert phase is being implemented over the appropriate radio channel for the affected alert zone.
- Broadcast Alert every 15 minutes over the production radio channel for the affected alert zone

All personnel outdoors;

- Blast guards and/or bollards positioned where required, personnel to move beyond blasting clearance zones,
- Immediately make the work area safe,
- Determine the nearest safe location,
- Prepare to move to the safest location **when advised**,
- Listen for further advice,

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- Crane booms and Drill masts are to be lowered unless an exemption has been give i.e. Drill rigs conducting borehole drilling etc. (The exemption can only be approved by the relevant General Manager or Head of), and
- The following activities will cease;
 - Roof Works,
 - Working at heights,
 - Using metallic scaffolding in open areas,
 - Crane operations,
 - Blasting operations,
 - Drilling operations e.g. Blasthole Drilling, Ore Definition, Exploration,
 - Work on/in vicinity of Overhead line, metal piping and rail lines that don't have the appropriate earthing protection ,
 - Work in manholes,
 - HV Electrical works, and/ or
 - All refuelling activity that are out in the open environment to cease.

If the storm continues to approach, identify and plan;

- Park up zones for heavy vehicles including the;
 - Direction of parking considering expected travel paths of heavy equipment wheel components in the event of catastrophic failure from an electrical charge, and
 - Distance from buildings and personnel.
 - Exclusion zones or adequate barricading for vehicles following the storm if it is suspected that a heavy vehicle has been struck by lightning.

Level 3 – Red Alert – Storm activity has been detected within 10 kilometres

- Monitoring centre;
- To monitor lightning detection network and advise respective Site Supervisors of potential for lightning activity.
- After consultation with respective Site Supervisor, announce that the RED alert phase is being implemented over the production radio channel for the affected alert zone.
- Broadcast Alert every 15 minutes over the production radio channel for the affected alert zone
- All Outdoor Personnel;
 - All high risk work shall cease,
 - All unprotected (activity that is undertaken that is not protected by a fully enclosed metal structure) outdoor actives to cease,
 - Moving between safe shelters or vehicles should be restricted. Where necessary, move promptly from one location to another using the least distance as possible to reduce your exposure. Where possible consideration should be given to boarding and disembarking adjacent larger structures (allowing for the principle of rolling sphere of protection)

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- Maintenance activities of any equipment may only continue if they are in approved workshop structure. Work cannot continue if the equipment is parked on the apron in an open environment, and
- Listen for further advice.

All Indoor Personnel;

- Stay inside the building,
 - Avoid the following;
 - Using wired telephones
 - Contact with water services
 - Standing near windows and external doors
- Listen for further advice, and
- If evacuation of site is required, this is to be in accordance with the area emergency management plans.

3. Lightning Safe Shelter and Lightning Protected Pathways

Having established that lightning is local and conditions are unsafe to remain outdoors, all persons exposed should be directed to seek an immediate refuge within a known and designated lightning safe shelter, and then wait for further instruction.

- Lightning safe shelters will typically include:
- Fully enclosed all-metal vehicles or equipment.
- Permanent, substantial buildings.
- Designated metal shelters (specially designed).
- Other locations as identified by specialists or H&S personnel.

In areas of high human traffic such as the mine village, safe area 'tents' will be created along the main pathways, these areas will be distinguishable by the placement of poles with catenary wires strung over the top of the path. During thunderstorms, regardless of the storm intensity personnel can safely traverse between Lightning Safe Shelter's using these pathways.

Note: Lightning safe shelter and lightning protected pathways are only for the protection of personnel during lightning events for other events such as cyclonic weather refer to the relevant management plan.

4. Personnel Struck by Lightning

Personnel struck by lightning carry no electrical charge and can be assisted safely assuming no further hazard exists. Ensure unconscious / non-breathing casualties are treated promptly. Raise an emergency call in accordance with the Emergency Management Plan. If trained and confident to do so, apply necessary first aid.

5. Faraday Cage Effect

The enclosed cab of a light vehicle or equipment forms what is known as a "Faraday Cage". A Faraday cage is a metallic enclosure that prevents the entry or escape of an electromagnetic field. When lightning strikes a vehicle, the charge will travel over the surface of the vehicle (including the cab) due to the phenomena of skin effect, and will pass through to ground through the tyres and GET. As long as you have the doors and windows

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shut, you are in effect creating a Faraday cage, and are therefore considered safe whilst you remain inside the vehicle or metal structure.

6. Resumption of Work

Lightning alert conditions may be removed 30 minutes after the last recorded lightning activity.

6.1 Inspection prior to Re-Commencing Operations

Area Supervisors shall direct the inspection of all equipment left unattended during the storm event, with particular attention being made to look for evidence of lightning strike.

Evidence of a strike may be self-evident or may be discreet. Any unusual markings such as dark marks on tyres or equipment should be treated as possible strikes and the area evacuated due to the potential of a tyre explosion.

7. Accountabilities

Role	Responsibility
Area Managers	The implementation of a lightning Management plan, within their respective areas/departments
Employees, Contractors and Visitors	Responsible for complying with all requirements within the Lightning Management Plan.
General Manager	For ensuring all resources are provided the implementation and application of the Lightning Management Plan
Monitoring Centre	Monitoring the Lightning Detection technology, and the communication and timely update of threat alerts
Senior Site Officer	Responsible for managing the exposure of their subordinate Employees, Contractors and Visitors.

Table 2 – Accountabilities

8. References and Associated Documents

Document Number	Title
	AS1768:2007 Lightning protection
	Bow Tie PH-01 Explosives (Storage, Handling and Transport)
	Bow Tie PH-02 Explosives (Blasting)
	Bow Tie PH-03 Fire and Explosion (Non Explosives)
	Bow Tie PH-15 Severe Weather
	Mines Safety and Inspection Act 1994 (WA)
	Mines Safety and Inspection Regulations 1995 (WA)
OP-PLN-00086	Emergency Management Plan

Table 3 - References and Associated Documents

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Appendix 1 – Minimum Actions based on Lightning Distance

The following tables describes the permissible (Yes) and prohibited (No) activities during the various lightning threat conditions.

ROY HILL Mining - General Activities	BLUE	YELLOW	RED
	18-30 kms	10-18 kms	0-10kms
ER Training/Fire/Ambulance	YES	YES	NO
General Freight Haulage	YES	YES	NO
Water Cartage (portable water delivery)	YES	YES	YES
Data room and IT work as required	YES	YES	YES
LV Vehicle Wash Down	YES	YES	NO
Helicopter flights for VIP visits	YES	YES	NO
Bulk Fuel Delivery (Road transport)	YES	NO	NO
Dangerous goods delivery and handling	YES	NO	NO
Bus Operations	YES	YES	YES
Light Vehicle Refuelling	YES	YES	NO
Plumbing Tasks	YES	YES	NO
Working on Roofs	YES	NO	NO
Electrical Refrigeration Maintenance	YES	NO	NO
Carpentry	YES	YES	NO
Working within Excavations/Trenches	YES	YES	NO
Bore Water Sampling	YES	YES	NO
Bulk Fuel Loading Unloading and transportation	YES	NO	NO
Maintain Fuel Facilities	YES	NO	NO
Weed Management Flora Surveys	YES	YES	NO
Fuel Dipping Tanks	YES	NO	NO
Storm Water Sampling	YES	YES	NO
Environmental Activities	YES	YES	NO
Structure wash down	YES	YES	NO
WWTP Spray Field Maintenance	YES	YES	NO
Cyclone Preparation	YES	YES	NO
EWP Operations - general	YES	YES	NO
Crane use (mobile)	YES	NO	NO
Forklift use	YES	YES	NO
Fuel and water dipping	YES	NO	NO

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General Warehouse Duties Outside	YES	YES	NO
Supply Warehouse Deliveries (in the open)	YES	YES	NO
Unloading, Loading Trucks	YES	YES	NO
General Duties Inside Warehouse	YES	YES	YES
Vehicle Loading Crane Operation	YES	YES	NO
Driving off Site (Public Roads)	YES	YES	YES
General Driving on Site (LV and road trucks etc.)	YES	YES	YES

Table 4 - Procedural Summary – Mining General

ROY HILL Mining - Mine	BLUE	YELLOW	RED
Activities	18-30 kms	10-18 kms	0-10kms
Operation of Autonomous Equipment	YES	YES	YES
Surveying Activities (Field / Pit)	YES	NO	NO
Bore field Maintenance / Inspections	YES	YES	NO
Dewatering Maintenance and Operation	YES	NO	NO
Tailings Dam Maintenance	YES	NO	NO
High Voltage Maintenance	YES	NO	NO
Electrical Maintenance (Field / Pit)	YES	NO	NO
Electrical Maintenance (Workshop)	YES	YES	NO
Access/Egress Mobile Equipment (Under direction)	YES	YES	YES
Refueling Mobile Equipment Go-Line	YES	NO	NO
Operating Dump Truck in Pit	YES	YES	YES
Operating Track Dozer	YES	YES	YES
Operating Wheel Dozer in Pit	YES	YES	YES
Operating Excavator in Pit	YES	YES	YES
Operating Ancillary Equipment	YES	YES	YES
Mobile Plant Maintenance (Field / In Pit)	YES	NO	NO
Mobile Plant Maintenance (Workshop)	YES	YES	YES
Refueling / Greasing Mobile Equipment (Field / In Pit)	YES	NO	NO
Fit/ Repairing Tyres (Workshop)	YES	YES	YES
Fit/ Repairing Tyres (Field / In Pit)	YES	NO	NO
Blasting Operations Shot firer / Blast Crew (Priming, Loading, Tying in)	YES	NO	NO
Bulk Storage Explosive Facility	YES	NO	NO
Ore Def Geologist Logging	YES	NO	NO
Pegging Clearing Sampling (Exploration/Evaluation Drilling)	YES	NO	NO
In Pit Geologist General Duties	YES	NO	NO

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Geologist In Pit Logging Blast Cones	YES	NO	NO
Explosives Magazine Facility Operation	NO	NO	NO
Operating Loader (Stemming)	YES	YES	NO
MPU Operations	NO	NO	NO
Service Truck Operation	YES	NO	NO
Refuel Truck Operation	YES	NO	NO
Blast Hole Drilling	YES	NO	NO
Water Test Pumping	YES	YES	NO
Water Bore Drilling	YES	NO	NO
Exploration/Evaluation Drilling Activities	YES	NO	NO
Drone Operation	YES	YES	NO
In Pit Inspections (outside vehicles)	YES	NO	NO
HME Vehicle Wash Down	YES	YES	NO

Table 5 - Procedural Summary – Mine

Activities	BLUE	YELLOW	RED
	18-30 kms	10-18 kms	0-10kms
Skid Steer Loader Operations (enclosed cab)	YES	YES	YES
Laboratory work	YES	YES	YES
Tipper Truck Operations	YES	YES	YES
Front End Loader Operations	YES	YES	YES
Mechanical Maintenance Fixed Plant Indoors or Undercover	YES	YES	YES
Mechanical Maintenance Fixed plant – Outdoors or Unprotected	YES	YES	NO
Fixed plant Inspections – Indoors or Undercover	YES	YES	YES
Fixed plant Inspections – Outdoors or Unprotected	YES	YES	NO
Scaffolding	YES	YES	NO
Stacker/Reclaimer operations and maintenance (Inside)	YES	YES	YES
Stacker/Reclaimer operations and maintenance (Out in the open)	YES	YES	NO
Structure wash down	YES	YES	NO
Tailings Dam Maintenance	YES	YES	NO
High Voltage Maintenance	NO	NO	NO
LV Electrical Maintenance – Repairs and Fault-finding	YES	YES	NO
Maintenance on production areas (Screen house, conveyors and other structures)	YES	YES	YES
Pedestrian traffic between buildings	YES	YES	YES

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Workshop activities	YES	YES	YES
Cyclone preparation	YES	YES	NO
Idler and roller replacements	YES	YES	NO
Belt change out	YES	YES	NO
EWP Operations - general	YES	NO	NO
Crane use (mobile)	YES	NO	NO
Switch Room Activities – Isolations, Cleaning and Inspections	YES	YES	YES
Track Dozer Operation on the Stockpile	YES	YES	YES
HV switching	YES	NO	NO
Removing items from belt	YES	YES	NO
Condition Monitoring – Indoors or Undercover	YES	YES	YES
Condition Monitoring – Outdoors or Unprotected	YES	YES	NO
Lubrication and sampling – Indoors or Undercover	YES	YES	YES
Lubrication and sampling - Outdoors or Unprotected	YES	YES	NO
NPI- Maintenance and Repair on Infrastructure	YES	YES	NO

Table 6 - Procedural Summary – Processing

ROY HILL Mining – Rail Operations General	BLUE	YELLOW	RED
Activities	18-30 kms	10-18 kms	0-10kms
Bulk fuel unloading	YES	NO	NO
Track inspections/repairs (rail contact)	NO	NO	NO
Signal box inspections/Repairs	YES	NO	NO
Ambulance use (Rail mounted and road)	YES	YES	YES
Communications tower inspections/Repairs	YES	NO	NO
Train walk downs (at any point along the alignment)	YES	NO	NO
Workshop activities (In the open)	YES	YES	NO
On Track machinery that is fully enclosed	YES	YES	YES
On Track machinery that is NOT fully enclosed	YES	NO	NO
Crane use (mobile)	YES	NO	NO
General driving	YES	YES	YES
ER Training/Fire/Ambulance	YES	YES	NO
VIP visitors - bus and walking (delays are not possible at times)	YES	YES	NO
Stores activities (Indoors)	YES	YES	YES
Stores activities (out in the open)	YES	YES	NO
Forklift use	YES	YES	NO
EWP Operations - general	YES	NO	NO

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Fuelling locomotives out in the open environment	YES	NO	NO
Locomotive wash down	YES	NO	NO
Locomotive servicing/provisioning (outside)	YES	NO	NO
Shunting	YES	NO	NO
Traffic control (Wide Loads at level crossing)	YES	YES	NO
Rail recovery	YES	NO	NO

Table 7 - Procedural Summary –Rail operation

Table 8 -Procedural Summary – Port Rail Operations

ROY HILL Mining – Port Operations	BLUE	YELLOW	RED
Activities	18-30 kms	10-18 kms	0-10kms
Water Sampling	YES	YES	NO
Storm Water Sampling	YES	YES	NO
Environmental Activities	YES	YES	NO
Structure wash down	YES	NO	NO
Surveying	YES	YES	NO
HV switching	NO	NO	NO
LV Electrical Maintenance – Repairs and Fault-finding	YES	YES	NO
Mooring Operations	YES	YES	NO
Ship loading operations	YES	YES	YES
WWTP Spray field maintenance	YES	YES	NO
ER Training/Fire/Ambulance	YES	YES	NO
Operating ships gangway	YES	YES	NO
Pedestrian traffic between buildings (outside)	YES	YES	YES
Workshop activities (inside)	YES	YES	YES
Cyclone preparation (belt tie down, machine cradling)	YES	YES	NO
Car dumper operator (inside)	YES	YES	YES
Idler and roller replacements	YES	YES	NO
Belt change out	YES	YES	NO
EWP Operations - general	YES	NO	NO
Crane use (mobile)	YES	NO	NO
Switch Room Activities –Isolations, Cleaning and Inspections	YES	YES	YES
Condition Monitoring – Indoors or Undercover	YES	YES	YES
Condition Monitoring – Outdoors or Unprotected	YES	YES	NO
Lubrication and sampling – Indoors or Undercover	YES	YES	YES
Lubrication and sampling - Outdoors or Unprotected	YES	YES	NO

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Stacker/Reclaimer operations and maintenance (Inside)	YES	YES	YES
Stacker/Reclaimer operations and maintenance (outside)	YES	YES	NO
Fuel and water dipping	YES	YES	NO
Resetting trip wires	YES	YES	NO
Removing items from belt	YES	YES	NO
Bore field inspections	YES	YES	NO
Bus operations	YES	YES	YES
Electrical switching	YES	NO	NO
Power station (diesel operated)	YES	YES	YES
Skid steer loader operations	YES	YES	NO
Laboratory work	YES	YES	YES
General Duties Inside Warehouse	YES	YES	YES
General Duties Outside Warehouse (out in the open)	YES	YES	NO
Vehicle Loading Crane Operation	YES	YES	NO
Driving off Site (Public Roads)	YES	YES	YES
General Driving on Site	YES	YES	YES
Mechanical Maintenance Fixed Plant Indoors or Undercover	YES	YES	YES
Mechanical Maintenance Fixed plant – Outdoors or Unprotected	YES	YES	NO
Fixed plant Inspections – Indoors or Undercover	YES	YES	YES
Fixed plant Inspections – Outdoors or Unprotected	YES	YES	NO

Table 9 - Procedural Summary – Port Rail Operations

ROY HILL Mining – Mine Village	BLUE	YELLOW	RED
Activities	18-30 kms	10-18 kms	0-10kms
Cleaning Rooms and Buildings (inside)	YES	YES	YES
General Freight Haulage	YES	YES	YES
Residents Moving within the Village (Unprotected)	YES	YES	NO
Working at Heights (Roof Access, etc.)	YES	YES	NO
Maintenance of the Village	YES	YES	NO
Residents Boarding and Disembarking from the Buses (Unprotected)	YES	YES	NO
Maintaining the Village Grounds/Gardens	YES	YES	NO
Rubbish Removal	YES	YES	NO
Village General Maintenance and Cleaning Duties	YES	YES	NO
Refuelling Generators	YES	YES	NO
Power Station Operation and Maintenance	YES	YES	NO
Outdoor Sporting Activities	YES	YES	NO

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Residents using the Gymnasium	YES	YES	YES
Walking the Heritage Walk Trail	YES	YES	NO
Buggy Operation	YES	YES	NO
Security (Manning the Gatehouse)	YES	YES	YES
Swimming (Village Pool)	YES	NO	NO
WWTP Maintenance	YES	YES	NO
Communication Tower Maintenance	YES	NO	NO
RO Water Treatment Plant Operation and Maintenance	YES	YES	NO

Table 10 - Procedural Summary – Mine Village

ROY HILL Mining - Aerodrome	BLUE	YELLOW	RED
Activities	18-30 kms	10-18 kms	0-10kms
Aerodrome Runway Checks	YES	YES	NO
Aircraft Refuelling	YES	NO	NO
Baggage Handling	YES	YES	NO
Aerodrome Maintenance	YES	YES	NO
Boarding and Disembarking the Aircraft (Under direction)	YES	YES	YES
Standby Emergency Services	YES	YES	NO

Table 11- Procedural Summary – Aerodrome

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