STANDARD OPERATING PROCEDURE (SOP)

WORKING NEAR ELECTRICAL OH LINES AND UG CABLES

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Document Change Note

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1 PURPOSE

This procedure provides practical guidance for managing electrical risks when working near energised (live) overhead or underground electric lines i.e. to ensure, so far as is reasonably practicable, that no person, plant or thing at the workplace comes within an unsafe distance of an overhead or underground electric line.

2 SCOPE

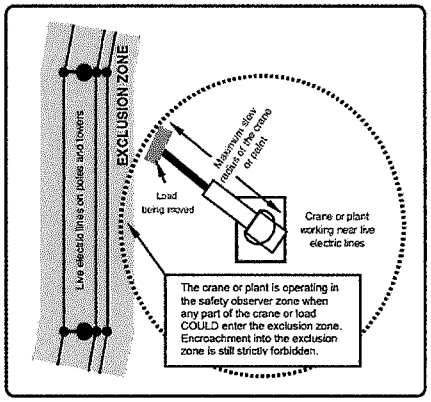
This procedure shall apply to all AMNS project sites and related work areas including contractors to meet –

- Legal and regulatory requirements
- AMNS HSE requirements
- ISO 45001 and ISO 14001 standard requirements

3 DEFINITIONS

Electrical risk: Electrical risks are risks of death, electric shock or other injury caused directly or indirectly by electricity.

Exclusion zone: An exclusion zone is a safety envelope around an overhead electric line. No part of a worker, operating plant/equipment or vehicle should enter an exclusion zone while the overhead electric line is energised (live).



Working near OH lines scenarios:

1. Marching of crane / piling rig (equipment with high mast)
2. Crane working/ marching with extended boom (Crawler Crane with Lattice Booms)
3. Personnel in contact with the crane, load or operating plant
4. Transportation of high loads
5. Scaffold erection
6. Personnel moving metal ladders or pipes

Working near Under Ground (UG) power lines scenarios:

1. Piling activities
2. Excavation activities
3. Soil testing activities

4 RESPONSIBILITIES

The Project Head is responsible for ensuring that the project is in compliance with the general requirements and those given in this procedure.

HSE Manager is responsible for providing advice on this standard and oversight inspections to verify compliance.

5 SAFE WORKING NEAR ENERGISED LINES

5.1 HAZARDS

The most common electrical risks and causes of injury associated with working near overhead or underground electric lines are:

- Electric shock causing injury or death. The electric shock may be received by direct or indirect contact, tracking through or across a medium, or by arcing
- Flashover, arcing, explosion or fire causing burns. The injuries are often suffered because arcing or explosion or both occur when high fault currents are present
- Fire resulting from an electrical fault
- Induction from high voltage overhead electric lines.

Contact with overhead or underground electric lines can be fatal, whether the lines are carrying a voltage as high as 400,000 volts or as low as 230 volts. Contact with overhead electric lines is not necessary for an electric shock to occur. A close approach to the live conductors may allow a 'flashover' or arc to take place. The risk of flashover increases as the voltage increases.

5.2 RISK CONTROL MEASURES

5.2.1 Elimination

The best way of eliminating these hazards is to prevent people, plant, equipment and materials from coming close enough to energised overhead electric lines for direct contact or flash over to occur.

This may include:

- De-energising the electric line during work
- Isolating and earthing the line (or equivalent for low voltage) so it is not live during work

If eliminating the risk is not reasonably practicable, then reducing risk using substitution, isolation or engineering controls, or a combination of these control measures, may be considered.

5.2.2 Substitution

Minimise the risk by substituting or replacing a hazard or hazardous practice with a safer one. This may include performing the work another way, for example:

- Using alternative plant/equipment which cannot enter an exclusion zone
- Using non-conductive tools designed to reduce the possibility of direct contact with the overhead electric line

5.2.3 Isolation

Minimise the risk by isolating or separating the hazard or hazardous work practice from people. For example, erecting a physical barrier (height barrier / goal post) to prevent any part of the plant or equipment from entering an unsafe distance, or, similarly, to prevent a person, anything held by a person, or anything attached to a person from entering an unsafe distance. A physical barrier should consist of non-conductive material like wood or plastic. The barrier should be erected safely which may entail isolating the electricity supply while the barrier is installed.

5.2.4 Engineering controls

Engineering controls are physical control measures to minimise risk, for example:

- Fitting proximity sensors and a warning device to plant to alert operators when they are about to enter an unsafe distance.
- Limiting movement of plant with mechanical stops
- Mechanically limiting slew speed of a crane to slow
- Using electrically insulated plant and equipment
- Use underground cable detector to identify the cable and secure the area / route

If a risk then remains, the Project Head shall minimise the remaining risk, so far as is reasonably practicable, by using administrative controls.

5.2.5 Administrative controls

Administrative controls should only be considered when other higher order control measures are not reasonably practicable, or to increase protection from the hazard. These are work methods or procedures designed to minimise exposure to a hazard, for example:

- Establishing the minimum clearance distance from the closest part of the crane or other operating plant to the power line, as per below table

Minimum Safe Clearance values for various voltage levels:

Voltage kV Ph. to Ph. rms		Minimum Safe clearance (Metre)
6.6 kV		2.57
>6.6 kV	<= 11 kV	2.59
>11 kV	<= 22 kV	2.64
>22 kV	<= 33 kV	2.75
>33 kV	<= 66 kV	3.00
>66 kV	<= 132 kV	3.43
>132 kV	<= 220 kV	4.57
>220 kV	<= 400 kV	5.48

- Unexpected movement of the terrain, ground or surface upon which the crane or other plant is located or uneven surfaces over which the plant/equipment moves, possibly resulting in a corresponding surge or sudden movement towards live electric lines;

- Prevailing or unexpected wind strength and direction and other weather conditions shall be studied. In the case of a crane, the size and shape of the load, particularly the surface area facing the wind shall be studies.
- The possibility of sway and sag of the overhead powerlines (sway of overhead powerlines is usually caused by wind, while sag may vary as temperatures vary) shall be considered
- Making hazards more visible by:
  - ❖ using warning signs to indicate the location of overhead electric lines and defined work areas
  - ❖ arranging for the electricity entity to identify exposed energised low voltage conductors, up to and including 1000 volts and fitting them with approved visual indicators like sheeting or sleeves
  - ❖ a competent person should inspect visual indicators each day before starting plant operations
  - ❖ if visual indicators have moved or been damaged the electricity entity should be contacted so they are replaced or located in the correct position.
- Emergency equipment is provided and readily accessible on site, including first aid kits and fire-fighting equipment suitable for electrical fire, and workers are trained in the correct usage and application in the event off an emergency
- An emergency plan including contact with energised electric lines is developed and documented with input from workers performing specific tasks
- A safety observer is used to warn people and plant operators when they are likely to come closer within an unsafe distance of an electric line
- Exclusion zone distances are strictly maintained. Any remaining risk must be minimised, as far as is reasonably practicable, by providing and ensuring the use of personal protective equipment.
- When the crane or operating plant is operating near the exclusion zone, only the following persons shall be allowed to touch any part of the crane, plant or load being moved:

  (a) The operator, while not in contact with an electrical earth, e.g. operator remaining in the cabin instead of standing on the ground beside the crane or plant.

  (b) The operator, while standing on the ground or while in contact with an earthed situation, may operate the crane or operating plant under any of the following conditions, when used appropriately:
  - ❖ The controls are effectively insulated (Insulation must at least be effective against the maximum voltage of the particular overhead electric line.
  - ❖ The operator wears insulating gloves where the voltage of any of the overhead electric lines does not exceed 1000 volts
  - ❖ The operator stands on rubber mat while operating the controls.
- Other personnel who are essential to the particular operation of the crane or operating plant e.g. helper, flag man or other worker helping to set up the crane or operating plant, provided these persons are not required to have direct contact with any part of the crane, operating plant or load. However, where direct contact is necessary:
  - ❖ Suitable insulating gloves should be worn; or

- ❖ Such contact should be via a non-conductive object e.g. pole or tail rope used to control load movement.

- For excavation, piping and underground cable diagram to be obtained from concerned team. If the excavation is near the underground utility, a manual trail pit shall be done to assess the depth of the utility line. In case of a trench, trial pit shall be made manually along the planned route every 10m distance and then the excavation work shall be started.
- No mechanical excavation shall be allowed where the underground utility is detected.
- If piping and underground cable diagram is not available, trial pit shall be made every 5m along the trench route or along the length and breadth of the area to be excavated.
- Work shall be started only after the permit to work is applied for the task.

5.2.6 Personal protective equipment

PPE should only be considered when other higher order control measures are not reasonably practicable or to increase protection from the hazard. Examples of PPE include:

- Insulating gloves which are effectively electrically tested
- Rubber soled boots
- Safety helmets
- Standing on a rubber insulating mat
- Standing on an equipotential conductive mat
- Dry clothes especially in wet or humid conditions.

6 CHECKING, CORRECTIVE AND PREVENTIVE ACTION

Periodic inspections shall be carried out to assess compliance to this procedure.

Any deviations shall be reported to Project Head & Corrective and preventive action shall be taken.

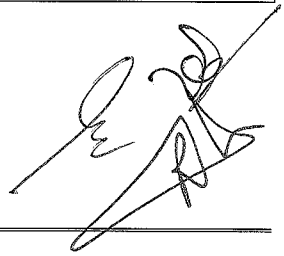
7 TRAINING

All employees shall be trained in general hazards and precautions to be taken while working near overhead lines / underground cables.

Relevant supervisors/ Engineers shall be trained in this procedure for compliance.

8 RECORDS

S. No.	Title	Location	Retention period
1	Permit to Work	HSE department	Until the completion of the project.



9 REFERENCE DOCUMENTS

AMNS/Project/SS/HSEM/08	Hazard identification, risk assessment and control
AMNS/Project/SS/HSEM/12	Emergency Response Management
AMNS/Project/TS/HSEM/06	Electrical Safety
AMNS/Project/TS/HSEM/13	Personal protective equipment management