Safe Work Instruction - Handling, Storage and Maintenance of Liquefied Chlorine Gas

DO NOT use this plant* or complete this task unless you have been inducted in its safe use and operation by an Authorised Experienced Operator

This SWI may not cover all possible hazards and risks and should be referred to as a control measure in the risk assessment process. Additional training may be required for high risk plant. Site and task may change required PPE.

PERSONAL PROTECTIVE EQUIPMENT

- Eye protection must be worn
- Long and loose hair must be contained or covered.
- Protective body clothing must be worn
- Foot protection must be worn
- Hand protection must be worn
- Breathing apparatus must be available

POTENTIAL HAZARDS AND RISKS

Exposure to High Pressure Fluid
Injury from exposure to high pressure fluids

Manual Task Injury
Manual task injury from incorrect manual handling techniques

Electrical Shock or Burn
Electrical shock or burn from plant contact with live electrical conductors

Other
Exposure to hazardous chemicals
Exposure to toxic fumes

Explosion
Explosion of gases, vapours or liquids

Equipment Failure
Exposure to toxic gas

Slip, Trips, Falls
Slip, trip, fall due to uneven or slippery work surfaces

PRE-OPERATIONAL SAFETY CHECKS

- ✓ Complete site-specific risk assessment & Work Permit – Chlorine Gas Facilities
- ✓ Complete the appropriate pre-operational plant checklist if applicable
- ✓ Ensure you are familiar with plant operations and controls
- ✓ Ensure that guards are fitted, secured and functional in accordance with manufacturers guidelines
- ✓ Ensure all workers have read and understand the instructions on the IXOM Wall Posters (inside CL_2 container room), IXOM Chlorine Handbook and current SDS for Chlorine Gas
- ✓ PPE in the form of an escape respirator shall be worn or carried by the Operator in readiness in the event of an emergency.
- ✓ Also the Operator shall wear supplied gas tight goggles (except when a full face respiratory protection is worn) and thermal gloves.
- ✓ A fully serviced Self-contained breathing apparatus (SCBA) must be kept at least 10m away from the chlorine installation in a readily accessible location upwind of the most prevalent or current wind direction. All personnel involved in these operations must have had training in the use of SCBA.
- ✓ The ventilation fan (if present) must be operational and must remain on until the operation has been completed (**Note: Vent fan is to run for 2 minutes minimum, or the time indicated on signage, prior to entry)**
- ✓ All doors to the chlorine plant must be opened to provide additional ventilation and allow a ready exit if a leak is detected. Exits must not be obstructed
- ✓ Ensure safety shower and gas leakage sensor are in working order and tested
- ✓ At no time should a safety cover be removed from a 70kg cylinder unless it is first secured into position with an individual chain.
- ✓ A 50ml puffer bottle containing 5% ammonia solution must be provided to assist with leak detection if required (Ammonia solution bottle should be date labelled and changed regularly to provide maximum reaction to Cl_2)
- ✓ Check wind intensity and direction to identify safe evacuation route if needed

Note: Prior to connecting or disconnecting a chlorine container, a minimum of two workers trained in chlorine handling & safety, must always be present to perform the tasks. One trained worker is to act solely as the safety observer.

HANDLING AND STORAGE

CONNECTION & DISCONNECTION PROCEDURES

Disconnection

- ✓ Once all the above preparations & precautions have been made, isolate the pipework from the empty container by closing the chlorine container valve.
- ✓ If possible, put the vacuum regulator into the operating position and run the chlorinator for a short period to allow any residual gas to be drawn from the system (With the 920kg system the drip leg heater should be checked (warm) to ensure liquid chlorine has not accumulated)
- ✓ Isolate the empty side from the system via any downstream isolation valves i.e. Manifold valves or Inline ball valves
- ✓ Loosen the chlorine container coupling/regulator and auto shutdown system (if fitted) without complete removal and check for leak with ammonia bottle. If chlorine gas (white cloud) detected evacuate to a safe distance to allow the residual chlorine gas in pipeline to dissipate to atmosphere
- ✓ Follow all remaining steps as laid out in the IXOM Wall Posters and IXOM Chlorine Handbook

Connection

- ✓ If connecting a full chlorine container refer directly to the IXOM Wall Posters and IXOM Chlorine Handbook **Note: This is a generic SWI to ensure common practice and training for both 70kg & 920kg systems.**

TRANSPORTING 70kg CHLORINE CONTAINER

- ✓ Ensure proper manual handling techniques are used when moving/lifting/lowering containers in and out of transport trailer (two-person operation)
- ✓ Chlorine cylinders are heavy and should be handled using a properly designed trolley with a safety chain by two trained workers
- ✓ Valve protection caps must always be in position when chlorine cylinders are being moved
- ✓ Cylinders should be transported horizontally in a properly designed cradle and secured to the truck or trailer using correctly tensioned winch belts or over centre clamps

  Note: Placard is only required if quantity is over 250kg. If instructed to display placards - truck and trailer should marked with front and rear "Toxic Gas 2", Oxidising Agent diamond and "Corrosive 8" diamond signs.

TRANSPORTING 920KG CHLORINE CONTAINERS USING ELECTRIC OVERHEAD TRAVEL CRANE (EOT)

- ✓ Ensure person/s have been trained/instructed in use of Overhead electric travel gantry crane
- ✓ Turn ON EOT isolation switch and using EOT remote control, raise chlorine container lifting beam from storage spot with EOT
- ✓ Travel forward at a height above chlorine containers to the desired location
- ✓ Lower the lifting beam down to a position just above the chlorine container so that the lifting beam hooks can be attached to either side of the chlorine container
- ✓ Raise the lifting beam slowly making sure the end lifting hooks are correctly attached to the chlorine container
- ✓ Travel forward or backward to desired location at a height above chlorine containers or infrastructure
- ✓ Lower chlorine container to resting location and release lifting beam end hooks
- ✓ Raise lifting beam and travel EOT with lifting beam back to storage spot and lower into position
- ✓ Turn OFF EOT isolation switch

MAINTENANCE

OPERATING PROCEDURES

- ✓ Ensure the worksite is suitably barricaded from public access if required
- ✓ To enable dismantling of chlorine equipment, isolation of the gas needs to be completed as per IXOM Chlorine handbook and SWI309. Then, with the chlorinator still running, all residual chlorine gas is to be used by the system to ensure complete evacuation of the remaining gas. Only when this evacuation is complete, can maintenance work commence
- ✓ Vacuum pressure will increase due to isolation of the gas supply, this can be observed on the V10K vacuum gage. The system will now call for gas, to evacuate the lines, air must be introduced into them
- ✓ To allow air into the lines, loosen the gas line connection on the furthest away vacuum regulator. Check for chlorine gas at each stage using the ammonia bottle. As the vacuum pressure increases you will hear air being drawn in by the vacuum, through the loosened gas line fitting. This will purge the system with air. The system needs to be left in this state for a few minutes
- ✓ If a second regulator is used, then the process can be repeated to purge these lines
- ✓ The systems residual chlorine will be reduced to suitable levels after several minutes depending on size of the system. The injector water can then be isolated
- ✓ Work can now commence, continue to check for chlorine gas at each stage of dismantling
- ✓ Maintenance and servicing of all components of the chlorine system should be carried out following the manufactures instructions

HANDLING CHLORINE LEAK EMERGENCIES

There are 3 different types of chlorine leaks;

1. **Local Emergency** is a minor leak unlikely to affect anyone more than a few metres from that part of the plant involved and can generally be dealt with by trained workers using SCBA equipment.

2. Site Emergency is a more substantial leak likely to cause danger to people in other work areas within the Water or Wastewater facility and may require the aid of the fire brigade to provide additional equipment etc. IXOM Australia can provide advice if required.

3. Serious Emergency is a major leak that could cause a danger to people outside the Water or Wastewater facility and has the potential to cause major injury or damage, may require evacuation of the surrounding community and would almost certainly require the aid of the fire brigade and advice from the IXOM Australia emergency team.

NOTE: In almost every case, a leak can be stopped by closing the containers valve. If this is not possible IXOM Australia emergency teams have specialised equipment available 24 hrs.

- ✓ In any emergency the co-ordinator in charge of the Water or Wastewater facility will decide the actions to be taken based on the circumstances and location of the leak.
- ✓ In order to help determine the extent of a leak, all Water and Wastewater Treatment facility chlorine leak detectors are set to activate at a "Low Level" leak at > 2 ppm Chlorine and can be reset if the leak is momentary. The "High Level" leak alarm is set to activate at ≥ 20 ppm Chlorine which would require the Chlorine Leak Procedure to be followed.
  For more detailed information regarding the handling of emergencies refer to the section titled "Handling Emergencies" in the IXOM Chlorine Handbook and AS/NZS 2927:2019 (Appendix J)

CHLORINE LEAK PROCEDURE

NOTE: In the event of a chlorine leak the following procedure must be carried out:

- ✓ If during a workday, initiate the Evacuation Procedure specific to the Treatment Plant for all people likely to be in any danger. Evacuate to a safe location upwind of leak.
- ✓ If after hours, the co-ordinator will call the on-call operator to first establish the validity of the alarm. This may be done by the operator visiting the site and approaching with caution considering site and environmental factors.
- ✓ When it is determined that isolation of the chlorine leak can be carried out safely, then isolation can be attempted. Two or more trained workers must be present at all times. One trained worker must not become involved in the operation and remain on site, during the entirety of the operation as the safety observer.
- ✓ All workers participating in this operation must use a serviceable SCBA set.
- ✓ The worker entering the chlorine container room shall shut down all chlorine container valves and then evacuate to fresh air as soon as possible.
- ✓ Time should then be allowed for the chlorine gas to dissipate prior to attempting to establish the location of the gas leak and performing repairs

ENDING OPERATIONS

- ✓ Ensure SCBA is clean in good condition and stored in the appropriate location
- ✓ If SCBA unit is used, ensure that it is refilled (All SCBA cylinders shall be kept at 100% - full)
- ✓ Resecure room
- ✓ Replace any tools etc. to the tool box
- ✓ Remove clean & store PPE
- ✓ Remove any barricades/signs if used from the area

DO NOT

- ✗ Do not use if plant is faulty. Attach an Out of Service tag and report fault to your supervisor
- ✗ Do not use equipment capable of generating noxious gas in the work area
- ✗ Do not obstruct exits with any equipment or article
- ✗ Do not leave plant running unattended
- ✗ Do not use mobile phone while operating plant
- ✗ Do not connect or disconnect a chlorine container by yourself (strictly 2-person operation)
- ✗ Do not attempt to do any of the procedures unless appropriately trained

***Plant in this SWI refers to any machinery, equipment, appliance, container, implement and tool.**

Shoalhaven Water Chlorine Gas Leak Alarm/Incident Reporting File

Site Location	How was Alarm/Incident Reported	Alarm/Incident Details	Time/Date of Alarm/Incident	Person/s Responsible	Action Taken	Alarm/Fault Cleared Yes/No	Comments