Integrated Risk Management

RMIT - Building 57

CO2 Refrigeration Lab | Prepared By : RDJ 27/12/14 | Reviewed By: JEF 25/3/15

Updated: 6 Jan -15 ISECO Engineering Services PTY

Ref	Risk	How can it happen	What can happen	Assessment Likelihood	Assessment Consequence	Level of risk rating	Details of existing controls	Adequacy of existing controls	Implementation of existing controls	Reassessment Likelihood	Reassessment Consequence	Level of risk rating	Further treatment required	Comment
1	**Major NH3 leak (Note full charge is 12 kgs)**	Pipe rupture	Exposure to NH3 vapour or liquid causing danger to people in the immediate working area and surroundings	Unlikely	Medium	Medium	Certified welders / procedures/ pressure testing . Also ensure any capped pipe work /valves with Ammonia liquid have provisions to prevent over pressure liquid trapping (i.e. check valve or relief valve)	Adequate	Always	Unlikely	Medium	Low	NO	Check any capped future connections cannot trap CO2 or Ammonia Liquid - ok no valves on future caps
		Relief valve lift		Possible	Medium	Significant	Pressure releif vent lines discharge to water tank	Adequate	Always	Unlikely	Minor	Low	NO	Routine Maintenance required to manage tank water level & check pressure relif valves as per supplier recommendations
		Pressure Vessel failure		Unlikely	Medium	**Medium**	Vessels to AS1210 & pressure tested/register with WHS and inspected annually /as per standard AS 3788	Adequate	Always	Unlikely	Minor	Low	NO	Routine pressure vessel inspection required
		Corrosion		Possible	Medium	**Significant**	Use of stainless steel pipes, Painted vessels and copper tubing (CO2)	Adequate	Always	Unlikely	Minor	Low	NO	Routine Maintenance only
		Gland or seal leak		Possible	Medium	Significant	Valves capped / regular inspections (weekly)	Adequate	Always	Unlikely	Minor	Low	NO	Regular Inspection
		Gauge failure		Common	Medium	**Significant**	Capped gauge valves to isolate gauges	Adequate	Always	Unlikely	Minor	Low	NO	
		Topping up the system		Possible	Medium	**Significant**	Signage. Trained personnel. Follow correct procedures. Protective safety equipment on hand	Adequate	Always	Unlikely	Minor	Low	NO	Trained Personnel only and written procedures required
		Vibration of pipe work or rubbing through of touching parts		Possible	Medium	**Significant**	Vibration isolation and appropriate pipe supports / sleaves	Adequate	Always	Unlikely	Minor	Low	NO	Review final installation to confirm compliance -ok no excessive vibration
		Mechanical Impact from forklifts, vehicles etc		Possible	Medium	**Significant**	Plant is not in an area subject to traffic and all items protected within enclosure	Adequate	Always	Unlikely	Minor	Low	NO	
		System over pressure due to high ambient temperature or compressor control malfunction		Possible	Medium	**Significant**	Air cooled condenser has been generously sized to operate at a low (3K) temperature difference between ambient air and condensing . Thus unlikely to get to relief valve discharge pressure in ambient temperature range below 52 oC . Pressure switches will automatically cut off compressors if high pressure set point is exceeded.	Adequate	Always	Unlikely	Minor	Low	NO	Test pressure switches & relief valves regularly
		Ammonia to glycol heat exchanger freeze up / rupture		Possible	Medium	**Significant**	Glycol system has an antifreeze system control which automatically shuts off ammonia compressor if glycol temperature is too low . Also glycol concentration maintained with 6oC safety factor on freezing temperature . Do not connect mains water to automatically top up system (dilution will result)	Adequate	Always	Unlikely	Minor	Low	NO	Test antifreeze shut down on commissioning and regularly, also test glycol concentration at handover and at least 2 times per year. Confirm mains water is not connected for automatic make up .
		Water supply not available to emergency spray / scrubber system		Possible	Medium	**Significant**	Provide signage on valves " Warning must be open for safety system " and lock valve open . Include warning in system operating instructions not to operate if water supply is not available	Adequate	Always	Unlikely	Minor	Low	NO	Provide signage , lock and operating instructions
		Valves not plugged		Possible	Medium	**Significant**	Regular valves inspections, all valves capped & plugged at initial handover	Adequate	Always	Unlikely	Minor	Low	NO	Routine Maintenance Only
		Any of the above		Possible	Medium	**Significant**	Proper signage and placarding	Adequate	Always	Unlikely	Minor	Low	NO	
							Gas detector installed (early warning) and plant room ventilation and water spray/ scrubber system installed . Also Emergency Stop Buttons provided .	Adequate	Always	Unlikely	Minor	Low	NO	Routine calibration and testing of gas detection required .
							Eye wash & safety shower	Adequate	Always	Unlikely	Minor	Low	NO	Confirm Eyewash & safety shower installed -RMIT to review
							Emergency plan in place for evacuation and calling in outside assistance (Fire Brigade / police / ambulance)	Adequate	Always	Unlikely	Minor	Low	NO	Emergency Response Plan to be developed
2	**Minor NH3 leak**	Servicing strainers / filters and draining oil	Discomfort with breathing / sore eyes but unlikely to affect anyone outside the immediate working area	Possible	Minor	Medium	Only qualified technicians to service equipment / proper procedures in place. Service personnel and /or trained operators access to respirator masks / shut-off NH3 supply and isolate leak	Adequate	Always	Unlikely	Minor	Low	NO	Written maintenance procedure & trained personnel only . Also clearly identify ammonia shut off valve (King Valve) on liquid receiver and ensure it is easily accessible. PPE equipment onsite.
		Leakage at connections to gauges or transducers and sensors due to vibration , connection leakage etc.	Discomfort with breathing / sore eyes but unlikely to affect anyone outside the immediate working area	Possible	Minor	Medium	Connections to be welded or designed for correct pressures and temperatures . Vibration elimination and prevention of rubbing through to be included . All connections to be pressure tested before handover	Adequate	Always	Unlikely	Minor	Low	NO	Check pressure tests have been performed at hand over
3	**Rotating machinery**	Accidental contact	Risk of injury	Possible	Severe	High	Proper guards are fitted to coupling/fans etc in acc. with the Standards. E Stop buttons also fitted	Adequate	Always	Unlikely	Minor	Low	NO	
		Servicing equipment	Risk of injury to service personnel	Possible	Severe	High	Only qualified technicians to service equipment / proper procedures in place. JSAs and tag lock-out systems in place during service operations	Adequate	Always	Unlikely	Minor	Low	NO	Develop procedures that require qualified service personnel only
4	**Working at Height**	Servicing the condenser or ceiling mounted evaporators	Risk of injury from fall	Possible	Severe	High	Proper ladder and service platforms	Adequate	Always	Unlikely	Minor	Low	NO	Use standard working at height procedures
5	**Heavy Equipment**	Removal of heavy equipment items for servicing	Risk of back injury	Possible	Medium	Significant	Adequate access for heavy lifting equipment around the unit (forklift / trolley etc.)	Adequate	Always	Unlikely	Minor	Low	NO	
6	**Fire**	External e.g. spread from adjacent building; or electrical malfunction	Risk of injury to operator from overpressure and CO2 or Ammonia release	Unlikely	Medium	Medium	No significant conbustible building materials in vicinity of rack plant . Relief valves will vent any over pressure.	Adequate	Always	Unlikely	Minor	Low	NO	Monitor to conirm no combustible storage in area of refrigeration rack
7	**Electrical shock**	Maintenance on electrical equipment and switchboards	Risk of injury to technicians	Possible	Severe	High	Only qualified technicians to service equipment / proper procedures in place. JSAs and tag lock-out systems in place during service operations. Provide warning signs for all heat traced Pipe work using 240 V	Adequate	Always	Unlikely	Minor	Low	NO	Check heat traced pipes & drains have warning labels
8	**Hypothermia**	Accidentally trapped in Freezer or chiller rooms	Injury or death	Unlikely	Severe	Significant	Emergency lighting and exit doors with manual release mechanism as per BCA Section G1.2	Adequate	Always	Unlikely	Minor	Low	NO	Check compliance with BCA G1.2
9	**Incorrect Emergency Response**	Lack of Emergency Response plan resulting in delayed or incorrect evacuation procedures	Injury	Unlikely	Medium	Medium	Develop Emergency response plan which also incorporates : Notification of adjacent Furniture Tech Building in event of ammonia detection alarm or release, Security to direct building occupants away from ammonia leakage (Use wind sock etc to decide which evacuation doors are safe) , notification of Fire Brigade and emergency response team of type of refrigerant and quantities , Provide signage to direct emergency response ,Clearly identify main ammonia shut off valve (king valve) on outlet of liquid receiver and ensure its easy to access with Breathing Apparatus on.	Adequate	Always	Unlikely	Minor	Low	NO	Develop procedures and install windsock or equal to show wind direction
10	**Environmental contamination**	Release of water containing ammonia and oil to stormwater or trade waste drains	Injury	Possible	Medium	Significant	Review possibility & consequence of water from ammonia scrubber entering stormwater or trade waste drains and provide bunded collection if required.	Adequate	Always	Unlikely	Minor	Low	NO	RMIT accept one off limited discharge in event of emergency situation .
11	**Carbon Dioxide leak in Freezer and or adjacent class room**	Pipe rupture or valve/ component failure allowing CO2 to leak into an enclosed freezer room or adjacent class room.	Cold burns to eyes and skin . High concentrations in air can lead to asphyxiation	Possible	Medium	Significant	Pipe work and equipment to be located above normal head height. Students entering cold rooms/freezer room to wear PPE. Automatic CO2 detector to be installed at low level in Freezer room to activate alarm and ventilation systems if alarm levels exceeded (15,000 ppm).Also ensure any capped pipe work /valves with CO2 liquid have provisions to prevent over pressure liquid trapping (i.e. check valve or releif valve).	Adequate	Always	Unlikely	Minor	Low	NO	Develop PPE procedure for students & staff. Test CO2 detection at commissioning and regularly as per detector manufacturer recommendations.
12	**Carbon Dioxide discharge from plant skid**	Pipe rupture or valve/ component failure allowing CO2 to leak into plant skid area	Cold burns to eyes and skin .	Possible	Medium	Significant	Students entering plant skid area to wear PPE. Also must be with trained plant operator who also has PPE . Because plant area is open at sides , unlikely to build up significant CO2 concentration in event of leakage. Pressure relief valves installed on all vessels and piped to safe location.	Adequate	Always	Unlikely	Minor	Low	NO	Develop PPE procedure for students & staff. Confirm pressure relief valve discharge to safe location.
13	**Extended Mains Power outage**	Supply failure or isolation of power supply to refrigeration switchboard	Ammonia detectors fail to operate , Co2 detectors fail to operate ,	Possible	Medium	**Significant**	Detectors to be monitored via fail safe contacts into Security System which has battery back up	Adequate	Always	Unlikely	Minor	Low	NO	Checked ok durring commissioning
			Ammonia plant does not restart in correct sequence when power resumed	Possible	Medium	**Significant**	Check during commissioning that all drives and controls restart automatically or go to safe status when power is restored. Also check all tx valves remain closed until the relevant compressor is operating	Adequate	Always	Unlikely	Minor	Low	NO	Checked ok durring commissioning
			Carbon dioxide plant does not restart in correct sequence when power resumed	Possible	Medium	**Significant**	Check during commissioning that all drives and controls restart automatically or go to safe status when power is restored. Also check all tx valves remain closed until the relevant compressor is operating	Adequate	Always	Unlikely	Minor	Low	NO	Check during commissioning
			Low temperature carbon dioxide receiver pressure relief valve lifts when vessel contents rise above -4.5oC	Possible	Medium	**Significant**	The vessel is insulated and has a back up refrigeration unit but this also need mains power to operate. The vessel relief valve will lift automatically if pressure is exceeded. The valve is discharged to a safe location outside of buildings .	Adequate	Always	Unlikely	Minor	Low	NO	