CO2 R	- Building 57 efrigeration Lab		Prepared By : RDJ 27/12/14	Revie	ewed By: JEF 25/3	3/15								
Updat	ed: 6 Jan -15 ISECO Engir	IS ISECO Engineering Services PTY						Adequacy of	Implementation				Further	
Ref	Risk	How can it happen	What can happen		ssment Consequence	Level of risk rating	Details of existing controls	existing controls	of existing controls	Reasses Likelihood	consequence	Level of risk rating	treatment required	Comment
1	Major NH3 leak (Note full charge is 12 kgs)	Pipe rupture		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	Law	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				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	Adequate	Always	Unlikely	Minor	Low	NO	Routine pressure vessel inspection required
		Corrosion		Possible	Medium	Significant	AS 3788 Use of stainless steel pipes, Painted vessels and copper tubing (CO2)	Adequate Adequate	Always	Unlikely	Minor	Low	NO	Routine Maintenance only
		Gland or seal leak		Possible	Medium	Significant		Adequate	Always	Unlikely	Minor	Low	NO	Regular Inspection
		Gauge failure Topping up the system		Common Possible	Medium	Significant	Capped gauge valves to isolate gauges Signage. Trained personnel. Follow correct procedures. Protective safety equipment on hand	Adequate	Always	Unlikely 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	
			Exposure to NH3 vapour or liquid causing danger to people in the immediate working area and surroundings	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.	racquire		Unitery				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					Provide signage on valves " Warning must be open for safety system " and lock valve open .	Adequate	Always	Unlikely	Minor	Low	NO	Provide signage , lock and operating instructions
		emergency spray / scrubber system		Possible	Medium	Significant	Include warning in system operating instructions not to operate if water supply is not available	Adequate	Always	Unlikely	Minor	Low	NO	
		Valves not plugged		Possible	Medium	Significant	Regular valves inspections, all valves capped & plugged at initial handover Proper signage and placarding	Adequate	Always	Unlikely	Minor	Low		Routine Maintenance Only
		Any of the above		Possible	Medium	Significant	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 Adequate	Always Always	Unlikely 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		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							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 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							Develop procedures that require qualified service personnel only
4	Working at Height	Servicing the condenser or ceiling	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	mounted evaporators 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	Risk of injury to operator from overpressure and CO2 or Ammonia release	Unlikely	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			Low		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 Adequate	Always Always	Unlikely 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 sulliding in event of amnonia detection alarm or release, Security to direct building occupants away from ammonia leakage (Use wind sock etc to decide which exacution doors are safe), notification of Fire Brighead 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.							Develop procedures and install windsock or equal to show wind direction
	-							Adequate	Always	Unlikely	Minor	Low	NO	
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	enclosed freezer room or adjacent	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.	- Jogudic			Items			Develop PPE procedure for students & staff. Confirm pressure relief valve discharge to safe location.
13	Extended Mains Power outage	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 Adequate	Always Always	Unlikely 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			1. M				Checked ok durring commissioning
			Carbon dioxide plant does not restart in correct sequence when power resumed	Possible	Medium		operating 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 Adequate	Always Always	Unlikely Unlikely	Minor	Low	NO	Check during commissioning
			Low temperature carbon dioxide receiver pressure relief valve lifts when vessel contents rise above - 4.50C	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	Alwan-	Unlikely	Minor	Low	NO	
L	1	1	4.300		1	1	uiscriargeu to a safe location outside of buildings .	Adequate	Always	Uniikely	MINOr	LOW	NU	

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