## *ANNEX 5.6 – DRAFT CONSTRUCTION HAZID WORD DIAGRAM*

| CONSTRUCTION PHASE | | | | |
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| **#** | **Hazardous Event** | **Possible Causes** | **Possible Consequences** | **Proposed Controls** |
| 1 | Road transport – collision of vehicles; vehicle roll-over; vehicle crash into object (stationary or mobile). | Driver failure (speed, judgment error, loss of control of vehicle).<br>Contributing factors:<br>o Narrow roads<br>o Limited shoulders<br>o Dust<br>o Parked vehicles<br>o Loose surface<br>o Unsuitable vehicle condition | o Fatality.<br>o Major injury.<br>o Damage/loss of vehicle.<br>o Impact on environment (e.g., spill of cargo). | o Driver Training<br>o Dust control on roads<br>o Signs<br>o Vehicle inspection program<br>o Ongoing training and awareness<br>o Monitoring speed & driver behaviour and taking action if unsafe<br>o Road improvements<br>o Remove public vehicles from site<br>o Core Process # 229: Vehicle Safety Management |
| 2 | Road transport – road pavement collapse; road subsides | o Road design or maintenance inadequate.<br>o Vehicles too heavy for road.<br>o Heavy rain and poor drainage or run off. | o Fatality.<br>o Major injury.<br>o Damage/loss of vehicle.<br>o Impact on environment (e.g., spill of cargo). | As above for item #1, plus:<br>o Design and construction standards for new roads<br>o Limit heavy vehicle access on roads not able to take them safely<br>o Road maintenance and inspection |
| 3 | Road transport – offsite collision or roll-over | As for item #1. Additional contributory factors:<br>o Driver failure (non-project vehicle)<br>o Travelling at night | o Fatality.<br>o Major injury.<br>o Damage/loss of vehicle.<br>o Impact on environment (e.g., spill of cargo). | As above for item #1 for site personnel, plus:<br>o Suitable roll cage or provisions in heavy vehicles |
| 4 | Pedestrians near heavy vehicle activity.<br>Light vehicles near heavy vehicles. | o Various – supervisors, workers, & others need to approach or work near heavy vehicles from time to time | o Fatality – heavy vehicle runs over pedestrian or light vehicle | o Site awareness & training; competency assessments<br>o Flashing lights on light vehicles when near heavy vehicles<br>o High-visibility clothing on personnel on foot. |
| 5 | Vehicles reverses into another vehicle or pedestrian | o Vehicle reverses from a park and a person at the rear not seen by driver<br>o Driver is in a hurry and fails to look | o Pedestrian hit by car – injured or killed. | o Heavy vehicles to be fitted with reversing beeper<br>o All vehicles to be parked so they can be driven out forward |
| 6 | Ferry/barge transport:<br>o Collision | o Collision with other craft.<br>o Human error by captain. | o Fatality; injury<br>o Loss of cargo | o Sufficient number of lifejackets and buoyancy aids on all vessels.<br>o Maximum number of |

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| | | **CONSTRUCTION PHASE** | | | |
| | o Capsize<br>o Sinking | | o Schedule delay<br>o Loss of ferry/barge | | passengers/weight posted on all vessels.<br>o Personnel to wear lifejacket when working on the deck of the barge.<br>o Ferry/barges operated by competent trained professionals. |
| 7 | Fuelling of vehicles – spill of fuel. | o Operator error.<br>o Hose failure.<br>o Vehicle drives off with hose still on tank.<br>o Ignition source – smoking; vehicle. | o Environmental spill.<br>o Possible fire. | o | Diesel fuel used in majority of vehicles<br>o Fuelling area to have containment for spills, and spill kits<br>o Response plan for spills.<br>o No smoking at fuel station.<br>o Fire extinguishers at fuelling points. |
| 8 | Storage of fuels + oils – leaking drum or container | o Leak of drum due to corrosion, puncture with forklift, drum tipped over.<br>o Leak from fuel tank due to corrosion, valve opened or leaking. | o Environmental impact.<br>o Possible fire. | o | All tanks and drums to be in bunded area.<br>o Regular inspection of bunded areas.<br>o Fire extinguishers.<br>o Core Process #211: Fire Prevention and Protection |
| 9 | Petrol fire. | o Petrol onsite used for some small equipment – compactors, concrete finishers, etc. | o Petrol is highly flammable – possible fire from leaks or during refuelling. | o | Eliminate petrol powered equipment and vehicles as far as possible.<br>o Special storage for petrol.<br>o Only small containers to be on the job site for refuelling stationary equipment.<br>o Fire extinguishers.<br>o Other fire fighting equipment (fire truck with foam capability).<br>o Core Process #211: Fire Prevention and Protection |
| 10 | Splash of hazardous material in eyes or on skin. | o Operator error.<br>o Person does not realize what the chemical is. | o Burns to eyes, skin. | o | All materials to be clearly labelled.<br>o Training for people using materials.<br>o Safety showers, eye wash where material properties require it.<br>o Safe storage of materials.<br>o PPE required for handling chemicals.<br>o MSDS register on site and available to |

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| **CONSTRUCTION PHASE** | | | | | | | |
| | | | | | | | all employees.<br>o Core Process # 205: Personal Protective Equipment<br>o Core Process # 202: Hazard Communication Program |
| 11 | Injury to a member of the public. | o | Unauthorized site access | o | Risk of injury due to lack of knowledge about site. | o | Photo ID Badge.<br>o Site access control point (Security Gate).<br>o Induction for employees and visitors. |
| 12 | Injury or medical emergency<br>o Heat stress or illness<br>o Burns<br>o Heart Attack<br>o Other construction incident or injury | o<br>o<br>o<br>o | Weather<br>Mosquitoes, midges, other<br>Non work-related illness or condition<br>Nature of work | o<br>o<br>o | Injury, serious injury or fatality to self and/or others<br>Medical treatment case<br>Lost time injury | o<br>o<br>o<br>o<br>o<br>o<br>o<br>o<br>o<br>o<br>o | Provisions of paramedic services.<br>Pre-employment medical screening.<br>Provision of emergency response team and equipment.<br>Provision of ambulance and emergency response vehicles.<br>Training of the above.<br>Emergency communication procedures and process.<br>Clothing issues to workers.<br>Potable water supply.<br>Amenities for rest.<br>Other PPE (sunscreen, insect repellent, etc.)<br>Drug and alcohol testing.<br>Health promotion. |
| 13 | Wharf Activities<br>o Ship/barge collision at wharf<br>o Incident during unloading of ship or barge<br>o Truck collision<br>o Unloading incident | o<br>o<br>o<br>o<br>o | Pilot error; bad weather.<br>Rigging or crane failure.<br>Error by operator.<br>Movement by truck from wharf to process plant or laydown areas - traffic movement.<br>Unloading of material at site by crane – rigging or crane failure; error by operator. | o<br>o<br>o<br>o<br>Per item #1.<br>o | Damage to barge or wharf<br>Spill of fuel or cargo<br>Fatality or injury to workers.<br>Spill of cargo<br>Fatality or injury to workers. | o<br>o<br>o<br>Per item #1.<br>o<br>o<br>o | Ship/barge movement under control of Pilot<br>Require contractors on wharf to follow safe work procedures<br>Supervision of unloading<br>Training; supervision<br>Induction to site<br>Safe work procedures |
| 14 | Incident during heavy or | o<br>o | Rigging failure<br>Crane overload | o<br>o | Fatality or injury to workers<br>Damage to equipment | o | All heavy or difficult lifts, including dual crane lifts, to have detailed lifting plan, |

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| | difficult crane lift | o | Two (or more) cranes used and one operator makes error | | | o<br>o<br>o<br>o<br>o | rigging engineer in charge, and dedicated single channel radio communication<br>Area to be clear of non-essential personnel during lift.<br>Lift coordination between neighbouring work areas and contractors<br>Core Process # 223: Cranes and Lifting Operations<br>SWPP # 4MP-T81-01904-001: Cranes Use and Operation |
| 15 | Excavation & trenching<br>o Collapse<br>o Personnel fall into trench<br>o Animal falls into trench | o<br>o<br>o<br>o | Human error factors<br>Haste<br>Inattention to path of travel (vehicle or pedestrian)<br>Open trench/excavation | o<br>o<br>o<br>o | Injury, serious injury or fatality<br>Falls<br>Engulfment<br>Confined space classification | o<br>o<br>o<br>o | Permitting and procedures<br>Barricading and controls as per permit<br>Site awareness and training<br>Core Process #218: Excavation and Trenching |
| 16 | Boat operations<br>(Small vessels for construction operations)<br>o Capsize<br>o Rough conditions<br>o Animal interference<br>o Explosion (fuel, gases) | o<br>o<br>o<br>o | Human error including failure to obey direction of boat driver)<br>Weather conditions<br>Wildlife<br>Incorrect loading of boat | o<br>o<br>o | Injury, serious injury or fatality<br>Drowning<br>Loss of materials or equipment | o<br>o<br>o<br>o<br>o | Person operating from boats to wear lift jackets<br>Weather conditions monitored by supervisor, stop work if conditions become unsafe<br>Driver of boat must be a 'competent person'<br>No smoking in boats<br>Core Process #232: Work On or Near Water. |
| 17 | Manual handling<br>o Force exerted by a person to grasp, manipulate, strike, throw, carry, move (lift, push pull, lower), hold or restrain an object, load or body part. | o<br>o<br>o<br>o<br>o<br>o | Poor ergonomics<br>Poor lifting techniques<br>Person unfit for that task<br>Haste<br>Poor attention to body positioning<br>Cramped working conditions | o<br>o | Injury or serious injury<br>Lost time injury/medical treatment case | o<br>o<br>o<br>o<br>o | Access to lifting equipment in a timely manner.<br>Site awareness and training.<br>Pre-employment medical: Fit for duty assessment.<br>Rehabilitation of injured workers including early return to work program.<br>Early medical and paramedical intervention. |
| 18 | Electrical shock | o<br>o | Equipment fault<br>Human error | o<br>o | Burns<br>Electrocution | o<br>o | Hardwire RCD at source<br>Quarterly inspection and tag |

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| **CONSTRUCTION PHASE** | | | | | | | |
| | | | | | | o<br>o<br>o<br>o | Isolation and tag out procedures<br>Earthing rods for all portable generators and welders<br>Site awareness and training<br>Core Process # 221: Lockout Tagout Procedure |
| 19 | Elevated Work - Fall from height | o<br>o<br>o | Failure to inspect harness or equipment<br>Improper construction of scaffolding<br>Failure to tie-off | o | Fall resulting in injury, serious injury or death. | o<br>o<br>o<br>o<br>o | Edge protection and elevating work platforms<br>Tie off when working at elevated heights.<br>Supervision of workers.<br>Core Process #212: Fall Protection<br>Core Process #213: Scaffolding |
| 20 | Inclement weather – Cyclone (Construction Phase) | o<br>o | Location of plant near the ocean<br>Nature | o<br>o<br>o<br>o<br>o | Flying debris<br>Destruction of temporary structures.<br>Major Injury<br>Fatality<br>Localized flooding | o<br>o<br>o<br>o<br>o<br>o | Early notification of site personnel<br>Tie down loose items and general clean up.<br>Lower crane booms and anchor equipment if possible.<br>Shut down site and non essential road traffic.<br>Use heavy equipment to provide windbreak for vulnerable structures.<br>Core Process #203: Emergency Preparedness |
| 21 | Handling and storage of compressed gas cylinders – rapid release of stored energy | o<br>o<br>o<br>o<br>o | Mechanical failure of cylinder<br>Failure to secure cylinders<br>Failure to screw protective cap back on valve assembly<br>Accident during transport – dropped from forklift or crane.<br>Damaged or worn hoses. | o<br>o<br>o | Missile<br>Injury, serious injury or death.<br>Damage to surrounding equipment. | o<br>o<br>o<br>o | Designated storage areas.<br>Inspect hoses regularly.<br>Secure cylinders at all times.<br>Core Process # 225: Compressed Gas Cylinders. |
| 22 | Confined spaces – work in:<br>o Tanks<br>o Vessels; pipe<br>o Sumps; etc. | o<br>o<br>o<br>o<br>o | Oxygen deficient atmosphere.<br>Restricted egress routes.<br>Failure to stage emergency rescue team and proper equipment.<br>Failure to ventilate space<br>Failure to monitor atmosphere. | o<br>o<br>o<br>o | Suffocation.<br>Burns.<br>Explosion.<br>Death. | o<br>o<br>o<br>o | Confined space entry procedure and permits.<br>Isolate process lines.<br>Monitoring of the confined space atmosphere.<br>Supervision by entry supervisor. |

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| **CONSTRUCTION PHASE** | | | | | | |
| | | | | | | o Training/Operating Procedures.<br>o SCBA's or PAPR where necessary.<br>o Core Process #221: Lockout Tagout Procedure<br>o Core Process #217: Confined Space Entry. |
| 23 | Pressure Testing (pneumatic) – rapid release of stored energy | o | Requirement to do pneumatic testing on vessels and piping in cryogenic services at pressures beyond operating pressures. | o Failure of piping.<br>o Major release of stored energy.<br>o Injury<br>o Death<br>o Damage/loss of equipment | | o Exclusion zones.<br>o Limit size of system being tested to minimize stored energy whenever possible.<br>o Staged pressure increases (10 barg)<br>o Calculations to quantify amount of stored energy in system being tested.<br>o Pressure testing of vessels and piping SWPP # 4MP-T81-03506-003<br>o Radiography and progressive sampling of welders SWPP # 4MP-T81-03711-000 |