

Plant Description: Liquid Nitrogen Offloading, Storage, and Vapourisation Facility.

This facility will be designed to safely receive, store, and vapourise liquid nitrogen (LN2) and produce gaseous Nitrogen for industrial use. It integrates heavy-duty reinforced concrete foundations, safe offloading zones, robust vapourisation systems, utilities, and comprehensive safety measures.

1. Foundations and Civil Works

- Tank Bearing Pads
 - **Dimensions:** Approximately 40 m × 30 m coverage area.
 - **Construction:** 300 mm thick reinforced concrete slab with a two-layer reinforcement mat designed to support high loads from liquid Nitrogen tanks and associated equipment.
 - **Structural Purpose:** Provides stable and durable base to prevent settlement or movement under cryogenic storage loads.
- Offload Drive/Vehicle Area
 - **Thickness:** 200 mm reinforced slab with welded mesh or bar reinforcement per structural design.
 - **Features:** Anti-slip surface finish, ample clearance for tanker manoeuvring and safe coupling/uncoupling of transfer lines.
 - **Additional Systems:** Integrated transfer pipeline, task lighting, emergency stop (ESD) stations, and spill containment systems.
- Walkways and Equipment Platforms
 - **Thickness:** 150 mm concrete slab, reinforced as required.
 - **Purpose:** Safe operator access to vapourisers, tank valves, and instrumentation.
- All areas will be illuminated suitable for pedestrian access, plant monitoring and specific task lighting

2. Cryogenic Handling and Vapourisation Systems

- Grounding/Earthing System
 - Heavy-duty grounding cables installed throughout offloading and tank farm areas to prevent static discharge during LN2 transfer.
- Storage Facility Area
 - Large vertical or horizontal liquid Nitrogen tanks (per vendor specification) located on tank pads with ambient air clearance for venting and maintenance.

- Vapourisers
 - **Quantity:** 2 industrial Liquid Nitrogen vapouriser units located downstream of the main storage tank.
 - **Purpose:** Convert liquid nitrogen to gaseous nitrogen (GN2) for process use.
 - **Supporting Equipment:** Gas purification stage and pressure regulation sets to deliver GN2 at required pressure and quality.

3. Utilities and Buildings

- Compressor Building Approx 6mx5mx3m
 - Ventilated, weather-protected structure housing nitrogen / air compressor and associated mechanical equipment.
 - PSA nitrogen generation system delivering high purity Nitrogen , including pretreatment, VSD compressor, PSA skids, product buffer, analyzers, controls, remote monitoring,
 - Dedicated space within the small building for electrical switchgear, PLC/SCADA systems, control panels, compressed air supply, and instrument air (for pneumatic valve actuation where needed).

4. Safety and Compliance Features

- Fire and Gas Safety
 - Fire detection systems with suppression measures considered based on hazard analysis.
 - Continuous gas detection for oxygen deficiency hazards (ODH) with alarm and auto-shutdown integration.
- Access and Evacuation
 - Clearly marked escape routes, muster points, and illuminated exit signage for safe evacuation.
 - PPE zones and controlled access points for liquid Nitrogen handling areas.
- Emergency Shutdown (ESD)
 - ESD stations positioned in the offloading bay, tank farm, and vapouriser area to instantly shut down operations during an incident.

5. Operational Workflow

1. Tanker Offloading
 - Tanker drives onto reinforced offload pad, connects via cryogenic transfer line, and grounds to facility earthing system.
 - LN2 pumped into storage tank with monitoring of pressure and temperature.

- Spill containment and emergency systems remain live during transfer.

2. Storage & Management

- LN2 stored in main cryogenic tank on reinforced bearing pad; boil-off gases recovered or vented safely.

3. Vapourisation

- On demand, LN2 routed to vapourisers.
- Vapourised GN2 regulated and purified before entering distribution system.

4. Safety Systems Engagement

- Fire/gas systems continuously monitor.
- ESD activated in emergencies to isolate all cryogenic flows and shut down compressors/vapourisers.