ONGC Winter Training 2024

REPORT

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Training under: Mr. Vivekanand, Superintending Engineer (Production)

ACKNOWLEDGMENT

I would like to express my sincere gratitude to ONGC for providing me with the opportunity to undertake winter training under the guidance of Mr. Vivekanand, Superintending Engineer (Production). His invaluable mentorship, encouragement, and insights have been instrumental in enhancing my understanding and practical knowledge during this training period.

I am deeply thankful to the entire team at ONGC for their support and cooperation, which made my learning experience enriching and seamless. Their expertise and willingness to share knowledge have greatly contributed to the successful completion of the assigned tasks.

Lastly, I extend my heartfelt thanks to my faculty at Delhi Technological University and my family for their constant encouragement and support throughout this training.

INTRODUCTION:

The Linch Redevelopment Project (LRDP), undertaken by Oil and Natural Gas Corporation Limited (ONGC), represents a critical modernization effort to enhance the infrastructure and efficiency of the Linch Group Gathering Station (GGS) and associated facilities located near Mehsana, Gujarat. Discovered in 1972, the Linch field has been a vital asset for ONGC's operations. However, the existing surface facilities, which have been in operation for over 32 years, require significant upgrades to meet modern engineering, safety, and environmental standards.

The redevelopment project is strategically designed to replace and augment the outdated infrastructure with state-of-the-art systems that ensure efficient processing of well fluids, optimized gas handling, and environmentally compliant effluent treatment. This project is part of ONGC's commitment to maintaining operational excellence and aligning with sustainable practices in the oil and gas sector.

OBJECTIVES OF THE PROJECT:

The primary objective of the LRDP is to establish new surface facilities for the Linch GGS while retaining and integrating some of the existing installations. The project aims to:

- Enhance the capacity and reliability of well fluid processing.
- Implement advanced gas compression and dehydration systems.
- Introduce a modern effluent treatment plant (ETP) for environmentally compliant disposal of produced water.
- Develop a water injection plant (WIP) to support enhanced oil recovery (EOR) techniques.
- Ensure operational safety and efficiency through comprehensive safety studies and adherence to modern engineering codes and standards.

SCOPE OF THE REDEVELOPMENT:

The redevelopment effort encompasses several key facilities and components, including:

1. **Group Gathering Stations (GGS):** Modernized well fluid collection and processing systems featuring advanced separators, heaters, and pumps.
2. **Effluent Treatment Plant (ETP):** A sophisticated setup for treating and managing produced water with features like Corrugated Plate Interceptors (CPI) and Induced Gas Floatation Units (IGFU).
3. **Water Injection Plant (WIP):** Facilities designed to treat water and re-inject it into the reservoir for enhanced oil recovery.
4. **Gas Handling Systems:** Low-pressure (LP) and high-pressure (HP) gas compression systems and a Triethylene Glycol (TEG) based gas dehydration unit for conditioning the produced gas.
5. **Safety and Environmental Compliance:** Implementation of HAZOP studies, operability reviews, and compliance with statutory regulations to ensure a safe and sustainable operation.

KEY FEATURES AND DELIVERABLES

The project's scope includes design, procurement, installation, and commissioning of cutting-edge equipment and systems. Detailed engineering tasks such as process simulations, safety studies, and preparation of Process Flow Diagrams (PFDs) and Piping and Instrumentation Diagrams (P&IDs) are integral to the project. Additionally, the redevelopment focuses on minimizing the environmental footprint through efficient effluent and gas management systems.

STRATEGIC IMPORTANCE

The LRDP holds strategic importance for ONGC as it ensures the longevity and productivity of the Linch field. By leveraging modern technology and engineering practices, the project aims to enhance oil and gas recovery rates, reduce operational downtime, and comply with stringent environmental standards. This redevelopment aligns with ONGC's vision of sustaining energy security for the nation while adhering to global best practices in the oil and gas industry.

In summary, the Linch Redevelopment Project is a cornerstone initiative for ONGC, reflecting its commitment to innovation, sustainability, and operational excellence. The integration of advanced facilities and systems under the LRDP will not only optimize the field's production capabilities but also set a benchmark for future redevelopment projects within ONGC.

TERMINOLOGY/ABBREVIATIONS

ABBREVIATIONS	FULL FORMS
CBD	Closed Blowdown Drain
CTF	Central Tank Farm
CPI	Corrugated Plate Interceptor
DCS	Distributed Control System
ESD	Emergency Shutdown System
EPS	Early Production System
ETP	Effluent Treatment Plant
F&G	Fire & Gas Detection System
GGS	Group Gathering Station
HAZOP	Hazards & Operability Study
IDBH	Indirect Bath Heater
IGFU	Induced Gas Floatation Unit
LRDP	Linch Re-development Project
LSF	Linch Surface Facility
NPSH	Net Positive Suction Head
PDS	Process Data Sheet
SCMD	Standard Cubic Meter per Day
SGCU	Sales Gas Conditioning Unit
TBP	Technical Bid Package
OWS	Oily Water System
WIP	Water Injection Plant

GROUP GATHERING STATION:

A **Group Gathering System (GGS)** is a critical component in the upstream oil and gas production process. It serves as a centralized facility where crude oil, natural gas, and water from multiple wells within a field are collected, processed, and distributed for further treatment or transportation.

Process Description:

1. **Collection of Well Fluid:**
    - Well fluid from both old and new well networks is collected and sent to a new inlet manifold at Linch GGS.
    - This manifold has **three parts**:
        - **Group Manifold** (for processing in bulk).
        - **Test Manifold** (for testing individual wells).
        - **Activation Manifold** (for wells under activation).
2. **Well Fluid Processing:**
    - The fluid is heated to **45°C** in an **Indirect Bath Heater (IDBH)** and sent to a **3-phase Separator** to separate oil, water, and gas.
    - The separated oil is further heated to **90°C** in a **Heater Treater** and stored in tanks.
    - Water is used to preheat incoming oil, optimizing heat efficiency.
3. **Gas Processing:**
    - Gas from separators is compressed in two stages:
        - **Low-Pressure (LP) Compression:** Increases gas pressure from **1-2 kg/cm²g** to **7 kg/cm²g**.
        - **High-Pressure (HP) Compression:** Boosts pressure to **65 kg/cm²g** for further use.
    - Dehydrated gas is either used internally, sent to the gas lift network, or conditioned for sale.
4. **Activation and Testing:**
    - **Activation Header:** Handles fluid from wells under activation, heating it and separating liquid and gas.

- **Test Headers:** Process fluid from wells being tested, separating liquid and gas, with liquids stored in test tanks for further treatment.

5. **Final Steps:**
    - Treated oil is sent through pipelines to storage.
    - Gas is conditioned to meet consumer requirements, and condensates are recycled back into the system.

Safety and Control:

The GGS incorporates advanced systems for monitoring and safety, such as:

- Distributed Control System (DCS) for automated operations.
- Emergency Shutdown System (ESD) and Fire & Gas Detection System (F&G) for safety.

Applications:

- GGSs are vital in onshore and offshore oil fields, especially in integrated facilities like the Linch Surface Facility (LSF) or Early Production Systems (EPS).

EFFLUENT TREATMENT PLANT:

The **Effluent Treatment Plant (ETP)** is an integral facility in oil and gas production operations designed to manage and treat industrial wastewater generated during the extraction and processing of hydrocarbons. It ensures compliance with environmental standards by treating effluents to minimize environmental impact before discharge or reuse.

Process Description:

1. **Effluent Collection and Preliminary Treatment:**
    - Produced water from Heater-Treaters and Group Separators is collected in an inlet receiving tank and transferred to Wash Tanks using feed pumps. Chemical dosing (PAC and DOPE) is performed in Flash Mixing and Flocculator Tanks before removing large particles in CPI units.
2. **Oil and Solid Separation:**
    - Effluent flows to IGF units, where nitrogen bubbles aid in separation, followed by Nut Shell Filters, clarifiers, and Pressure Sand Filters for further purification. Treated water is stored in tanks and dosed with bactericides, oxygen scavengers, and corrosion inhibitors.
3. **Effluent Disposal and Recycling:**
    - Treated water is either recycled to Wash Tank-1 or disposed into Effluent Disposal wells using high-pressure pumps. Off-spec effluent is also recycled for re-treatment.
4. **Slop Oil, Water, and Sludge Management:**
    - Free oil is collected in the Slop Oil Sump and pumped to other units. Water from the Slop Oil Sump and sludge from equipment are managed using dedicated pumps and routed to designated sumps or drying beds.
5. **Backwash and Waste Management:**
    - Backwash waste and supernatant water are pumped back to the Wash Tank. Sludge handling is supported by a Multiscrew Press and backup sludge drying beds.

6. **Chemical Dosing:**
    - Chemical dosing ensures the treated effluent meets performance guarantees.

Key Components:

- **Oily Water System (OWS)**: Initial stage for the removal of oil from water.
- **Advanced Separation Units**: Systems like the CPI and IGFU for secondary and tertiary oil-water separation.
- **Monitoring Systems**: Continuous quality checks are performed using automated systems like the **Distributed Control System (DCS)** to ensure treated effluent complies with safety norms.

Significance in Operations:

- Essential for managing wastewater in facilities such as **Group Gathering Stations (GGS)** and **Central Tank Farms (CTF)**.
- A critical part of sustainability initiatives within projects like the **Linch Surface Facility (LSF)** and **Linch Re-development Project (LRDP)**.

Safety and Compliance:

- Equipped with emergency protocols, including the **Emergency Shutdown System (ESD)** and **Fire & Gas Detection System (F&G)**, to handle potential risks during operations.
- Regular audits and **Hazards & Operability Studies (HAZOP)** ensure the ETP operates at optimal safety and efficiency.

WATER INJECTION PLANT:

The **Water Injection Plant (WIP)** is a vital facility in oil and gas production operations, primarily used to enhance reservoir pressure and improve hydrocarbon recovery. It involves treating and injecting water into the reservoir to maintain optimal pressure and boost oil production efficiency.

Process Description:

1. **Ultra-Filtration for Water Polishing:**
    - Water from Treated Water Storage Tanks/Booster Pumps is processed in Ultrafiltration (UF) Units (3 units, 50% capacity each) to reduce turbidity to less than 1 NTU.
    - Treated water is stored in an Ultrafiltration Tank and pumped to existing Treated Water Storage Tanks using UF Tank Pumps (3 pumps, 2 operating, 1 standby).
2. **Injection Pumping System:**
    - Water is pumped from the Treated Water Storage Tanks to Main Injection Pumps (MIP) via Booster Pumps (3 units each, 50% capacity, 2 operating, 1 standby).
    - MIPs deliver water at 130 kg/cm²g to water injection headers, which distribute it to injector wells with appropriate pressure and flow measurement.
3. **Chemical Dosing and Monitoring:**
    - Oxygen scavenger is dosed at the Treated Water Storage Tanks, while scale inhibitor, corrosion inhibitor, and chlorine dioxide are added at the MIP inlets.
    - A nitrogen blanket is provided for the storage tanks, supported by an on-site nitrogen generation system.
4. **Water Quality Monitoring:**
    - Parameters like water quantity, oil content, suspended and dissolved solids, dissolved oxygen, and SRB count are regularly monitored using suitable systems to ensure quality compliance.

Key Components:

- **Pumps and Compressors**:
  High-capacity pumps ensure the water is injected at the required pressure to reach the target reservoir zones.
- **Monitoring Systems**:
  - Advanced control systems like the **Distributed Control System (DCS)** ensure precise operation and monitoring of the injection process.
  - **Net Positive Suction Head (NPSH)** calculations are critical to ensure pump efficiency and prevent cavitation.
- **Injection Wells**:
  - Specially designed wells transport treated water into the reservoir.

Integration with Other Facilities:

- The WIP is closely linked with facilities like the **Group Gathering Station (GGS)** and **Central Tank Farm (CTF)**, where water produced during oil and gas extraction is separated, treated, and recycled.
- The use of treated water from systems such as the **Induced Gas Floatation Unit (IGFU)** and **Corrugated Plate Interceptor (CPI)** ensures efficient recycling of wastewater.

Significance:

1. **Sustainability**:
   - Recycling produced water reduces environmental impact and conserves freshwater resources.
2. **Operational Efficiency**:
   - Enhanced reservoir management through water injection optimizes hydrocarbon production.
3. **Environmental Compliance**:
   - Treated water meets environmental standards, ensuring safe reinjection and disposal practices.

GAS HANDLING SYSTEMS:

Gas Handling Systems are essential in oil and gas production facilities for processing, treating, and managing natural gas extracted alongside crude oil. These systems ensure that natural gas is separated, conditioned, and prepared for transport, sales, or reinjection into reservoirs. Advanced technology in gas handling enhances operational efficiency, safety, and environmental compliance.

Process Description:

The gas handling process includes the following stages:

1. **Gas Separation**:
    - Natural gas is separated from crude oil and produced water at facilities like the **Group Gathering Station (GGS)**.
    - Initial separation occurs in separators where gas rises to the top for collection.
2. **Gas Treatment**:
    - The separated gas undergoes conditioning in the **Sales Gas Conditioning Unit (SGCU)** to remove impurities such as moisture, carbon dioxide, hydrogen sulfide, and other contaminants.
    - This ensures the gas meets specifications for transportation and end-use.
3. **Gas Compression**:
    - Compressors increase gas pressure for transport through pipelines or reinjection into the reservoir to maintain pressure.
4. **Gas Monitoring and Control**:
    - Advanced systems like the **Distributed Control System (DCS)** continuously monitor flow rates, pressure, and gas quality to ensure efficient and safe operations.

5. **Safety Measures**:
    - Systems such as the **Fire & Gas Detection System (F&G)** and **Emergency Shutdown System (ESD)** are employed to detect leaks and prevent accidents.

Key Components:

The Gas Handling System comprises several critical components, including:

1. **Separators**:
    - Equipment used at the initial stage to separate gas from liquids (oil and water).
2. **Sales Gas Conditioning Unit (SGCU)**:
    - Responsible for removing impurities and conditioning the gas to meet sales and transport specifications.
3. **Compressors**:
    - Machines that increase the gas pressure to facilitate transportation through pipelines or reinjection.
4. **Monitoring and Control Systems**:
    - **Distributed Control System (DCS)** ensures the system operates efficiently and safely.
5. **Safety Systems**:
    - **Emergency Shutdown System (ESD)** to stop operations during critical situations.
    - **Fire & Gas Detection System (F&G)** for early detection of leaks or hazardous conditions.
6. **Effluent Treatment Plant (ETP)**:
    - Handles wastewater produced during gas processing, ensuring environmentally safe disposal or reuse.

Significance in Operations:

1. **Resource Optimization**:
    - Gas handling systems maximize resource utilization by preparing natural gas for sale or reinjection, reducing wastage.
2. **Environmental Compliance**:
    - Ensures that emissions and effluents are treated to meet regulatory standards.
3. **Safety and Reliability**:
    - Advanced monitoring and safety systems like ESD and F&G enhance operational safety and reliability.
4. **Integration with Other Facilities**:
    - Gas handling is closely integrated with facilities such as the **Group Gathering Station (GGS)** and **Early Production System (EPS)** to ensure seamless production workflows.
5. **Support for Projects**:
    - Plays a critical role in large-scale projects such as the **Linch Surface Facility (LSF)** and **Linch Re-development Project (LRDP)**.

SAFETY AND ENVIRONMENT COMPLIANCE:

Safety and environmental compliance are critical aspects of oil and gas operations. The oil and gas industry, due to its complex and high-risk nature, requires stringent adherence to safety standards and environmental regulations to minimize risks to personnel, assets, and the surrounding ecosystem. Effective safety management systems and environmental safeguards ensure the sustainable operation of oil and gas facilities while meeting regulatory obligations.

Safety Systems and Protocols:

The safety of personnel and infrastructure is a top priority in operations, and multiple safety systems are integrated across various stages of oil and gas production to mitigate risks and ensure a safe working environment.

1. **Emergency Shutdown System (ESD)**:
    - The **ESD** is an automatic system designed to shut down critical operations in the event of an emergency, such as equipment failure, fire, or gas leaks.
    - It helps prevent accidents and minimize damage to assets by halting operations before a hazardous situation escalates.
2. **Fire & Gas Detection System (F&G)**:
    - The **F&G** system continuously monitors for the presence of combustible gases or fire hazards within the facility.
    - It triggers alarms and activates safety measures, including automatic shutdowns, ventilation adjustments, and fire suppression systems, to ensure immediate response to fire or gas leakage incidents.
3. **Hazards & Operability Study (HAZOP)**:
    - **HAZOP** is a systematic study conducted to identify potential hazards and operational risks in a process or facility.

- It is carried out periodically to ensure that safety protocols are up to date and to prevent unforeseen safety issues during operations.

4. **Distributed Control System (DCS)**:
    - The **DCS** is a critical safety management tool that enables real-time monitoring and control of operational parameters.
    - It ensures that all process variables are within safe limits, triggering alerts if any values deviate from preset thresholds.

Environmental Compliance:

The oil and gas industry must comply with stringent environmental regulations to minimize its impact on the surrounding environment. This includes proper waste management, water treatment, emissions control, and responsible resource utilization.

1. **Effluent Treatment Plant (ETP)**:
    - The **ETP** plays a key role in ensuring that produced water and other effluents are treated to meet environmental standards before being discharged into the environment or reused.
    - This helps prevent contamination of local water bodies and ensures that operations align with environmental protection regulations.
2. **Oily Water System (OWS)**:
    - The **OWS** ensures that any wastewater produced during oil and gas operations is treated to remove oil residues and other contaminants before it is either disposed of or reused.
    - Proper treatment of oily water reduces the environmental impact and ensures compliance with waste management regulations.
3. **Induced Gas Floatation Unit (IGFU)**:
    - The **IGFU** is used in the treatment of produced water to remove fine oil droplets that could otherwise lead to contamination of water bodies.

- By enhancing the separation of oil from water, it aids in reducing the environmental footprint of the facility.

4. **Regulatory Compliance**:
    - Compliance with local and international environmental regulations, such as emission limits and waste disposal guidelines, is ensured by monitoring systems and treatment units.
    - These systems help reduce the environmental impact of operations and maintain public health standards.

Sustainability Initiatives:

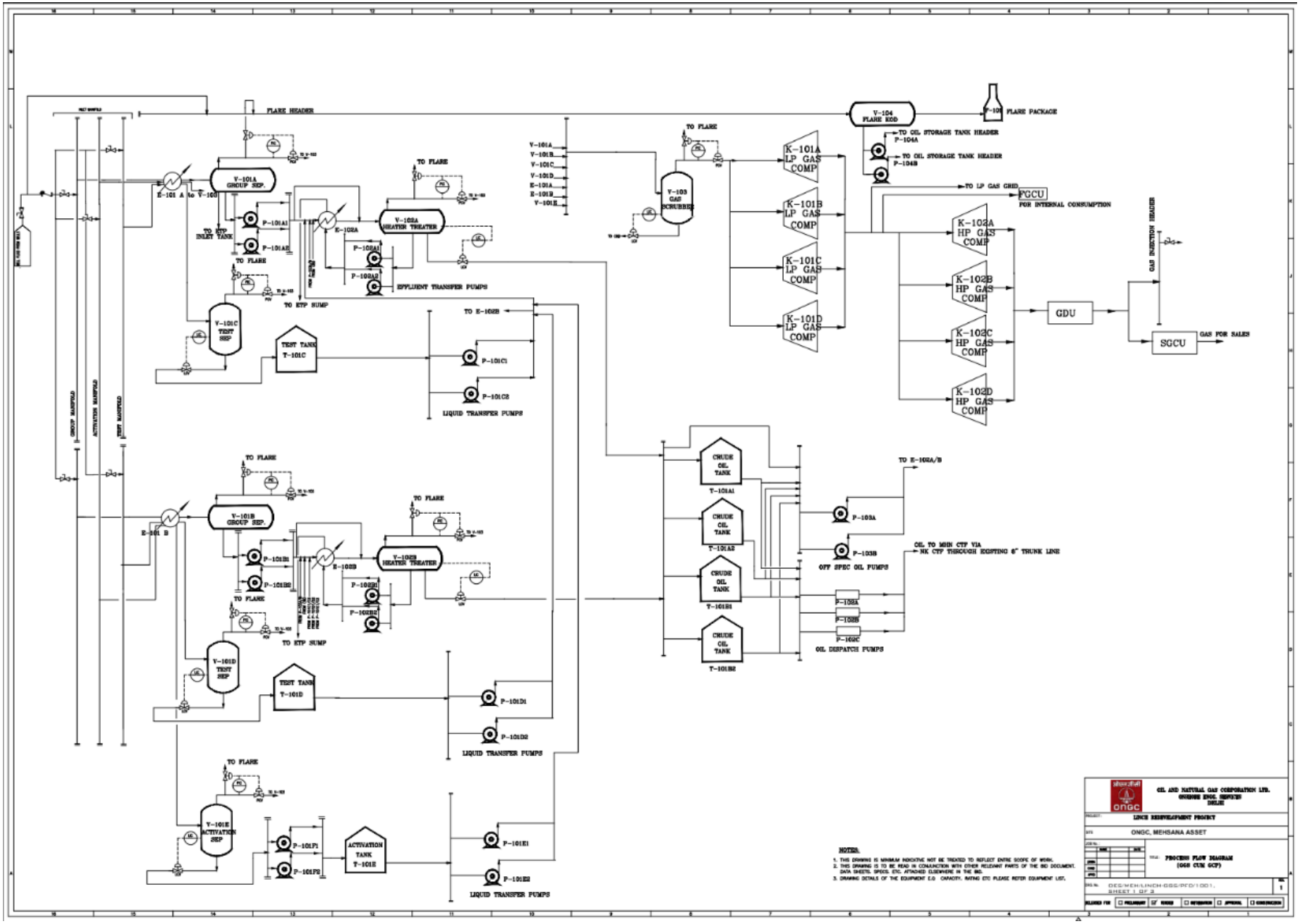
In addition to ensuring compliance with regulatory standards, oil and gas companies are increasingly adopting sustainability initiatives that focus on long-term environmental stewardship:

1. **Water Injection Plant (WIP)**:
    - The **WIP** supports sustainability by recycling produced water for reinjection, reducing the need for fresh water and helping maintain reservoir pressure.
    - This reduces the environmental burden associated with water extraction and consumption.
2. **Gas Handling and Conditioning**:
    - Natural gas is treated and processed in systems such as the **Sales Gas Conditioning Unit (SGCU)**, which removes contaminants and ensures the gas is suitable for sale or reinjection.
    - By conditioning gas to meet market standards, the facility minimizes environmental impact while maximizing resource utilization.
3. **Greenhouse Gas (GHG) Emissions Control**:
    - Efforts are made to monitor and reduce greenhouse gas emissions, particularly from flaring and venting processes, by utilizing flare gas recovery systems and adopting cleaner technologies.

PROCESS FLOW DIAGRAM (PFA)

- A **PFD** is a simplified graphical representation of a process, showing the main flow of materials and energy within a system.
- It typically illustrates key components such as reactors, heat exchangers, separators, compressors, and storage tanks.
- It does not show the detailed control elements, instrumentation, or piping layout.
- **Purpose**: Used to provide a high-level overview of the entire process, helping engineers and operators understand the sequence of operations, mass and energy balances, and basic process relationships.
- **Common Symbols**: Use of standard symbols for equipment and flow lines for materials or energy streams.

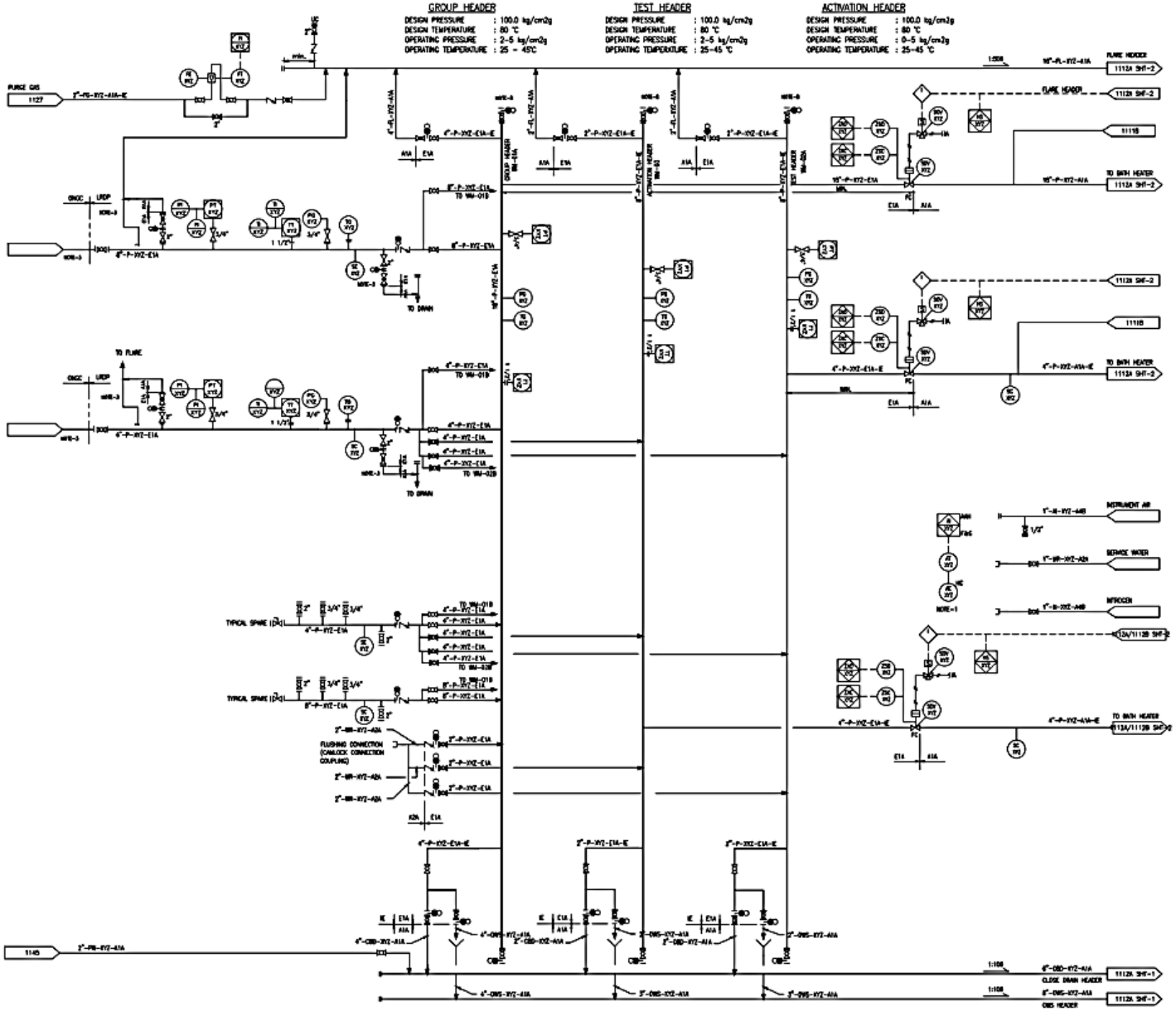
Below is an example of a Process Flow Diagram from the Linch Redevelopment Project at the Mehsana Plant of ONGC.


FLARE HEADER
V-104
FLARE KOD
P-105 FLARE PACKAGE
TO OIL STORAGE TANK HEADER
P-104A
TO OIL STORAGE TANK HEADER
P-104B
TO LP GAS GRID
FGCU
FOR INTERNAL CONSUMPTION
GAS INJECTION HEADER
GDU
SGCU
GAS FOR SALES
V-101A
GROUP SEP.
E-101 A
V-101C
TEST SEP
TEST TANK
T-101C
P-101C1
P-101C2
LIQUID TRANSFER PUMPS
TO E-102B
V-102A
HEATER TREATER
E-102A
P-102A1
P-102A2
EFFLUENT TRANSFER PUMPS
TO ETP SUMP
TO ETP INLET TANK
P-101A1
P-101A2
V-101B
GROUP SEP.
E-101 B
V-101D
TEST SEP
TEST TANK
T-101D
P-101D1
P-101D2
LIQUID TRANSFER PUMPS
V-102B
HEATER TREATER
E-102B
P-102B1
P-102B2
V-101E
ACTIVATION SEP
P-101F1
P-101F2
ACTIVATION TANK
T-101E
P-101E1
P-101E2
LIQUID TRANSFER PUMPS
V-103
GAS SCRUBBER
K-101A LP GAS COMP
K-101B LP GAS COMP
K-101C LP GAS COMP
K-101D LP GAS COMP
K-102A HP GAS COMP
K-102B HP GAS COMP
K-102C HP GAS COMP
K-102D HP GAS COMP
CRUDE OIL TANK
T-101A1
T-101A2
T-101B1
T-101B2
P-103A
P-103B
OFF SPEC OIL PUMPS
P-102A
P-102B
P-102C
OIL DISPATCH PUMPS
TO E-102A/B
OIL TO MHN CTF VIA NK CTF THROUGH EXISTING 6" TRUNK LINE
GROUP MANIFOLD
ACTIVATION MANIFOLD
TEST MANIFOLD
NOTES
1. THIS DRAWING IS MINIMUM INDICATIVE NOT BE TREATED TO REFLECT ENTIRE SCOPE OF WORK.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH OTHER RELEVANT PARTS OF THE BID DOCUMENT. DATA SHEETS, SPECS, ETC. ATTACHED ELSEWHERE IN THE BID.
3. DRAWING DETAILS OF THE EQUIPMENT E.G. CAPACITY, RATING ETC PLEASE REFER EQUIPMENT LIST.
OIL AND NATURAL GAS CORPORATION LTD.
ONGC
LINCH REDEVELOPMENT PROJECT
ONGC, MEHSANA ASSET
PROCESS FLOW DIAGRAM
(068 CUM GCF)
DES/MEH/LINCH-DSS/PFD/1001
SHEET 1 OF 2
REV 1

PIPING AND INSTRUMENTATION DIAGRAM (P&ID)

- A **P&ID** is a more detailed diagram that shows the piping, instrumentation, control systems, and other process equipment used in the plant.
- It includes specific symbols for piping, valves, pumps, instruments, and control loops, and it may also indicate how these components are interconnected.
- **Purpose**: Essential for the detailed design, operation, and troubleshooting of a process. P&IDs are used by engineers, operators, and maintenance personnel to understand the specifics of how a system is constructed and functions.
- **Common Symbols**: Detailed symbols and annotations representing valves, instruments, pumps, and control systems.

Below is an example of a Piping and Instrumentation Diagram (P&ID) from the Linch Redevelopment Project at the Mehsana Plant of ONGC.



REF. DWG. NO.	REFERENCE DRAWING TITLE
-	-

GENERAL NOTES:

1. FOR STANDARD SYMBOLS & NOMENCLATURE REFER TO LEGEND P&ID NO. OCS/MEH/LINCH-OCS/LEGEND/1101.
2. FOR GENERAL NOTES REFER TO LEGEND P&ID NO. OCS/MEH/LINCH-OCS/LEGEND/1102.
3. FOR EQUIPMENT SYMBOLS REFER TO LEGEND P&ID NO. OCS/MEH/LINCH-OCS/LEGEND/1103.

NOTES:

1. MINIMUM ONE NUMBER HYDROCARBON DETECTOR TO BE LOCATED NEAR GROUP HEADER/TEST HEADER AREA. REQUIRED NUMBERS ARE TO BE FINALIZED AS PER FIRE DETECTION LAYOUT DURING DETAIL ENGINEERING.
2. DOUBLE BLOCK AND BLEED ISOLATION VALVE FOR INSTRUMENTS IN 800# AND ABOVE.
3. TYPICAL DEPICTION OF SINGLE FINGER OF 8" AND 4" FOR EACH HEADER IS SHOWN.
4. ACTUAL NOS. OF FINGERS IS AS GIVEN BELOW:

FINGERS DESCRIPTION	
MANIFOLD	NO. OF FINGERS & SIZES
GROUP HEADER (TRAIN-A)	8" X 15 NOS. + 4" X 45 NOS. + 16 (8"X3+4"X13)SPARE
TEST HEADER (TRAIN-A)	4" X 65 NOS. + 4"X13 SPARE
ACTIVATION HEADER	4" X 65 NOS. + 4"X13 SPARE

5. ALL PGs, SPGs, PTs AND DPTs OF THE PROJECT SHALL BE SUPPLIED WITH A PRE-FABRICATED INSTRUMENTATION HOOKUP.
6. ALL CONTROL VALVES AND SHUTDOWN VALVES IN THE PROJECT SHALL BE ACTUATED BY A SELF-CONTAINED, INTEGRATED AND FAIL-SAFE ELECTROPNEUMATIC ACTUATOR.
7. TEST HEADER AND ACTIVATION HEADER AND LINE UPTO BATH HEATER SHALL BE HEAT TRACED.
8. TO BE CONNECTED WITH EXISTING HEADER.

INTERLOCK DESCRIPTION			
INTERLOCK NO.	ACTUATED BY	ACTION	REMARKS
	PAHH-BATH HEATER	CLOSE SDV-XYZ CLOSE ALL FACILITY	
	PAHH-BATH HEATER	CLOSE SDV-XYZ	

REV.NO.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
1		ISSUED FOR BID	XX	SR/VKT	SS

OWNER:
OIL AND NATURAL GAS CORPORATION LTD.

PROJECT : LINCH REDEVELOPMENT PROJECT (LRDP), MEHSANA

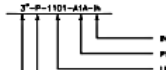
TITLE : PIPING & INSTRUMENTATION DIAGRAM MANIFOLDS (PRODUCTION/TEST/ACTIVATION), TYPICAL TRAIN-A

SCALE	JOB NO.	DRAWING NO.	REV.
~		OCS/MEH/LINCH-OCS/PID/1111A	

P&ID Standard Symbols and Nomenclature

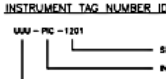
LINES

LINES IDENTIFICATION

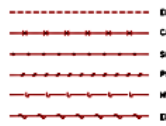


LINE LEGEND

INSTRUMENT TAG NUMBER IDENTIFICATION



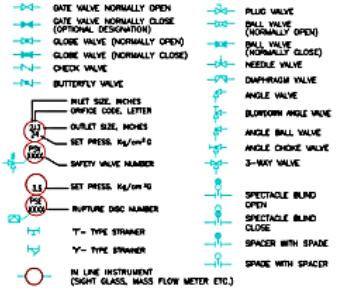
INSTRUMENT LINE SYMBOLS



LINE DESIGNATION

DESIGNATION	SERVICE	DESIGNATION	SERVICE
PROCESS LINES		**UTILITY OIL**	
P	PROCESS	LO	LUBE OIL
WI	WATER INJECTION	SO	SEAL OIL
DRAIN/VENT LINES		**CHEMICAL**	
BD	BLOW DOWN	C	CHEMICAL
CBD	CLOSE BLOW DOWN	GL	GLYCOL
OWS	OILY WATER SYSTEM	SH	SODIUM HYPOCHLORITE
SV	SAFETY VALVE DISCHARGE	**OTHERS**	
V	VENT	PL	SUB-SEA PIPELINES
DF	TEG DRAIN		
FL	FLARE	LT	LEAN TEG
		RT	RICH TEG
STEAM & CONDENSATE		PL	SUB-SEA PIPELINES
WB	BOILER FEED WATER	EX	TURBINE EXHAUST
CD	CONDENSATE		
S	STEAM	**UTILITIES GAS & FUEL**	
		AI	INSTRUMENT AIR
UTILITY WATER		AU	UTILITY AIR
WC	COOLING WATER	AB	BREATHING AIR
WF	FIRE WATER	GI	INSTRUMENT GAS
WP	POTABLE WATER	GU	UTILITY GAS
WR	RAW SEA WATER/ SERVICE WATER	N	NITROGEN
		FG	FUEL GAS
WU	UTILITY WATER	DF	DIESEL FUEL
WDR	DRINKING WATER		

VALVE, INSTRUMENT AND LINE SYMBOLS



VALVE, INSTRUMENT AND LINE SYMBOLS

INSULATION/TRACING TYPE

IA	ACOUSTIC INSULATION
IH	HOT INSULATION
IC	COLD INSULATION
IS	SAFETY INSULATION (PERSONAL PROTECTION)
IT	STEAM TRACED
IE	ELECTRICAL TRACED
IJ	STEAM JACKETED

GENERAL ABBREVIATIONS

ATM	ATMOSPHERE
AR	AUTO RESET
BL	BATTERY LIMIT
BP	BIOLOGICAL PROBE
CHD	CLOSED HYDROCARBON DRAIN
CMR	CONTROL ROOM MANUAL RESET (FOR SOV)
CS	CHEMICAL SEWER
CSC	CAR SEAL CLOSED
CSO	CAR SEAL OPEN
ESD	EMERGENCY SHUTDOWN
FA	FLAME ARRESTOR
FB	FULL BORE
FC	FAIL CLOSED
FF	FOUNDATION FIELD BUS
FL	FAIL LOCK
FMR	FIELD MANUAL RESET(FOR SOV)
FO	FAIL OPEN
FR	FLOW RECORDER
FSD	FIRE SHUTDOWN
FQ	FLOW TOTALIZER
H	HOLD
HLL	HIGH LIQUID LEVEL
HS	HOSE STATION
ISBL	INSIDE BATTERY LIMIT
LC	LOCK CLOSE
LLL	LOW LIQUID LEVEL
LO	LOCK OPEN
MOV	MOTOR OPERATED VALVE
MM	MANWAY
NNF	NORMALLY NO FLOW
NLL	NORMAL LIQUID LEVEL
NO	NORMALLY OPEN
NC	NORMALLY CLOSED
ODD	OPEN DECK DRAIN
OHD	OPEN HYDROCARBON DRAIN
OSBL	OUTSIDE BATTERY LIMIT
PB	PUSH BUTTON

GENERAL ABBREVIATIONS

PSO	POSITIVE SHUT OFF (CL.VI)
SC	SAMPLE CONNECTION
SL	SAMPLE LINE
TL	TANGENT LINE
TSO	TIGHT SHUT OFF (CL.VIdv)
UC	UTILITY CONNECTION
UV	PILOT OPERATED VALVE
USD	UNIT SHUTDOWN
VAC	VACUUM
VF	VENDOR FURNISHED
XPI	PIG DETECTOR / INDICATOR
XVPI	VALVE POSITION INDICATOR
YL	INDICATION LAMP

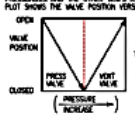
INSTRUMENTATION SYMBOLS AND LEGEND

NOTE: INSTRUMENTATION SYMBOLS AND LEGEND SHALL BE AS PER ISA "STANDARDS AND RECOMMENDED PRACTICES FOR INSTRUMENTATION AND CONTROL".

IDENTIFICATION LETTERS

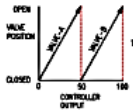
	FIRST-LETTER		SUCCEEDING-LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER' CHOICE
C	USER'S CHOICE			CONTROL	
D	USER'S CHOICE	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO(FRACTION)			
G	USER'S CHOICE		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	USER'S CHOICE	MOMENTARY			MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER' CHOICE
O	USER'S CHOICE		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE TOTALIZE			
R	RADIATION		RECORD		
S	SPEED FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVEN ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

1. SPLIT RANGE VALVES:
SOME CONTROL LOOPS HAVE TWO CONTROL VALVES ON THE OUTPUT SIGNAL OF ONE CONTROLLER FOR EXAMPLE WITH TWO CONTROL VALVES, ONE VALVE PRESSURIZES AND THE OTHER VENTS A VESSEL A PLOT SHOWS THE VALVE POSITION VERSES PRESSURE.

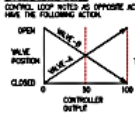


IT IS IMPORTANT TO KEEP THE CONTROL LOOP GAIN CONSTANT FOR GOOD SPLIT RANGE OPERATION, THE GAIN OF EACH VALVE (INCLUDING THE PROCESS) MUST BE MADE SIMILAR OTHERWISE LIMIT CYCLING OR POOR CONTROL WILL RESULT.

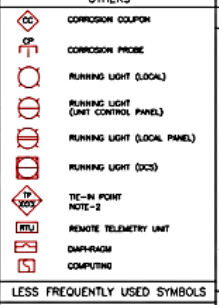
2. WHERE SEQUENCE VALVE:
OPERATION IS CALLED FOR, THEY ARE INTENDED TO WORK AS FOLLOWS.



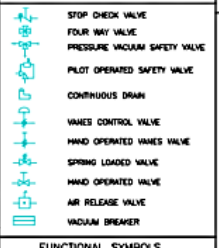
3. OPPOSITE ACTING VALVES:
CONTROL LOOP NOTED AS OPPOSITE ACTING VALVES HAVE THE FOLLOWING ACTION.



OTHERS



LESS FREQUENTLY USED SYMBOLS

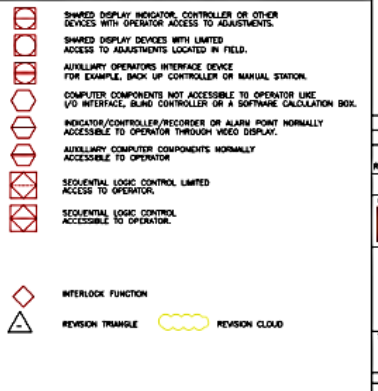


FUNCTIONAL SYMBOLS

FUNCTION BLOCK – FUNCTION DESIGNATIONS

NO.	FUNCTION	SYMBOL	NO.	FUNCTION	SYMBOL
1.	SUMMING	Σ	12.	TIME FUNCTION	f(T)
2.	AVERAGING	Σ/n	13.	HIGH SELECTING	>
3.	DIFFERENCE	Δ	14.	LOW SELECTING	<
4.	PROPORTIONAL	K	15.	HIGH LIMITING	▷
5.	INTEGRAL	∫	16.	LOW LIMITING	◁
6.	DERIVATIVE	K/s	17.	REVERSE PROPORTIONAL	-K
7.	MULTIPLYING	X	18.	BIAS	+
8.	DIVIDING	÷	19.	CONVERT * E- VOLTAGE I- CURRENT P- PNEUMATIC A- ANALOG H- HYDRAULIC D- DIGITAL	-
9.	ROOT EXTRACTION	√			±
10.	EXPONENTIAL	x^n			ⁿ√
11.	NON LINEARIZE UNSPECIFIED FUNCTION	f(x)			

DCS/COMPUTER SYSTEM SYMBOLS



REF. DWG. NO.	REFERENCE DRAWING TITLE
-	-

GENERAL NOTES:

NOTES:

1. THE FOUR-DIGIT INSTRUMENT SERIAL NUMBER IS AS FOLLOWS : FIRST 2 DIGITS : SAME AS LAST 2 DIGITS OF P&ID SERIAL NUMBER. LAST 2 DIGITS : SERIAL NUMBER STARTING FROM '01'.
2. THE FOUR-DIGIT TIE-IN POINT SERIAL NUMBER IS AS FOLLOWS : FIRST 2 DIGITS : SAME AS LAST 2 DIGITS OF P&ID SERIAL NUMBER. LAST 2 DIGITS : SERIAL NUMBER STARTING FROM '01'.
3. REFER PROJECT PMS DETAILS OF PIPING CLASS.
4. LSTK TO PROVIDE AND SHOW ISOLATION VALVES FOR ALL TAPPINGS/ INSTRUMENTS SHALL BE INSTALLED ON VESSEL/EXCHANGERS/TANKS ETC. AS PER LEGEND P&ID NO. 9658-00-01-A1-1101, 1102 DURING DETAIL ENGINEERING.
5. ALL PGs, DPGs, PTs AND DPTs OF THE PROJECT SHALL BE SUPPLIED WITH A PRE-FABRICATED INSTRUMENTATION HOOKUP.
6. ALL CONTROL VALVES AND SHUTDOWN VALVES IN THE PROJECT SHALL BE ACTUATED BY A SELF-CONTAINED, INTEGRATED AND FAIL-SAFE ELECTROHYDRAULIC ACTUATOR.
6. EACH OF THE 65 FINGERS IN THE PRODUCTION MANIFOLDS SHALL BE PROVIDED WITH PASSIVE ULTRASONIC PERMANENT SAND DETECTORS WITH WELL-MANAGEMENT SYSTEM .

1st DIGIT–PIPING PRESSURE RATING

A	150 CLASS
B	300 CLASS
C	400 CLASS
D	600 CLASS
E	900 CLASS
F	1500 CLASS
G	2500 CLASS

2nd DIGIT–SERIVE INDENTIFICATION

1	PROCESS PIPING, FLARE PIPING, TREATED EFFLUENT, DIESEL, DRAIN, FUEL GAS WATER INJECTION
2	FIRE WATER, SERVICE WATER
3	UTILITY AIR, POTABLE WATER, INSTRUMENT AIR, NITROGEN
4	CHEMICAL SERVICE

3rd DIGIT–MATERIAL INDENTIFICATION

A	CARBON STEEL-ASTM PIPES
B	CARBON STEEL-IS PIPE
E	STABILIZED STAINLESS STEEL TYPE-316L
G	CPVC
S	GRE

NOTE : FOR DETAILS, PLEASE REFER PIPING SPECS.

REV.NO.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.

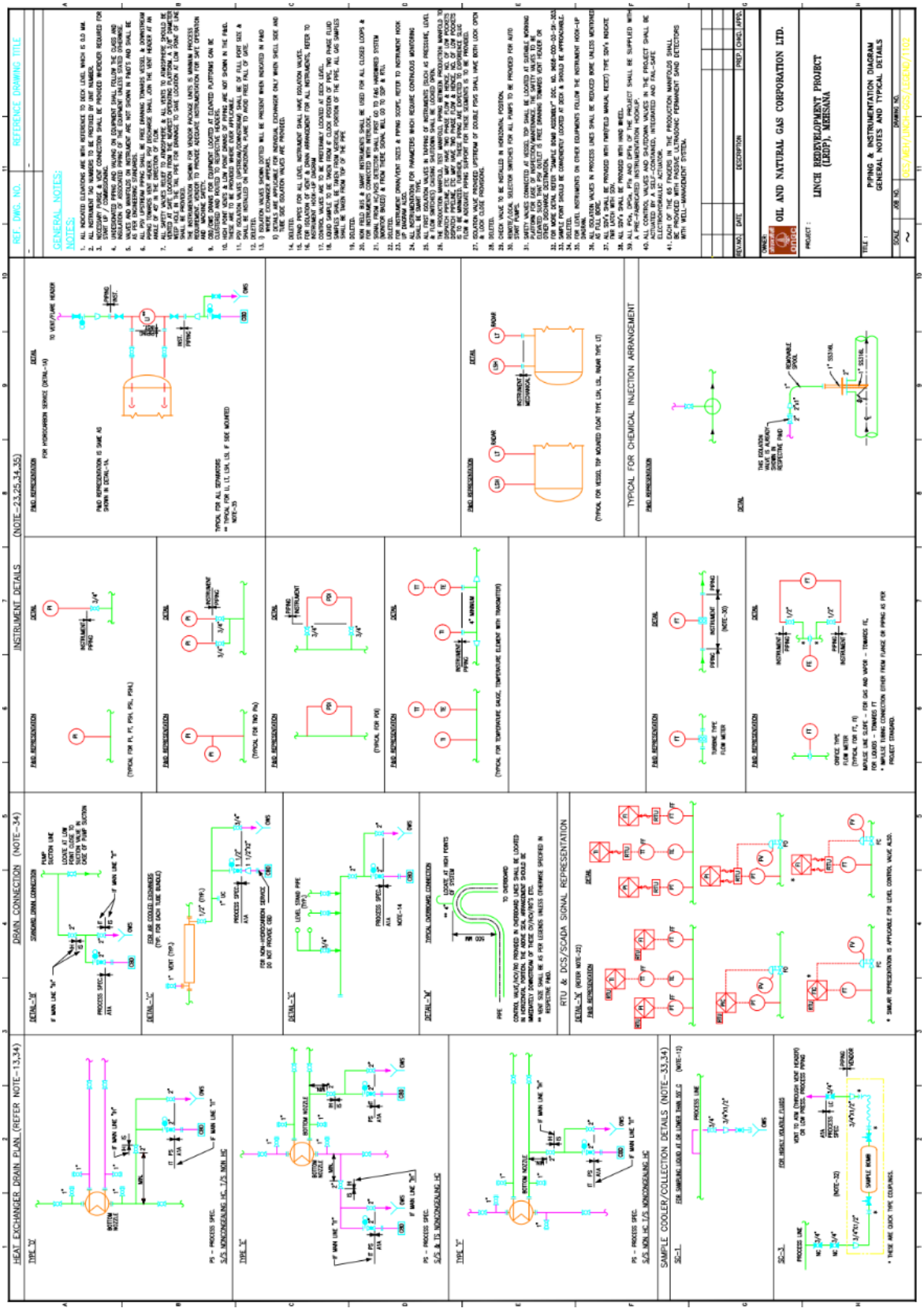
OWNER:
OIL AND NATURAL GAS CORPORATION LTD.

PROJECT :
LINCH REDEVELOPMENT PROJECT (LRDP), MEHSANA

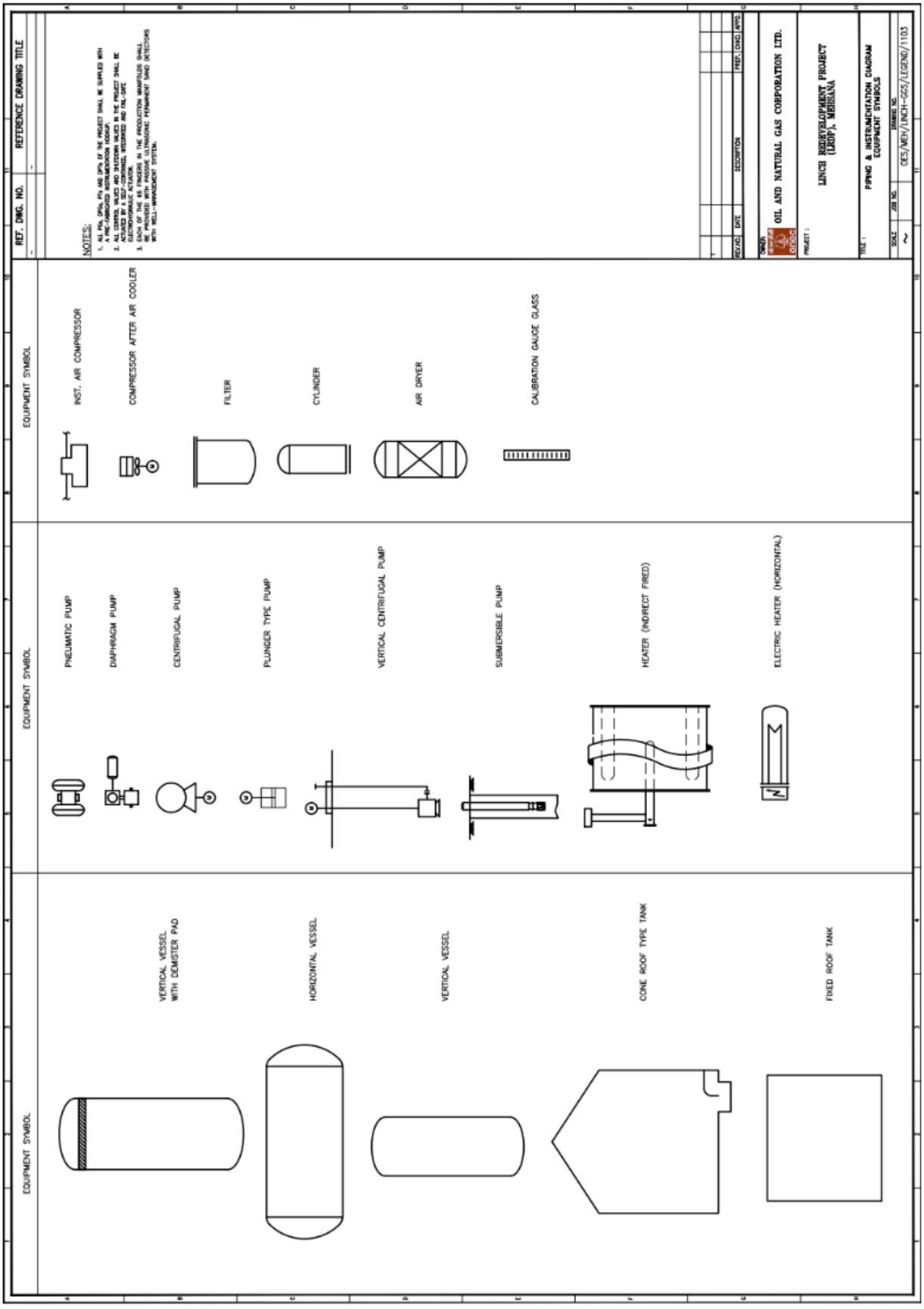
TITLE :
PIPING & INSTRUMENTATION DIAGRAM
STANDARD SYMBOLS AND NOMENCLATURE

SCALE	JOB NO.	DRAWING NO.
~		DES/MEH/LINCH-DGS/LEGEND/1101

P&ID - General Notes and Typical Details:



P&ID – Equipment Symbols:



SUMMARY AND CONCLUSION

The ONGC Winter Training Report outlines the Linch Redevelopment Project (LRDP), a significant initiative by ONGC to modernize and enhance the operational efficiency of the Linch Group Gathering Station (GGS) in Mehsana, Gujarat. The project aims to upgrade infrastructure to meet modern engineering, safety, and environmental standards while ensuring sustainable operations.

The report details the project's objectives, which include improving well fluid processing, implementing advanced gas compression and dehydration systems, and introducing state-of-the-art effluent and water treatment facilities. Key systems described include the Group Gathering Station (GGS) for fluid separation, the Effluent Treatment Plant (ETP) for wastewater management, the Water Injection Plant (WIP) for enhanced oil recovery, and Gas Handling Systems for processing and optimizing natural gas.

Process Flow Diagrams (PFDs) and Piping and Instrumentation Diagrams (P&IDs) are integral to the project, serving as critical tools in the design and operation of the facilities. The PFD provides a high-level overview of material and energy flows within the system, helping engineers and operators understand key process relationships. In contrast, the P&ID offers a detailed representation of piping, control systems, and instrumentation, facilitating the implementation, troubleshooting, and maintenance of the process.

The report also emphasizes the project's strategic importance for ONGC, highlighting its role in extending field productivity, complying with environmental regulations, and aligning with ONGC’s commitment to energy security and sustainability. Safety protocols such as the Emergency Shutdown System (ESD) and HAZOP studies, as well as advanced monitoring systems like Distributed Control Systems (DCS), ensure operational safety and environmental compliance.

In conclusion, the Linch Redevelopment Project is a landmark endeavour reflecting ONGC’s dedication to innovation, operational excellence, and sustainability in the oil and gas sector. By integrating modern technology and adhering to stringent safety and environmental standards, the project sets a benchmark for future initiatives, ensuring long-term productivity and environmental stewardship. The use of PFDs and P&IDs further underscores the meticulous planning and engineering excellence driving the success of this redevelopment effort.

REFERENCES

- https://drive.google.com/file/d/1kmsuFHzqESoieD99mF1gacT5L2ahyJfs/view?usp=drive_link
- https://drive.google.com/file/d/1hWU4r2ODFupzwn6mpOVrjxHnKtxfZ3YF/view?usp=drive_link