


Construction Design and Management Health and Safety
(CDM H&S) Plan for STG and TCE

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|  (BHEL, HYDERABAD) | | | | | | | | | | |
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| | | | | DAHEJ | 10091-G16-DAT000-BHB-0001 | | | | | 001 |

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Purpose

BHEL has received an order for Design, Supply Erection & Commissioning of 4x93.1MW STGs for Hazira manufacturing Division and 3x90.3MW STGs for Dahej manufacturing Division from M/s. Reliance Utilities & Power Pvt. Ltd (RUPPL). Bechtel Power Corp., USA is Detailed Engineering Contractor (DEC).

Site interface meeting with BHEL/customer/other contractors, held on 25th and 26th September 2013 at DMD, Dahej and HMD, Hazira respectively. After the site visit, preliminary information related to Site facilities, Material Management, HSE Execution Plan, Site Mobilization Plan & Construction approach for Generator assembly, condenser, deaerator and steam turbine was furnished. Now an Erection plan for all equipment's is outlined below.

It is assumed that necessary civil front, platforms & roads inside plant boundary are available before actual execution. Drawings & pictures presented below are for better understanding.

There may be changes in erection methodology during erection based on OEM recommendations, safety considerations and actual site conditions.

The erection sequence for various equipment's may be decided by site as per actual site conditions like civil front availability, product availability at site, etc.

Information provided below is applicable for each of the HMD & DMD sites, unless otherwise specified.

Trailer movement plan and crane/Hydra movement plan inside Hazira manufacturing division & Dahej manufacturing division is enclosed in the appendix.

Reference Documents :

| Sl. | Drawing Name | Drawing No | Rev | No of Sheets |
|-----|---|---------------------------|-----|--------------|
| 1. | Overall Layout | 10090-P15-HASI10-BEF-0001 | 04 | 1 |
| 2. | Input for STG Hall Equipment Layout | 0-381-01-01529 | 02 | 4 |
| 3. | Machinery Arrangement and Foundation | 0-313-01-08635 | 00 | 5 |
| 4. | General Arrangement of Drain Cooler | 2-162-01-00363 | 00 | 1 |
| 5. | GA of GSC | 2-162-14-00573 | 00 | 1 |
| 6. | GA of HP Heater 5 | 2-175-01-01595 | 00 | 1 |
| 7. | GA of HP Heater 6 | 2-175-05-01054 | 00 | 1 |
| 8. | GA of LP Heater 1 | 2-162-18-00377 | 00 | 1 |
| 9. | GA of LP Heater 2 | 2-162-22-00285 | 00 | 1 |
| 10. | GA of LP Heater 3 | 2-162-26-00241 | 00 | 1 |
| 11. | GA of SJAE | 1-161-01-00780 | 00 | 1 |
| 12. | GA of Spray cum Tray Deaerator | 1-163-10-11431 | 00 | 1 |
| 13. | GA of ST Twin Oil Cooler | 3-165-01-20579 | 00 | 1 |
| 14. | GA of STG Air Cooler | 2-166-03-00525 | 00 | 1 |
| 15. | GA of Surface Condenser | 1-160-10-01465 | 00 | 1 |
| 16. | Generator Foundation Drawing | 0-137-01-31037 | 06 | 1 |
| 17. | General Arrangement of BFP SET | HY-DG-1-18000-57626 | 00 | 1 |
| 18. | Foundation Details of BFP Set | HY-DG-1-18000-57627 | 00 | 1 |
| 19. | Interconnected Piping of Turbine Assembly | 0-308-59-00003 | 01 | 1 |

1. Surface Condenser

a. Transport arrangements

Dimensions of Condenser (Main assembly) to be handled.

Length - 10900 mm
Width - 4400 mm
Height – 5400 mm
Weight – 80 MT

It is planned to transport the condenser by trailer right up to STG hall. The trailer route is shown in trailer movement plan.

b. Storage

On arrival to site, condenser goes directly to the foundation. In case front is unavailable for placing equipment in position, alternative plan is that condenser shall be temporarily placed near to foundation. Storage is as per Field Quality Plan.

c. Access/Interface details within STG Hall :

Tubing of condenser shall be assembled at site after placing of condenser on its foundation. To avoid damage of tube during insertion, temporary platform of length 15 M length is planned to install for tubing works along grid 4-5, 10-11, 23-24 & 29-30 outside A-row.

All works between road (in front of A-row) and TG hall along grid 4-5, 10-11, 23-24 & 29-30 to be planned after condenser handling for trailer movement.

d. Lifting & placement arrangements

Shifting of surface condenser from trailer to final location is by chain pulley block.

The procedure of handling of condenser on receipt of same at site comprises the following major activities.

- a) Construction of foundation for condenser by RIL.
- b) Placement of 4 Nos. of Structural frames each having L-4 m, W-4m and Height of 3.3 m.
- c) Install two I-beam structural steel (ISMB 300) sections below the condenser supports, such a way that the extension of I-section bottom rests on top of condenser pedestals.
- d) Condenser will be shifted from Trailer to Structural steel frames with crane.
- e) Install adequate capacity chain pull block for winching.
- f) Pull the condenser to the required position.

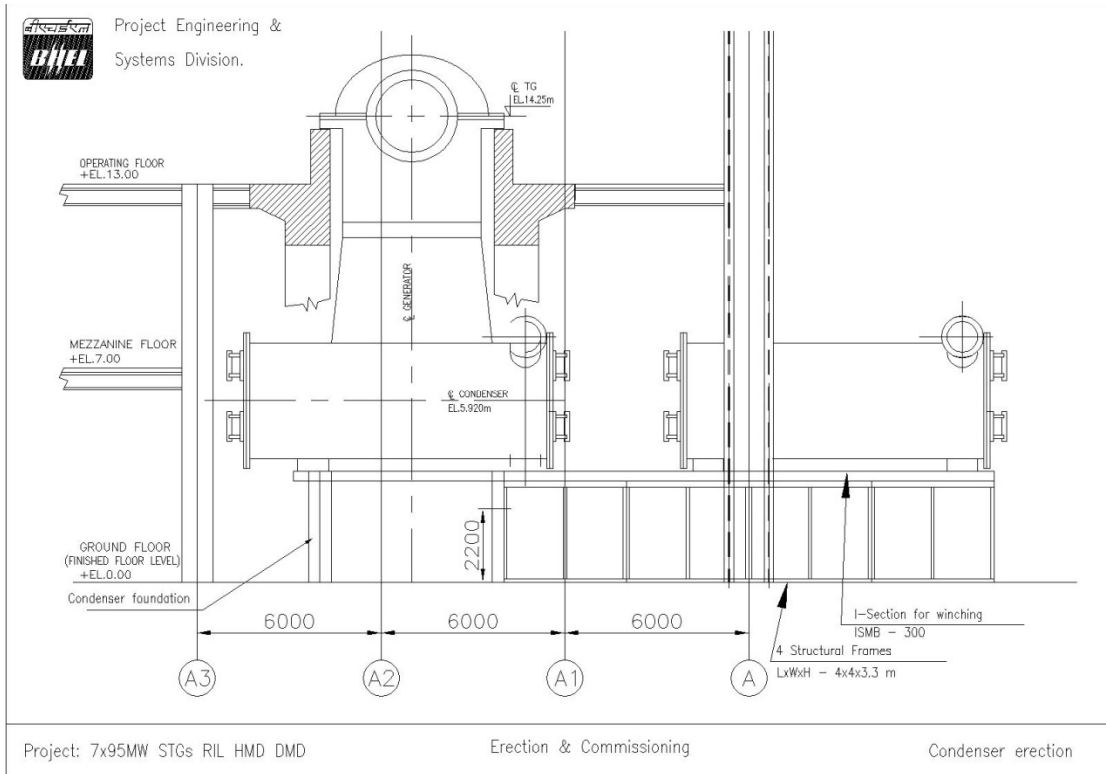


Diagram : Condenser-1A



2. Boiler Feed Pump with motor

a. Transport arrangements

Dimensions of BFP to be handled.

Length - 10340 mm

Width - 2600 mm

Height – 3050 mm

Weight – 35 MT

Numbers – 3 per unit

It is planned to transport BFP with Base frame mounted Motor Driven BFP, Booster Pump, Hydraulic Coupling and Auxiliaries.

BFP will be transported from Hyderabad unit works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure 1 & 3

b. Storage

On arrival to site, BFP goes directly to the foundation. In case front unavailable for placing equipment in position, alternative plan is that BFP shall be temporarily placed near to BFP foundation. Storage is as per Field Quality Plan.

c. Access/Interface details within STG Hall

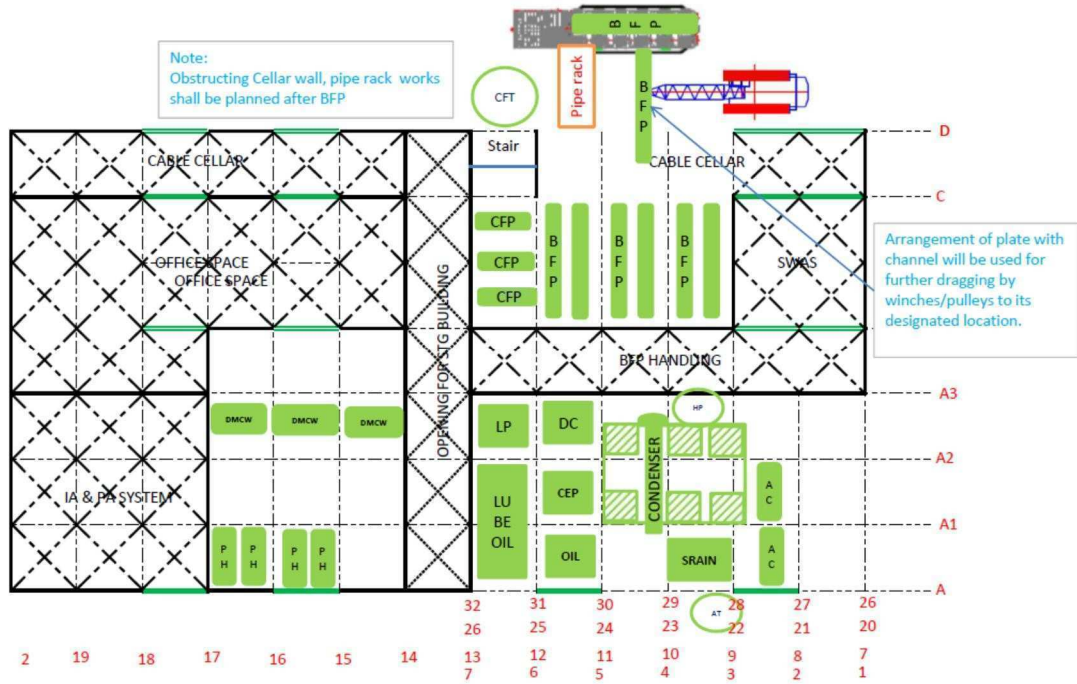
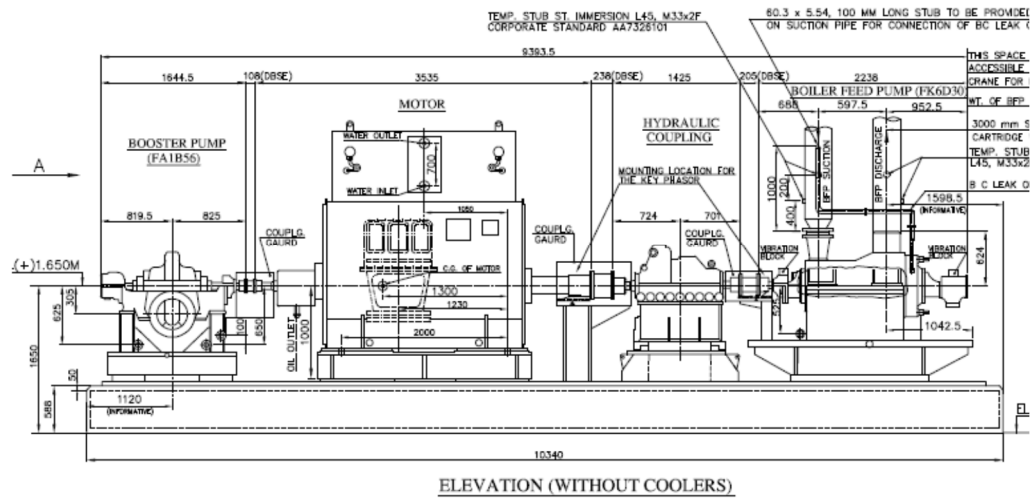
Interface required:

1. Cable cellar wall upto 7.0 M height shall be planned after BFP placement along
Horizontal grid : C & D row
Vertical grid : 3-6, 9-12, 22-25 and 28-31
2. Inter connecting pipe rack for unit 2&3 between boiler and STG by
Others shall be planned after BFP placement.
Horizontal grid : D row
Vertical grid : 11-12, 24-25

d. Lifting arrangements

Crane is used for lifting from trailer to place on ground.

Jack and crib method is used for placing and setting the equipment in position. Structural steel sections, rail will be placed on ground level for skidding the equipment.



3. Condensate extraction Pump

a. Transport arrangements

Dimensions of CEP to be handled.

Diameter - 1000 mm

Height – 4500 mm

Weight – 10 MT

Numbers – 2 per unit

It is planned to transport CEP with Auxiliaries from vendor works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, CEP goes directly to the foundation. Alternative plan is that CEP shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

CEP is lifted using EOT crane directly from the trailer through the erection opening, carried till the turbine deck. The same is placed in the vertical position through CEP opening of size 5.0 x 2.5 M and placed in the designated location.

d. Lifting arrangements

EOT crane of the TG building will be used for erection of condensate extraction pumps. The CEPs will be brought to the erection opening. From there using the EOT crane, the CEPs will be lifted over the turbine floor.

It should be ensured beforehand that the removable gratings / structures at operating & mezzanine floor over designated mounting location of CEPs are removed. CEPs will be lowered from these openings onto the foundation & installed.

4. Lube Oil Console

a. Transport arrangements

Dimensions of Lube Oil Console to be handled.

| Assembly | Content description | Numbers per unit | Length x Width x Depth (mm) | Weight (Kg) |
|----------|---|------------------|-----------------------------|-------------|
| 1. | Lube Oil Console Assembly-I (including Main Oil Pump Assembly along with AC motor ,Auxiliary Lube Oil Pump Assembly along with AC motor , Emergency Lube Oil Pump assembly along with DC motor) | 1 | 4000 X 3500 X 1000 | 2250 |
| 2. | Lube Oil Console Assembly -II (including Lube Oil Tank, Duplex Oil Filter, Oil Vapor Extraction fan assembly) | 1 | 4200 X 3000 X 3000 | 6000 |

It is planned to transport Lube Oil Assembly from Hyderabad unit works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, LO assembly goes directly to the foundation. Alternative plan is that the same shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

Lube oil console will access through grid 6-7/A.

d. Lifting arrangements

Jack and crib method is used for lifting and setting the equipment in position.

5. Flash Tanks (AT & HP)

a. Transport arrangements

| Sl.No. | Content description | Numbers per unit | Diameter x Depth (mm) | Weight (Kg) |
|--------|------------------------|------------------|-----------------------|-------------|
| 1 | Atmospheric Flash Tank | 1 | 2000 x 3000(approx.) | 1000 |
| 2 | HP Flash Tank | 1 | 3032 x 6100 | 8500 |

It is planned to transport these tanks from vendor works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1 & 3.

b. Storage

On arrival to site, the tank goes directly to the foundation. Alternative plan is that the tank shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

HP tank will access through maintenance bay (B-A3).
Atmospheric tank will be access through along A-row.

d. Lifting arrangements

The flash tanks shall be brought near A-row side. From here winches/pulley will be used to lift and move the flash tank under the TG deck.

EOT crane through the opening of TG deck will be used for its final alignment / installation. The photographs below show typical Flash Tank erection.



Flash tank being brought from A-row side



Flash tank being positioned below TG deck

6. Plate Heat Exchanger

a. Transport arrangements

Dimensions of PHE (1set = 4 numbers) to be handled.

Length – 3910 mm

Width - 1370 mm

Height – 2000 mm

Weight – 10.6 MT

It is planned to transport PHE with from vendor shop to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, PHE goes directly to the foundation. Alternative plan is that PHE shall be temporarily placed outside D-row.

c. Access/Interface details within STG Hall

PHE will access in front of A-row along grid 15-17.

d. Lifting arrangements

Jack and crib method is used for lifting and setting the equipment in position.

7. Condensate Forwarding Tank

a. Transport arrangements

Dimensions of CFT to be handled.

Diameter - 5500 mm

Height – 6000 mm

Weight – 15 MT

Numbers – 1 per unit

It is planned to transport the steel plates from vendor works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

Works like cutting, bending is done at fabrication yard. Shifted to work spot for welding and subsequent lifting.

c. Access/Interface details within STG Hall

The access of materials along D-row.

d. Lifting arrangements

Lifting is by Jacking method or erection using crane.

8. Lube Oil/Working Oil Cooler of Boiler Feed Pump

a. Transport arrangements

| Sl.No. | Content description | Numbers per unit | Length x Width x Depth (mm) | Weight (Kg) |
|--------|----------------------------------|------------------|-----------------------------|-------------|
| 1 | Duplex Lube Oil Cooler of BFP | 1 | 3800 x 1450 x 550 | 1350 |
| 2 | Duplex Working Oil Cooler of BFP | 1 | 3700 x 1620 x 620 | 2120 |

It is planned to transport BFP coolers with Base frame mounted from Hyderabad unit works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, BFP cooler goes directly to the foundation. Alternative plan is that BFP cooler shall be temporarily placed outside D-row.

c. Access/Interface details within STG Hall

BFP cooler will be brought to site along D-row road, lifted by crane and kept perpendicular to D-row.

d. Lifting arrangements

Jack and crib method is used for subsequent placing and setting the equipment in position.

9. Condensate Forwarding Pump

a. Transport arrangements

Dimensions of CFP to be handled.

Length – 3705 mm

Width – 1700 mm

Weight – 4 MT

Numbers – 3 per unit

It is planned to transport CFP from vendor shop to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, CFP goes directly to the foundation. Alternative plan is that CFP shall be temporarily placed outside D-row.

c. Access/Interface details within STG Hall

CFP will access through STG building main approach/perpendicular to D-row.

d. Lifting arrangements

Equipment <5MT, based on site conditions, one of the above possible means of lifting is adopted.

10. ACW Pump

a. Transport arrangements

Dimensions of ACW to be handled.

Length – 4600 mm

Width – 1520 mm

Weight – 6.89 MT

Numbers – 2 per unit

It is planned to transport ACW from vendor works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, ACW goes directly to the foundation. Alternative plan is that ACW shall be temporarily placed outside D-row or near to its foundation.

c. Access/Interface details within STG Hall

Maintenance bay (B-A3) will be used for access ACW pumps within site.

d. Lifting arrangements

ACW pumps will be shifted by Hydra to work spot and Jack and crib method is used for setting the equipment in position.

11. Drain Cooler

a. Transport arrangements

Dimensions of drain cooler to be handled.

Length - 6250 mm

Width – 1400 mm

Depth – 1400 mm

Weight – 5.8 MT

Numbers – 1 per unit

It is planned to transport drain cooler from vendor shop to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

Foundation bolts embedment/sole plate grouting is prerequisite to commence erection.

On arrival to site, drain cooler goes directly to the foundation. Alternative plan is that drain cooler shall be temporarily placed outside D-row.

c. Access/Interface details within STG Hall

Maintenance bay (B-A3) will be used for access drain cooler within site.

d. Lifting arrangements

Jack and crib method is used for lifting and setting the equipment in position.

12. DMCW Pump

a. Transport arrangements

Dimensions of DMCW to be handled.

Length – 4600 mm

Width – 1520 mm

Weight – 10 MT

It is planned to transport DMCW from vendor works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, DMCW goes directly to the foundation. Alternative plan is that DMCW shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

DMCW will access through A-row or maintenance bay.

d. Lifting arrangements

Jack and crib method is used for lifting and setting the equipment in position.

13. Centrifuge/JOP/HP Control Oil unit

a. Transport arrangements

Dimensions of equipment to be handled are

| Equipment | Length mm | Width mm | Height mm | Weight kg |
|---------------------|-----------|----------|-----------|-----------|
| Centrifuge | 2300 | 1700 | 1500 | 1500 |
| Jacking oil skid | 2200 | 2200 | 1600 | 3000 |
| HP Control oil unit | 4200 | 3000 | 1500 | 4000 |

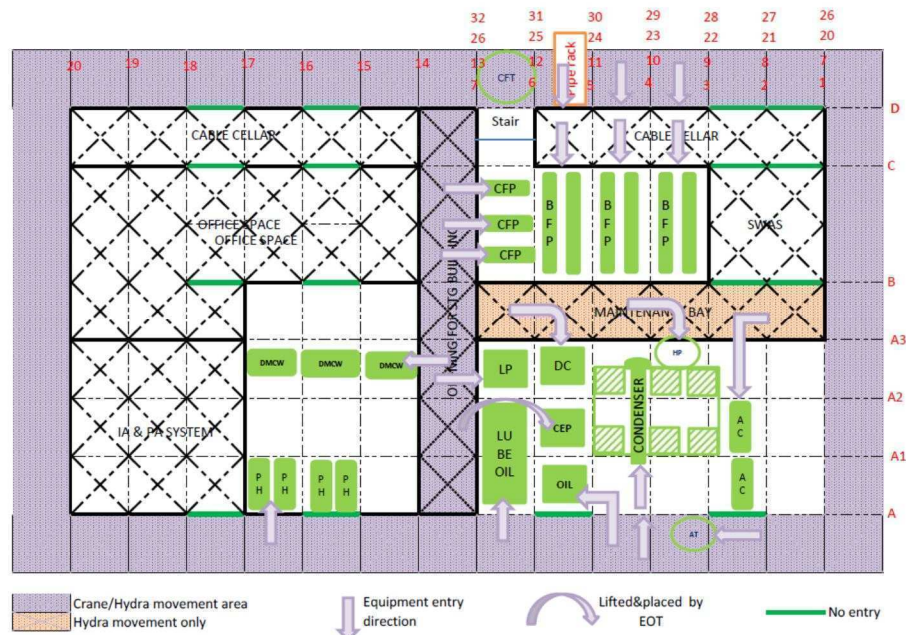
It is planned to transport the equipment from vendor works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, the above equipments goes directly to the foundation. Alternative plan is that the same shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall



d. Lifting arrangements

Equipment <5MT, based on site conditions, one of the above possible means of lifting is adopted.

14. LP Dosing Skid (Ammonia/Hydrazine/NaOH)

a. Transport arrangements

Dimensions of equipment to be handled are
 Length – 7000 mm
 Width – 5000 mm
 Weight – 3.5 MT

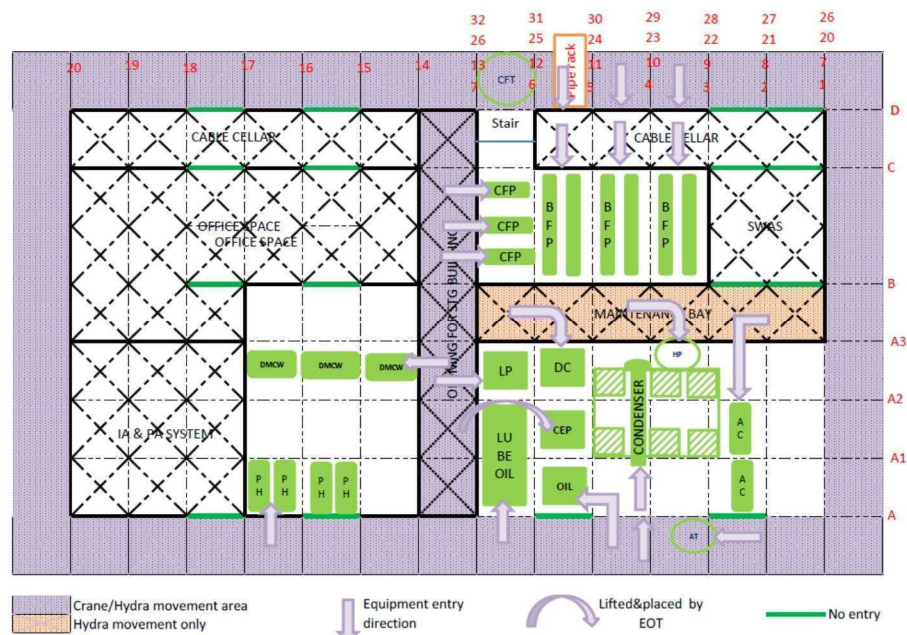
It is planned to transport the equipment from vendor works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, the above equipments goes directly to the foundation. Alternative plan is that the same shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall



d. Lifting arrangements

Equipment <5MT, based on site conditions, one of the above possible means of lifting is adopted.

15. LP Heater

a. Transport arrangements

Dimensions of LP heater to be handled.

Length - 13650 mm

Width – 2000 mm

Height – 1700 mm

Weight – 20 MT

Numbers – 3 per unit

It is planned to transport LP Heaters in one assembly from Hyderabad unit works to work spot on a hydraulic trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, LP Heater goes directly to the foundation. Alternative plan is that LP Heater shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

The access of LP Heater is either through A-row or through erection/maintenance opening.

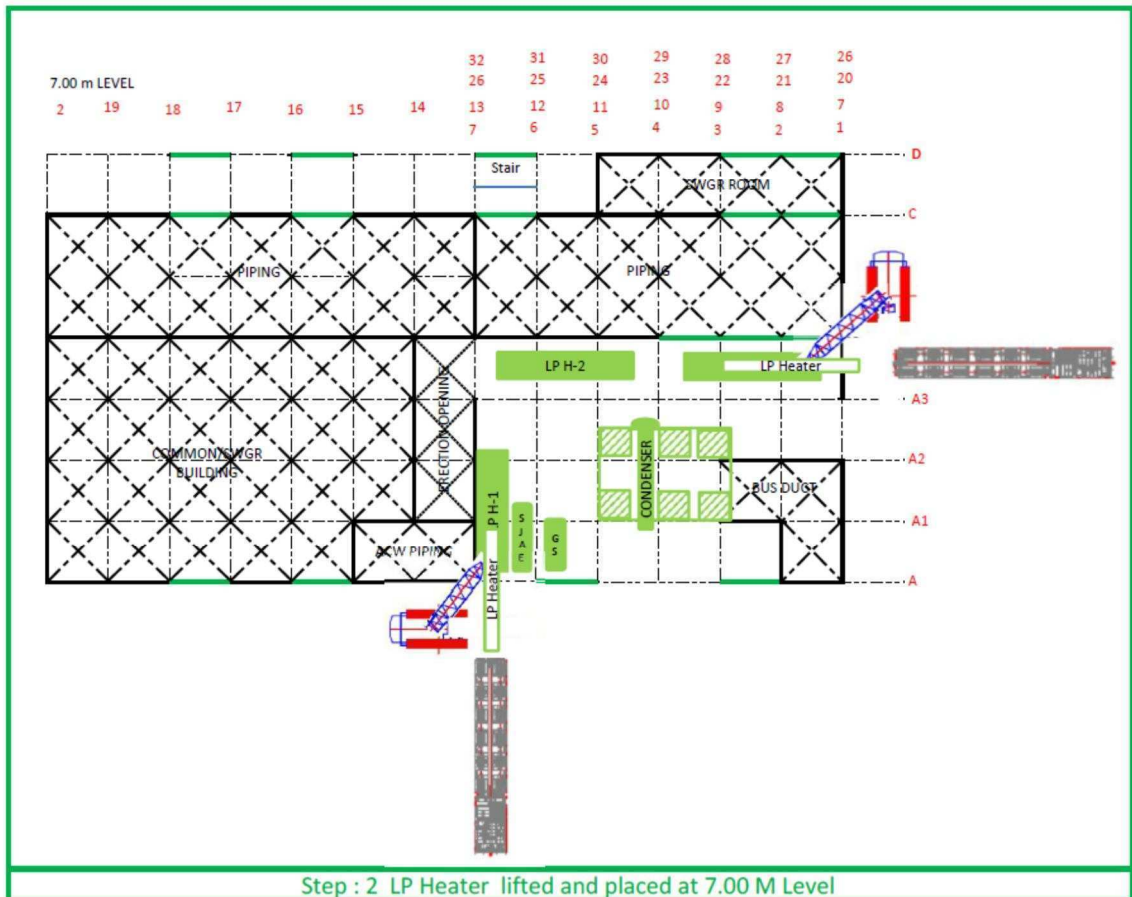
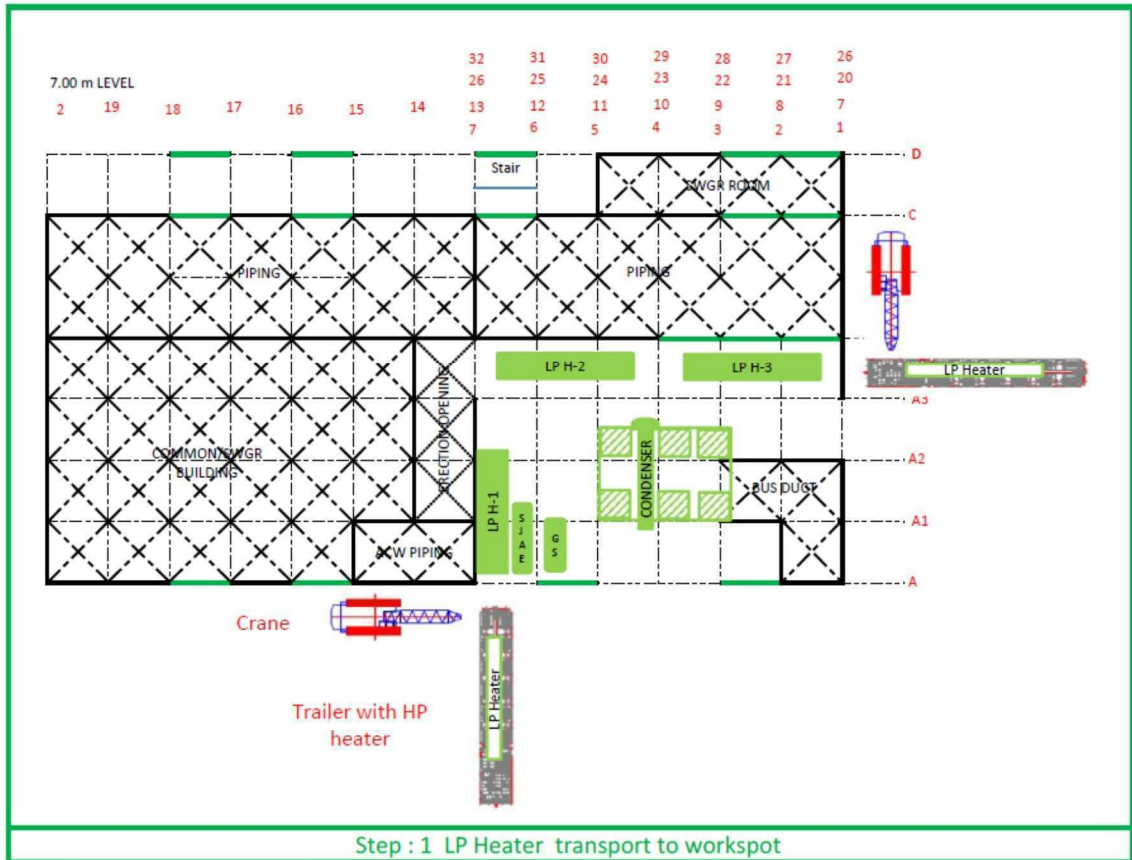
Generator assembly lifting foundation and temporary tower occupies the space of some LPH-1 heaters. So these heaters shall be placed near to its location and final placement shall be planned after removal of generator assembly lifting towers and subsequent structural works.

d. Lifting arrangements

Option-1:

The LP Heater will be brought in front of A-row facing condenser. By using mobile crane, the LPH will be lifted and placed perpendicular to A-row. The heater will be placed such that heater outermost support rests on the 3m extended roof outside A-row in condenser bays(temporary arrangement by site team). The heater will then be dragged inside condenser neck by winches/pulleys.

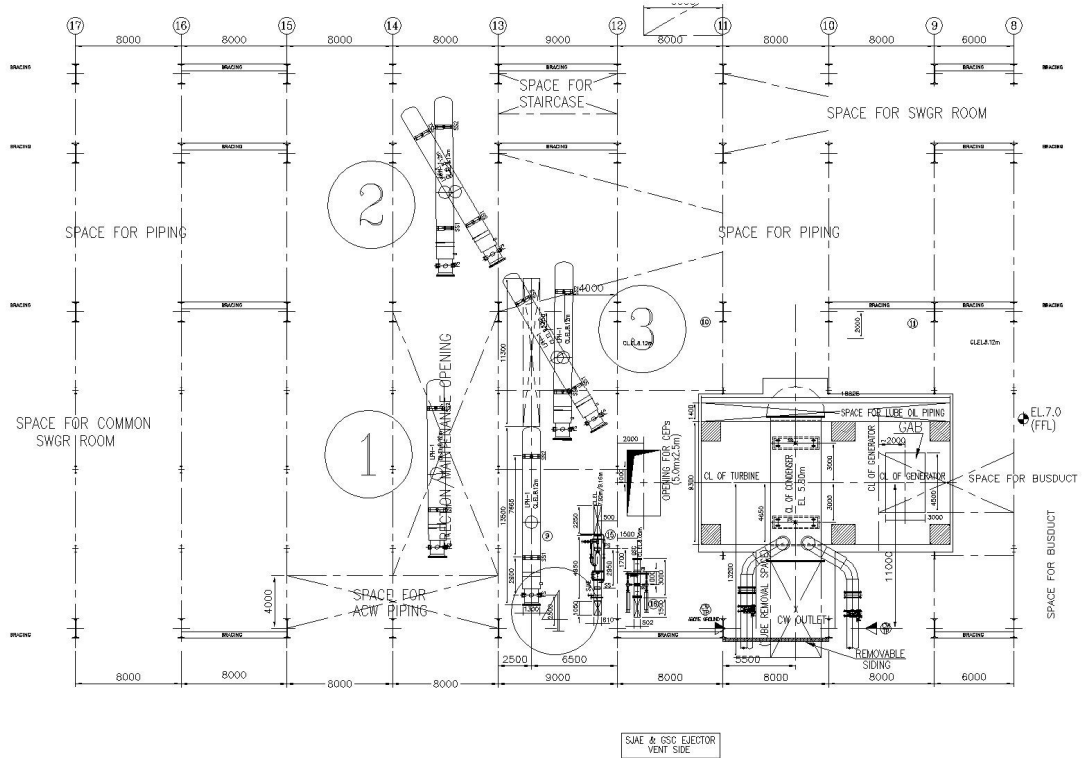




Option: 2

LP Heater will be brought to the erection opening. From here by the use of EOT crane, it will be lifted over to mezzanine floor for bringing it to place its designated location:

Rotate anticlockwise using EOT crane.
 Arrangement of plate with channel will be used for further dragging by winches/pulleys to its designated location.



16. Steam Jet Air Ejector (SJAE)

a. Transport arrangements

Dimensions of SJAE to be handled.

Length - 5400 mm

Width – 3000 mm

Height – 2000 mm

Weight – 7.5 MT

Numbers – 2 per unit

It is planned to transport SJAE from Hyderabad unit works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, SJAE get assembled at ground level at site and place in the designated position. Alternative plan is that SJAE shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

SJAE will access perpendicular to A-row.

d. Lifting arrangements

This operation is performed by a crane.

17. Gland Steam Condenser (GSC)

a. Transport arrangements

Dimensions of GSC to be handled.

Length - 3500 mm

Width – 1400 mm

Height – 1400 mm

Weight – 2 MT

Numbers – 1 per unit

It is planned to transport GSC from Hyderabad unit works to stores on a truck. From stores it will be shifted to site using tractor.

b. Storage

On arrival to site, GSC goes directly to the foundation. Alternative plan is that GSC shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

GSC will access through A-row.

d. Lifting arrangements

This operation is performed by a Hydra.

18. Generator Assembly

a. Transport arrangements

Dimensions of generator assembly to be handled.

Length - 9300 mm

Width - 4650 mm

Weight – 190 MT

It is planned to transport the generator assembly from unit works to workspot on a special trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, generator assembly goes directly to the foundation.

c. Access/Interface details within STG Hall

Generator assembly will access through A-row

d. Lifting of generator stator

- a. Lifting of generator assembly will be by Strand Jacks and Tower Lift system.
- b. Strand jack lifting methods requires TG deck construction shall be completed before the receipt of the stator.
- c. Location of anchor bolt & temporary structures are typical and such details will be furnished after finalization of vendor.

Lifting generator consists of following major activities.

- a. Construction of temporary tower foundation for strand jack system by customer.
- b. Erection of the strand jack system using EOT crane. (Ensure EOT availability by customer)
- c. Lifting and placing of generator assembly onto its foundation by strand jack system.



19. Steam Turbine

a. Transport arrangements

Dimensions of STG subassemblies to be handled area

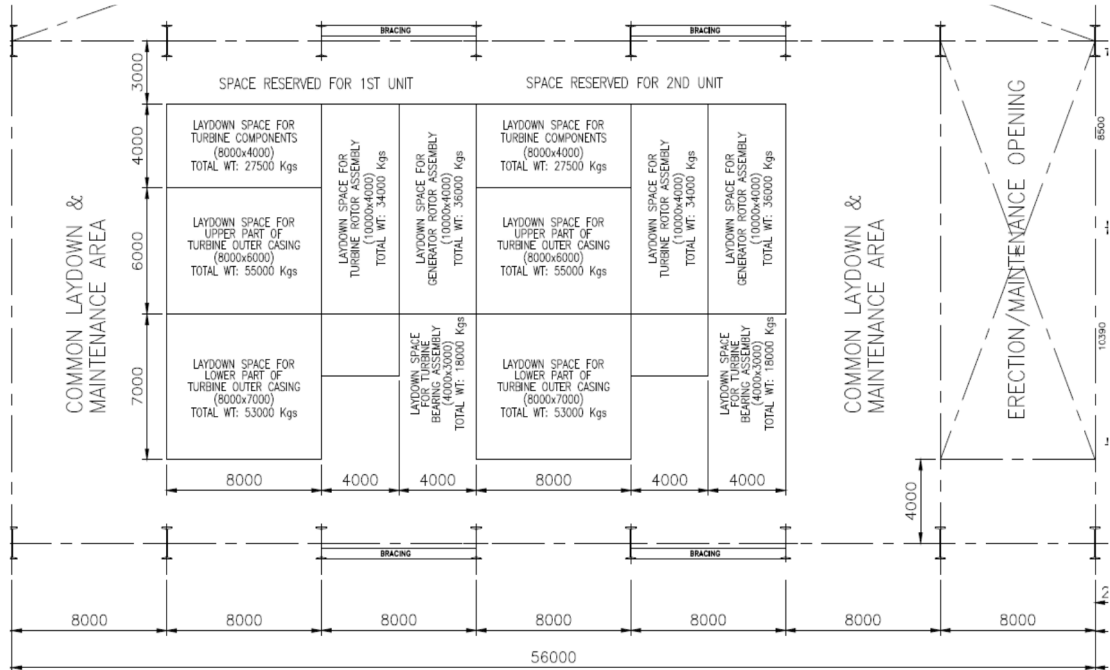
| SL. No. | Sub-assemblies | Qty. | Dimensions (mm) LxWxH | Weight (Kgs) each | Total Weight |
|--------------|--|------|--------------------------|-------------------|---------------|
| 1. | Outer Casing Upper Part | 1 | 4865 X 5600 X 3500 | 34162 | 34162 |
| 2. | Outer Casing Lower Part | 1 | 4700 X 3060 X 1400 | 23335 | 23335 |
| 3. | Inner Casing Assembly | 1 | 1784 X 1740 X 1600 | 8960 | 8960 |
| 4. | Guide Blade Carrier -I | 1 | 490 X 1780 X 1735 | 3500 | 3500 |
| 5. | Guide Blade Carrier - II | 1 | 540 X 1780 X 1735 | 3400 | 3400 |
| 6. | Guide Blade Carrier - III | 1 | 620 X 1980 X 1935 | 4500 | 4500 |
| 7. | Guide Blade Carrier - IV | 1 | 520 X 2200 X 2185 | 6900 | 6900 |
| 8. | Exhaust Hood Upper Part | 1 | 2050 X 5800 X 2500 | 11980 | 11980 |
| 9. | Exhaust Hood Lower Part | 1 | 2230 X 6140 X 2700 | 20731 | 20731 |
| 10. | Rear Bearing Housing Assembly | 1 | 1405 X 1400 X 900 | 1928 | 1928 |
| 11. | Front Bearing Housing Assembly | 1 | 1690 X 2610 X 950 | 15791 | 15791 |
| 12. | Rotor Assembly | 1 | 8650 X Dia. 2230 | 34000 | 34000 |
| 13. | Hydraulic oil supply unit | 1 | 4200 X 3000 X 1500 | 4000 | 4000 |
| 14. | High Pressure electrohydraulic actuators for stop valve | 2 | 1300 X 900 X 800 | 850 | 1900 |
| 15. | High Pressure electrohydraulic actuators for control valve | 4 | 1300 X 900 X 800 | 850 | 3800 |
| 16. | Turbine Enclosure | 1 | - | - | 13000 |
| 17. | Upper Part of Outer Casing & Exhaust Hood – Bolts | 1 | - | - | 9000 |
| 18. | Lower Part of Outer Casing & Exhaust Hood – Bolts | 1 | - | - | 9000 |
| 19. | Turbine Mounted Piping (8") | lot | - | - | 3127 |
| Total | | | | | 213014 |

It is planned to transport turbine sub-assemblies from Hyderabad unit works to work spot on truck / trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

By EOT crane, the turbine sub-assemblies will be moved through erection opening over the operating floor to their respective laydown locations grid (A-B/ 13-20) on TG deck as shown below.



c. Access/Interface details within STG Hall

Turbine sub-assemblies access through erection opening.

d. Lifting arrangements

Turbine sub-assembly / components will then be placed on TG deck to do the further assembly / alignment.

20. HP Heater

a. Transport arrangements

Dimensions of HP Heater to be handled.

Length - 10750 mm

Width - 2350 mm

Height – 2000 mm

Weight – 37 MT

Numbers – 2 per unit

It is planned to transport HP Heaters in one assembly from Hyderabad unit works to work spot on a hydraulic trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, HP Heater goes directly to the foundation. Alternative plan is that HP Heater shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

The access of HP Heater is through erection opening.

Generator assembly lifting foundation and temporary tower occupies the space of HP heaters. So heaters shall be placed near to its location and final placement shall be planned after removal of generator assembly lifting towers and subsequent structural works.

d. Lifting arrangements

The heaters will be lifted by EOT crane and placed on operating floor between grids 14-15 and 19-20 in common laydown area.

Arrangement of plate with channel will be used for further dragging by winches/pulleys to its designated location in BC bay once the construction constraint (generator assembly) is removed.

21. Generator Cooler Assembly

a. Transport arrangements

Dimensions of generator air cooler be handled.

Length - 3800 mm

Width - 1000 mm

Height – 600 mm

Weight – 1.5 MT

Numbers – 5 per unit

It is planned to transport this cooler from Hyderabad unit works to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, cooler goes directly to the foundation. Alternative plan is that Cooler shall be temporarily placed outside A-row.

c. Access/Interface details within STG Hall

Cooler will be lifted through erection opening by EOT crane and placed on its designated position.

d. Lifting arrangements

This operation is performed by EOT crane.

22. Deaerator

a. Transport arrangements

Dimensions of De-aerator to be handled.

Length - 27000 mm (transported in 3 pieces of 9000mm approximately)

Width - 3600 mm

Weight – 82 MT (each piece approx.. 28MT)

Numbers – 1 per unit

It is planned to transport the de-aerator storage tank in three pieces and heater assembly by trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, deaerator sections will be lifted and placed near to deaerator foundation. Alternative plan is that sections shall be temporarily placed outside D-row.

c. Access/Interface details within STG Hall

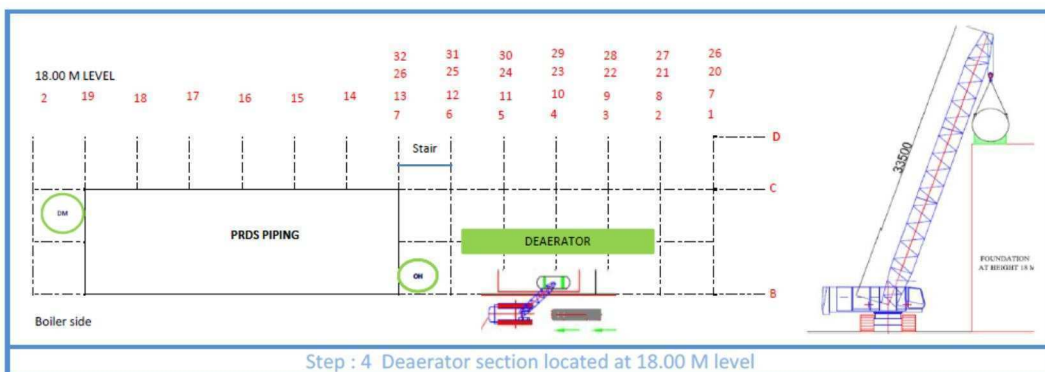
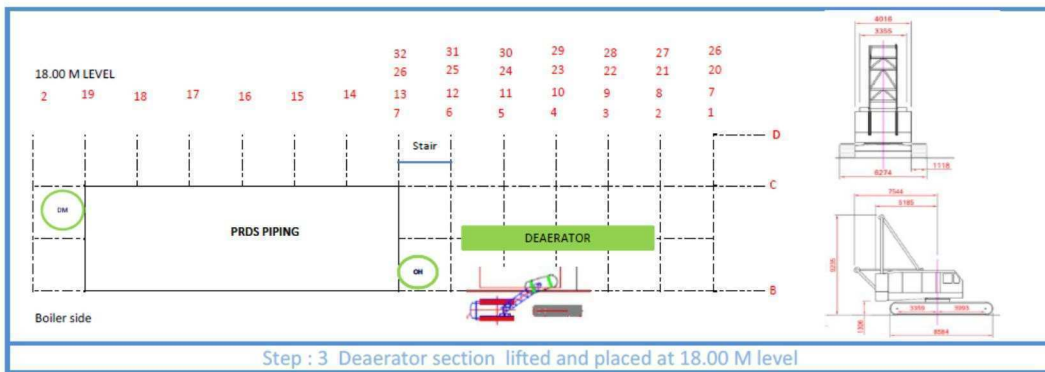
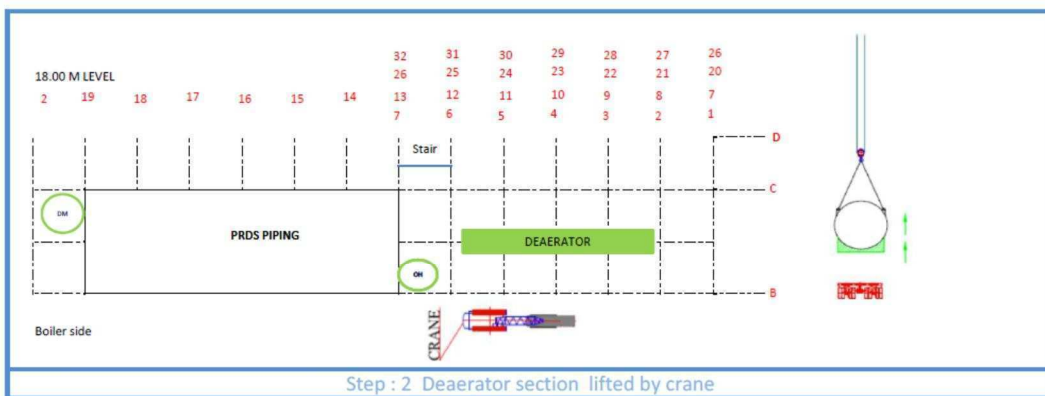
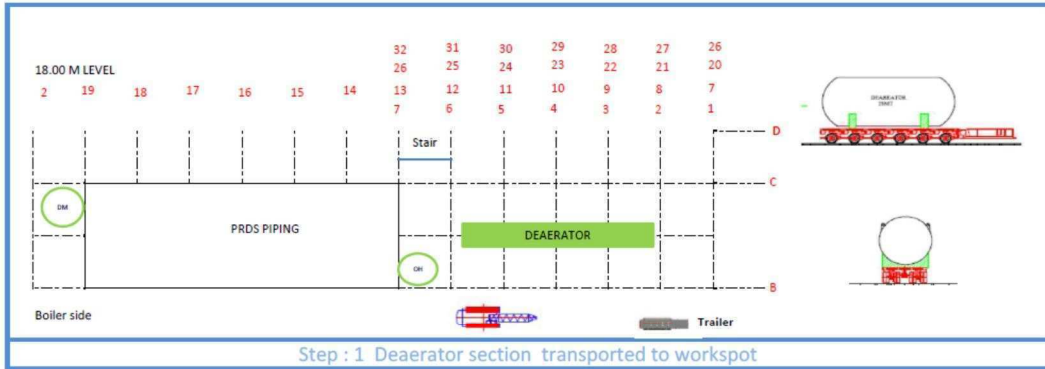
The access of the tank within site is as per Annexure A2.

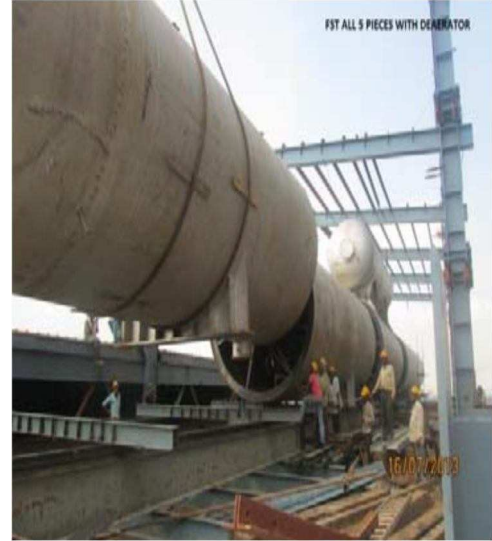
d. Lifting arrangements

A mobile crane of suitable capacity shall be placed along D-row. With the help of mobile crane, each part of storage tank will be lifted & then placed in position & dragged over temporary beams / sleepers.

After assembly over permanent supports, temporary beams / sleepers will be removed.

The photographs below show the typical sequence of Deaerator erection by mobile crane.





23. DMCW Expansion Tank

a. Transport arrangements

Dimensions of DM tank to be handled.

Diameter – 4500 mm

Weight – 10 MT

Numbers – 1 per unit

It is planned to transport DM tank along with lube oil console assembly from Hyderabad Unit to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, this tank goes directly to the foundation. Alternative plan is that the same shall be temporarily placed outside D-row.

c. Access/Interface details within STG Hall

The access of the tank is through D-row within site.

d. Lifting arrangements

This operation is performed by crane.

24. Over Head Oil Tank

a. Transport arrangements

Dimensions of Over Head Oil tank to be handled.

Diameter - 2750 mm

Height – 2750 mm

Weight – 2 MT

Numbers – 1 per unit

It is planned to transport Over head oil tank from vendor shop to work spot on a trailer.

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

b. Storage

On arrival to site, this tank goes directly to the foundation. Alternative plan is that the same shall be temporarily placed outside D-row.

c. Access/Interface details within STG Hall

The access of the tank is through D-row within site.

d. Lifting arrangements

This operation is performed by crane.

25. Piping

a. Transport arrangements

Dimensions of tentative piping to be handled are as below.

| SL NO | LINE DESCRIPTION | IBF | PIPE MATERIAL | PIPE SIZE (in) | PIPE LENGTH (m) |
|----------|--|-----|---------------|----------------|-----------------|
| A | COMMON | | | | |
| 1 | MAIN STEAM FROM TP TO HEADEF | IBF | A335GRP91 | 20 | 16 |
| 2 | MAIN STEAM HEADEF | IBF | A335GRP91 | 20 | 276 |
| 3 | BOILER STARTUP STEAM FROM TP UPTO PCV | IBF | A335GRP91 | 10 | 89 |
| 4 | BOILER STARTUP STEAM FROM FROM PCV UPTO DS | IBF | A335GRP11 | 32 | 40 |
| 5 | BOILER STARTUP STEAM HEADEF | IBF | A106GPE | 28 | 140 |
| 6 | FEED WATER HEADEF | IBF | A106GPE | 18 | 160 |
| 7 | FEED WATER FROM HEADER TO TP | IBF | A106GPE | 18 | 36 |
| 8 | DEAERATOR OVERFLOW & DRAIN HEADEF | IBF | A106GPE | 8 | 175 |
| 9 | COOW PIPING | | IS3589GRFE330 | 44 | 27 |
| 10 | COOW PIPING | | IS3589GRFE330 | 32 | 9 |
| 11 | COOW PIPING | | IS3589GRFE330 | 10 | 65 |
| 12 | COOW PIPING | | IS3589GRFE330 | 24 | 124 |
| 13 | COOW PIPING | | IS3589GRFE330 | 20 | 157 |
| 14 | COOW PIPING | | IS3589GRFE330 | 30 | 511 |
| 15 | COOW PIPING | | IS3589GRFE330 | 6 | 32 |
| 16 | COOW PIPING | | IS3589GRFE330 | 3 | 27 |
| 17 | DRAIN PIPING (P91) | IBF | A335GRP91 | 1.5 | 1089 |
| 18 | DRAIN PIPING (P11) | IBF | A335GRP11 | 1 | 364 |
| 19 | DRAIN PIPING (CS) | IBF | A106GPE | 1 | 1804 |
| 20 | SWAS PIPING (IBR) | IBF | A335GRP91 | 0.75 | 360 |
| 21 | SWAS PIPING (CS) | | A106GPE | 0.75 | 1632 |
| 22 | SWAS PIPING (SS) | | A312GRTP304 | 0.75 | 456 |
| 23 | INSTRUMENT AIR DISTRIBUTION PIPING | | ISI239(GALV) | 3 | 252 |
| 24 | INSTRUMENT AIR DISTRIBUTION PIPING | | ISI239(GALV) | 2 | 848 |
| 25 | INSTRUMENT AIR DISTRIBUTION PIPING | | ISI239(GALV) | 1 | 1204 |
| 26 | SERVICE AIR DISTRIBUTION PIPING | | ISI239 | 3 | 252 |
| 27 | SERVICE AIR DISTRIBUTION PIPING | | ISI239 | 2 | 848 |
| 28 | SERVICE AIR DISTRIBUTION PIPING | | ISI239 | 1 | 1204 |
| 29 | LP DOSING PIPING | | A312GRTP304 | 1 | 1329 |
| | COMMON PIPING | | | | 13526 |

| SL NO | LINE DESCRIPTION | IBF | PIPE MATERIAL | PIPE SIZE (in) | PIPE LENGTH (m) |
|----------|--|-----|---------------|----------------|-----------------|
| B | PER UNIT | | | | |
| 1 | MAIN STEAM PIPING FROM HEADER TO TURBINE | IBF | A335GRP91 | 16 | 39 |
| 2 | MAIN STEAM PIPING FROM HEADER TO TURBINE | IBF | A335GRP91 | 12 | 22 |
| 3 | TURBINE WARMUP VENT PIPING | IBF | A335GRP91 | 2 | 27 |
| 4 | BOILER STARTUP STEAM PIPING FROM HEADER TO CONDENSER | IBF | A106GRB | 18 | 62 |
| 5 | BOILER STARTUP STEAM PIPING FROM HEADER TO CONDENSER | IBF | A106GRB | 12 | 10 |
| 6 | TURBINE EXTRACTION STEAM PIPING TO HP HEATER-6 | IBF | A106GRB | 8 | 30 |
| 7 | TURBINE EXTRACTION STEAM PIPING TO HP HEATER-5 | IBF | A106GRB | 10 | 45 |
| 8 | TURBINE EXTRACTION STEAM PIPING TO DEAEERATOF | IBF | A106GRB | 10 | 20 |
| 9 | TURBINE EXTRACTION STEAM PIPING TO DEAEERATOF | IBF | A106GRB | 14 | 2 |
| 10 | TURBINE EXTRACTION STEAM PIPING TO DEAEERATOF | IBF | A106GRB | 14 | 23 |
| 11 | TURBINE EXTRACTION STEAM PIPING TO DEAEERATOF | IBF | A106GRB | 24 | 20 |
| 12 | TURBINE EXTRACTION STEAM PIPING TO DEAEERATOF | IBF | A106GRB | 8 | 16 |
| 13 | TURBINE EXTRACTION STEAM PIPING TO LP HEATER-3 | IBF | A106GRB | 16 | 10 |
| 14 | TURBINE EXTRACTION STEAM PIPING TO LP HEATER-3 | IBF | A106GRB | 24 | 2 |
| 15 | TURBINE EXTRACTION STEAM PIPING TO LP HEATER-3 | IBF | A106GRB | 24 | 27 |
| 16 | TURBINE EXTRACTION STEAM PIPING TO LP HEATER-2 | IBF | A106GRB | 20 | 8 |
| 17 | TURBINE EXTRACTION STEAM PIPING TO LP HEATER-2 | IBF | A106GRB | 30 | 34 |
| 18 | TURBINE EXTRACTION STEAM PIPING TO LP HEATER-1 | IBF | A106GRB | 30 | 14 |
| 19 | TURBINE EXTRACTION STEAM PIPING TO LP HEATER-1 | IBF | A106GRB | 44 | 33 |
| 20 | BALANCE PISTON LEAK-OFF PIPING | IBF | A106GRB | 8 | 17 |
| 21 | BFP DISCHARGE PIPING | IBF | A106GRB | 10 | 38 |
| 22 | BFP RECIRCULATION PIPING TO DEAEERATOF | IBF | A106GRB | 4 | 101 |
| 23 | BFP DISCHARGE HEADER | IBF | A106GRB | 14 | 9 |
| 24 | FEED WATER PIPING FROM BFP DISCH HEADER TO HPH-5 (INCL HPH-5 BYPASS) | IBF | A106GRB | 14 | 59 |
| 25 | FEED WATER PIPING FROM HPH-5 TO HPH-6 (INCL HPH-6 BYPASS) | IBF | A106GRB | 14 | 39 |
| 26 | FEED WATER PIPING FROM HPH-6 TO FEED WATER HEADER | IBF | A106GRB | 14 | 51 |
| 27 | OVERFLOW & DRAIN PIPING FROM DEAEERATOR TO HEADER | IBF | A106GRB | 6 | 87 |
| 28 | CCOW PIPING | | IS3589GRFE330 | 6 | 263 |
| 29 | CCOW PIPING | | IS3589GRFE330 | 4 | 159 |
| 30 | CCOW PIPING | | IS3589GRFE330 | 3 | 143 |
| 31 | CCOW PIPING | | IS3589GRFE330 | 8 | 41 |
| 32 | CCOW PIPING | | IS3589GRFE330 | 2 | 47 |
| 33 | CCOW PIPING | | IS3589GRFE330 | 14 | 2 |

| | | | | | |
|----|-------------------------|--|---------------|----|-------------|
| 34 | COCW PIPING | | IS3589GRFE330 | 20 | 27 |
| 35 | CONDENSATE PIPING (CS) | | A106GRB | 14 | 15 |
| 36 | CONDENSATE PIPING (CS) | | A106GRB | 2 | 6 |
| 37 | CONDENSATE PIPING (CS) | | A106GRB | 10 | 120 |
| 38 | CONDENSATE PIPING (CS) | | A106GRB | 8 | 8 |
| 39 | CONDENSATE PIPING (CS) | | A106GRB | 3 | 29 |
| 40 | CONDENSATE PIPING (SS) | | A312GRTP304 | 20 | 23 |
| 41 | CONDENSATE PIPING (SS) | | A312GRTP304 | 6 | 86 |
| 42 | CONDENSATE PIPING (SS) | | A312GRTP304 | 14 | 233 |
| 43 | CONDENSATE PIPING (SS) | | A312GRTP304 | 2 | 6 |
| 44 | CONDENSATE PIPING (SS) | | A312GRTP304 | 10 | 6 |
| 45 | CONDENSATE PIPING (SS) | | A312GRTP304 | 12 | 9 |
| 46 | CW/ ACW PIPING | | IS3589GRFE330 | 14 | 49 |
| 47 | CW/ ACW PIPING | | IS3589GRFE330 | 18 | 37 |
| 48 | CW/ ACW PIPING | | IS3589GRFE330 | 36 | 26 |
| 49 | BFP SUCTION PIPING | | A106GRB | 16 | 15 |
| 50 | BFP SUCTION PIPING | | A106GRB | 16 | 42 |
| 51 | BFP SUCTION PIPING | | A106GRB | 12 | 51 |
| 52 | BFP SUCTION PIPING | | A106GRB | 12 | 18 |
| 53 | HP HEATERS DRAIN PIPING | | A106GRB | 6 | 201 |
| 54 | HP HEATERS DRAIN PIPING | | A106GRB | 6 | 9 |
| 55 | HP HEATERS DRAIN PIPING | | A106GRB | 8 | 14 |
| 56 | LP HEATERS DRAIN PIPING | | A106GRB | 6 | 58 |
| 57 | LP HEATERS DRAIN PIPING | | A106GRB | 6 | 2 |
| 58 | LP HEATERS DRAIN PIPING | | A106GRB | 8 | 93 |
| 59 | LP HEATERS DRAIN PIPING | | A106GRB | 8 | 16 |
| 60 | LP HEATERS DRAIN PIPING | | A106GRB | 10 | 61 |
| 61 | VENT PIPING | | A106GRB | 6 | 31 |
| 62 | VENT PIPING | | A106GRB | 4 | 27 |
| 63 | VENT PIPING | | A106GRB | 10 | 5 |
| | PER UNIT PIPING | | | | 2823 |

b. Storage

Major pipes will be kept in storage yard and balance will be stacked at work spot depending upon the space availability at the time of erection.

c. Access/Interface details within STG Hall

The trailer route plan within Hazira and Dahej plant area is marked as per Annexure-1&3.

d. Lifting arrangements

Lifting operation is performed by winch, crane, EOT crane or chain block based on front, material and inputs availability.

26. Requirements on Help / Fronts for Equipment Erection.

a. Generator Erection

Concrete column & pedestals at 1A1, 1A2, 2A1, 2A2, 7A1, 7A2, 8A1, 8A2, 18A1, 18A2, 19A1, 19A2, 24A1, 24A2, 25A1 & 25A2 grids to be deferred till Generator Erection.

Ensure availability of Stand jack pockets as mentioned in Equipment layout, BHEL will provide anchor bolt, casting of anchor bolt to be carried out by Civil agency of RIL.

Ensure availability of EOT crane for Stand Jack tower assembly and erection.

b. Condensor

All works between road (in front of A-row) and TG hall along grid 4-5, 10-11, 23-24 & 29-30 to be planned after condenser handling for trailer movement.

c. Boiler Feed Pumps

1. Cable cellar wall upto 7.0 M height shall be planned after BFP placement along
Horizontal grid : C & D row
Vertical grid : 3-6, 9-12, 22-25 and 28-31
2. Inter connecting pipe rack for unit 2&3 between boiler and STG by Others shall be planned after BFP placement.
Horizontal grid : D row
Vertical grid : 11-12, 24-25

d. Turbine

Availability of EOT Crane for assembly of turbine.

ANNEXURE

Annexure-1 Trailer movement within HMD

Annexure-2 Trailer movement within DMD

Annexure-3 Crane/Hydra movement within HMD

Annexure-4 Crane/Hydra movement within DMD

Annexure-5 Major equipment- lifting & placing tentative schedule.

Annexure-6 Mobilization Plan

Annexure-7 Site Facilities

Annexure-8 Construction water & Power requirements

Annexure-9 HSE Execution Plan

Annexure-10 Material Management

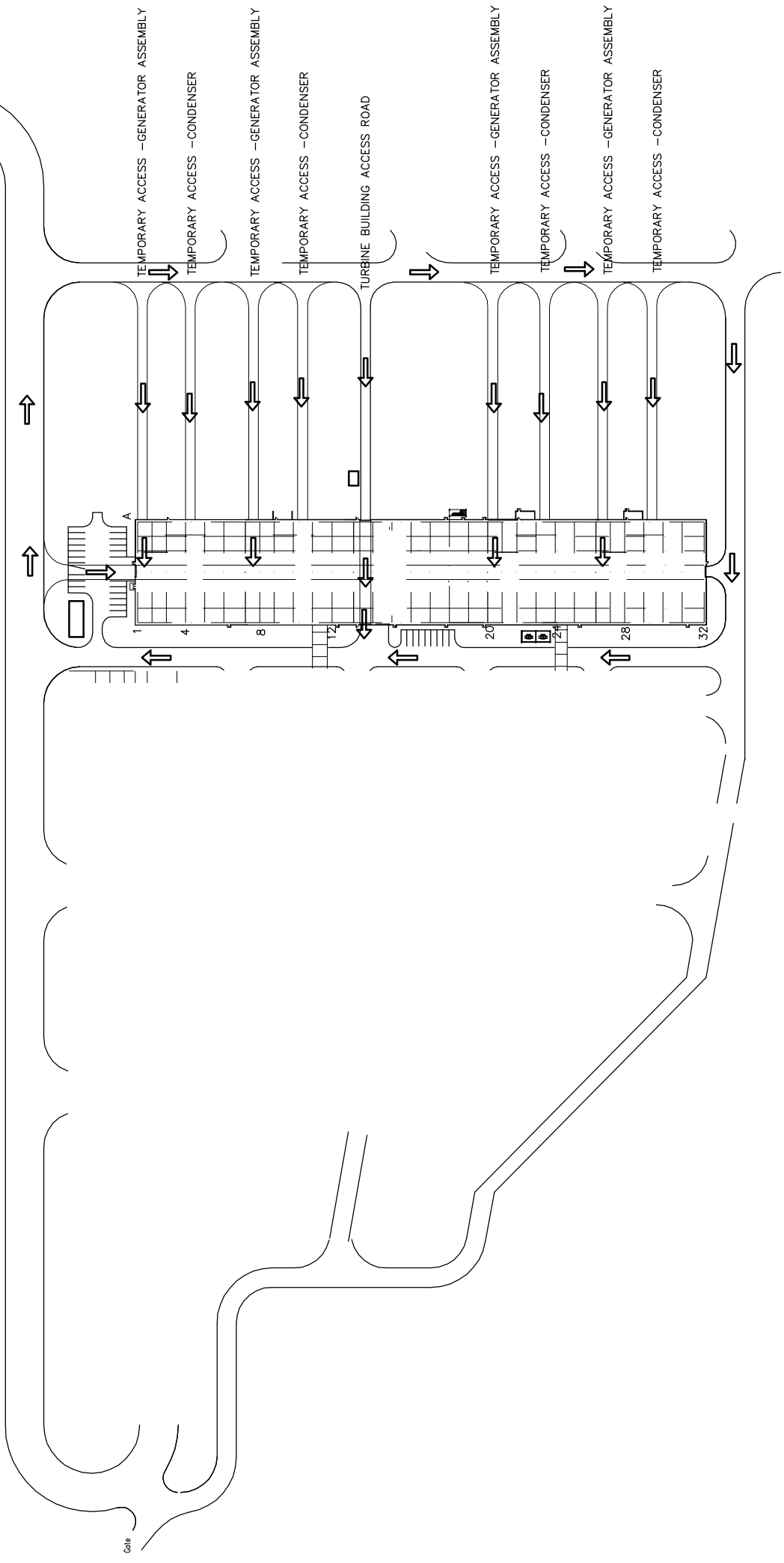


ANNEXURE-1 to Construction Design and Management Health and Safety (CDM H&S) Plan



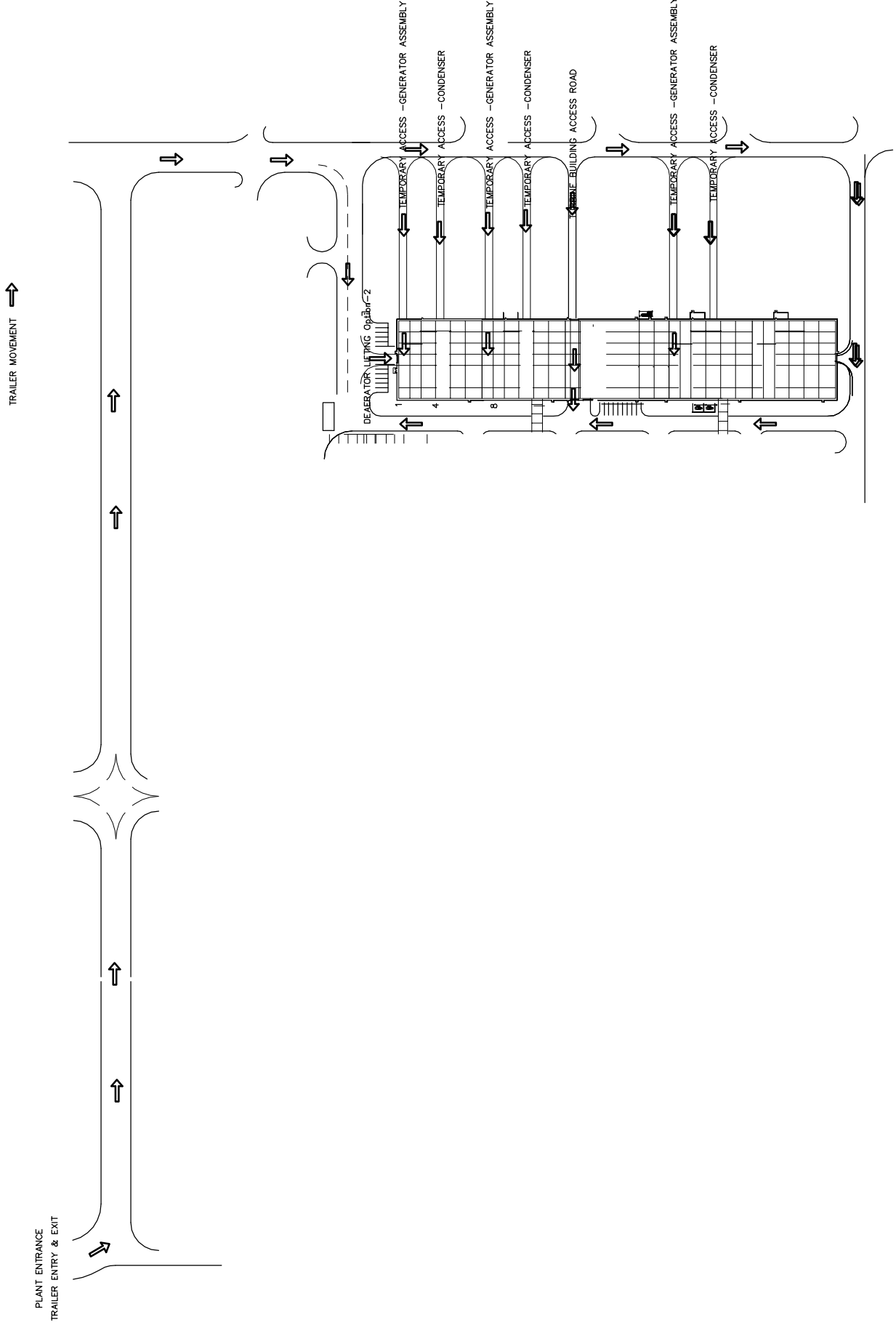
PLANT ENTRANCE
TRAILER ENTRY & EXIT

TRAILER MOVEMENT





ANNEXURE-2 to Construction Design and Management Health and Safety (CDM H&S) Plan

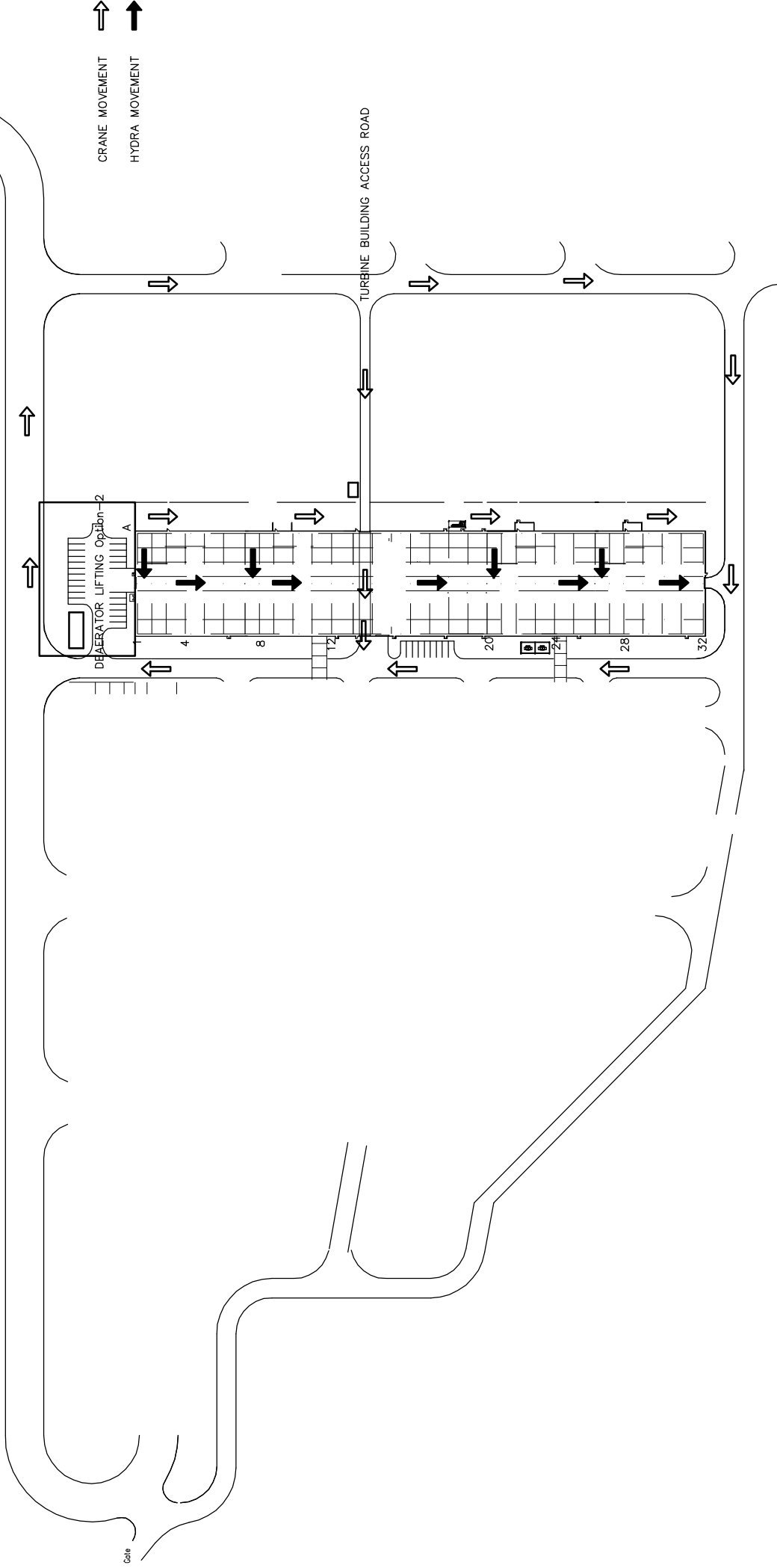




ANNEXURE-3 to Construction Design and Management Health and Safety (CDM H&S) Plan

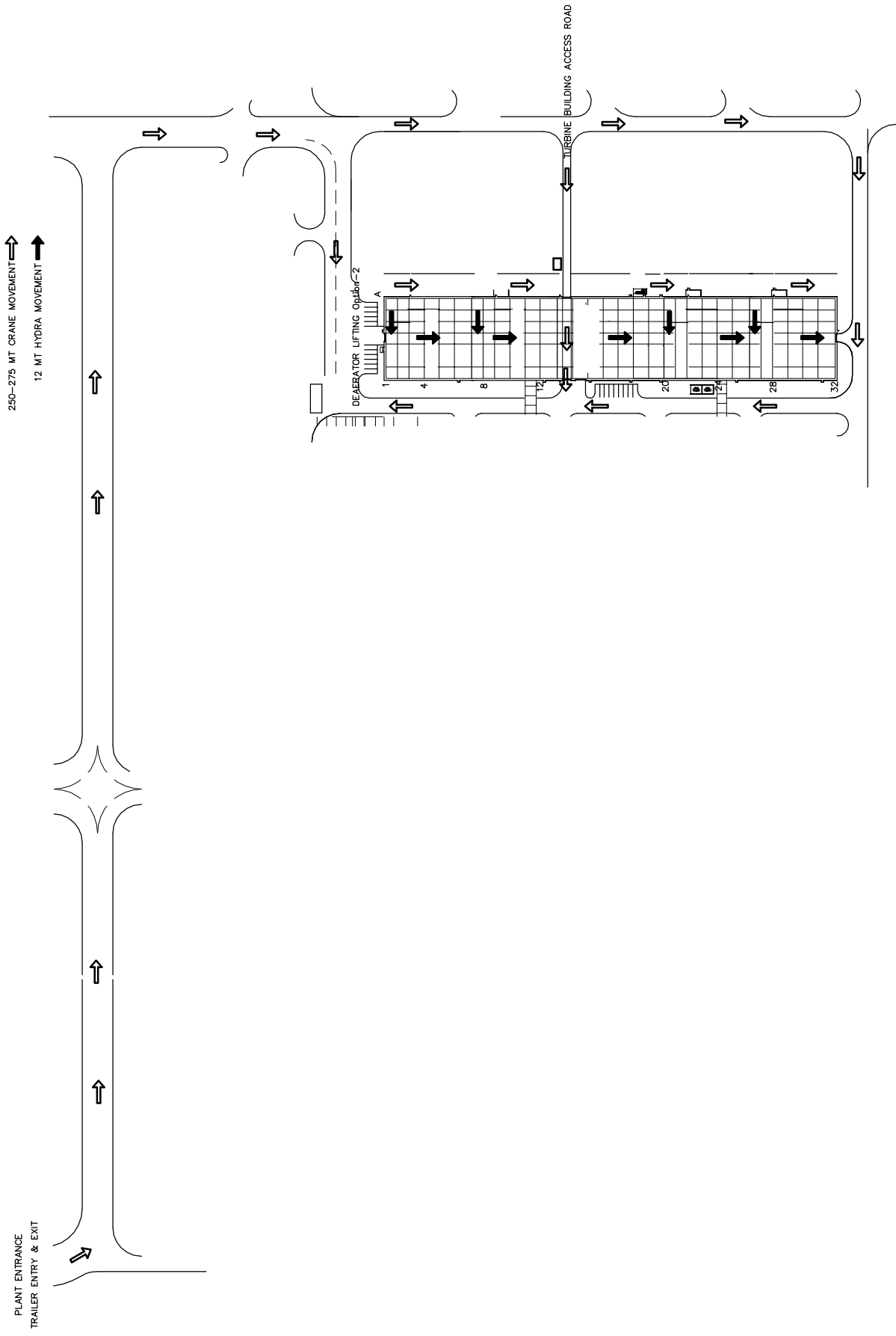


PLANT ENTRANCE
TRAILER ENTRY & EXIT





ANNEXURE-4 to Construction Design and Management Health and Safety (CDM H&S) Plan



| | | |
|--|---|-------------------------------|
|  Proj Engg & Systems Divn | 4x93.1MW STGs for HMD + 3x90.3MW STGs for DMD | Site Mobilization Plan |
| BHEL Hyderabad, India | Annexure -6 to Construction Design and Management Health and Safety (CDM H&S) Plan | Page 1 of 3 |

Annexure-6

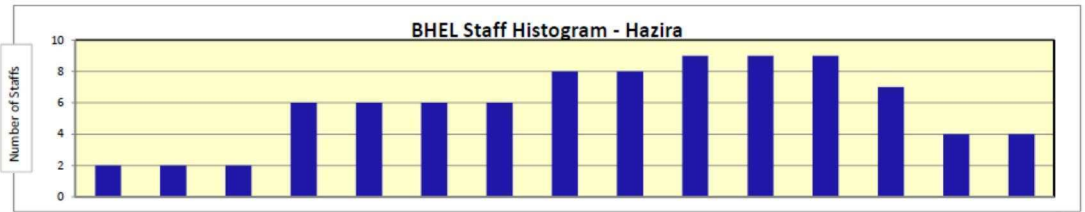
Site Mobilization plan

Receipt of materials at site is expected by June'2014. Prior to these site offices, store facilities shall be established to receive these materials.

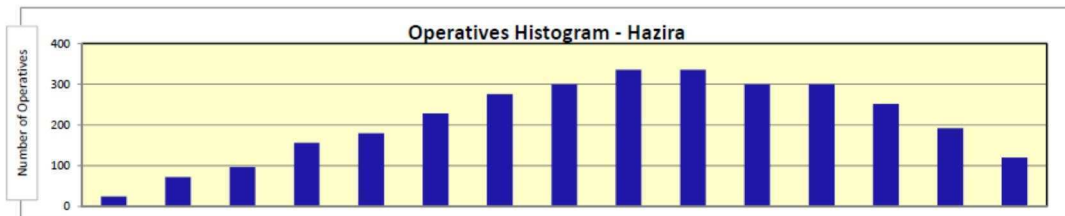
Plan for erection subcontractor

| Subcontractor | Mechanical works | Electrical, C&I | Enabling works |
|-----------------|------------------|-----------------|----------------|
| Hazira location | 1 | 1 | 1 |
| Dahej Location | 1 | 1 | |

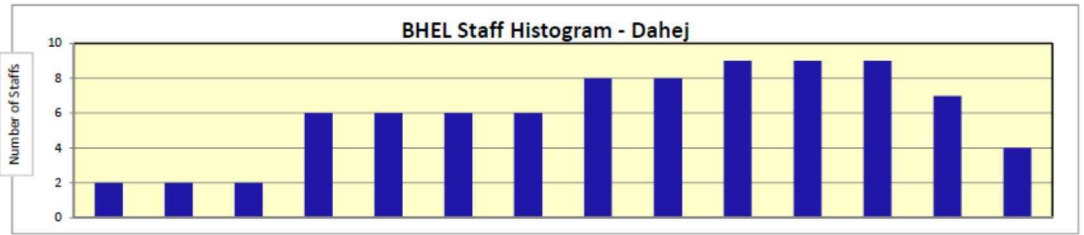
Staff and Operatives histogram (Hazira & Dahej) is shown below for information and the actual deployment will be based only on site conditions.



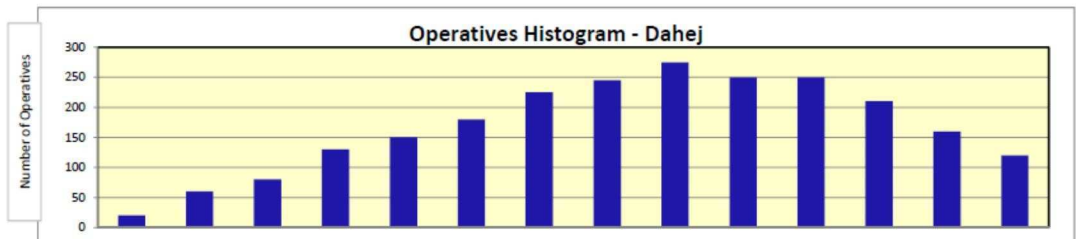
| BHEL Staff | Months | Jun-14 | Jul-14 | Aug-14 | Sep-14 | Oct-14 | Nov-14 | Dec-14 | Jan-15 | Feb-15 | Mar-15 | Apr-15 | May-15 | Jun-15 | Jul-15 | Aug-15 |
|--------------------------|-----------------------------------|-------------------|----------|----------|----------|-------------|----------|----------|----------|----------|----------|----------|----------|--------------|--------------|--------------|
| | Milestones (Zero date - 23.08.13) | Enab. works start | | | | Erec. Start | | | | | | | | Unit-1 Commn | Unit-2 Commn | Unit-3 Commn |
| Construction manager | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Erection - Mechanical | | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Electrical Engineer | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | | |
| Enabling works | | 1 | 1 | 1 | 1 | | | | | | | | | | | |
| Instrumentation Engineer | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Commissioning Engineer | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 |
| Piping + Welding + NDT | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| Quality/Safety | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| Material Mgmt | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total | | 2 | 2 | 2 | 6 | 6 | 6 | 6 | 8 | 8 | 9 | 9 | 9 | 7 | 4 | 4 |




| Subcontractor (RCM, staffs, operatives etc.,) | Months | Jun-14 | Jul-14 | Aug-14 | Sep-14 | Oct-14 | Nov-14 | Dec-14 | Jan-15 | Feb-15 | Mar-15 | Apr-15 | May-15 | Jun-15 | Jul-15 | Aug-15 |
|---|-----------------------------------|-------------------|-----------|-----------|------------|-------------|------------|------------|------------|------------|------------|------------|------------|--------------|--------------|--------------|
| | Milestones (Zero date - 23.08.13) | Enab. works start | | | | Erec. Start | | | | | | | | Unit-1 Commn | Unit-2 Commn | Unit-3 Commn |
| Material Management | | 12 | 24 | 24 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 24 | 24 | 24 | 12 | 12 |
| Enabling works | | 12 | 24 | 36 | 36 | 12 | | | | | | | | | | |
| Mechanical works | | | | | 48 | 96 | 120 | 144 | 144 | 144 | 144 | 120 | 96 | 72 | 72 | 48 |
| Electrical, C&I works | | | | | | | | 24 | 48 | 48 | 60 | 72 | 96 | 96 | 72 | 48 |
| Piping works | | | | | | | 48 | 72 | 72 | 108 | 96 | 84 | 84 | 60 | 36 | 12 |
| Critical lift works | | | 24 | 36 | 36 | 36 | 24 | | | | | | | | | |
| Total | | 24 | 72 | 96 | 156 | 180 | 228 | 276 | 300 | 336 | 336 | 300 | 300 | 252 | 192 | 120 |



| BHEL Staff | Months | Jun-14 | Jul-14 | Aug-14 | Sep-14 | Oct-14 | Nov-14 | Dec-14 | Jan-15 | Feb-15 | Mar-15 | Apr-15 | May-15 | Jun-15 | Jul-15 |
|--------------------------|-----------------------------------|-------------------|----------|----------|-------------|----------|----------|----------|----------|----------|----------|----------|--------------|--------------|--------------|
| | Milestones (Zero date - 23.08.13) | Enab. works start | | | Erec. Start | | | | | | | | Unit-1 Commn | Unit-2 Commn | Unit-3 Commn |
| Construction manager | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Erection - Mechanical | | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Electrical Engineer | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | |
| Enabling works | | 1 | 1 | 1 | 1 | | | | | | | | | | |
| Instrumentation Engineer | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Commissioning Engineer | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 |
| Piping + Welding + NDT | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Quality/Safety | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Material Mgmt | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total | | 2 | 2 | 2 | 6 | 6 | 6 | 6 | 8 | 8 | 9 | 9 | 9 | 7 | 4 |



| Subcontractor (RCM, staffs, operatives etc.,) | Months | Jun-14 | Jul-14 | Aug-14 | Sep-14 | Oct-14 | Nov-14 | Dec-14 | Jan-15 | Feb-15 | Mar-15 | Apr-15 | May-15 | Jun-15 | Jul-15 |
|---|-----------------------------------|-------------------|-----------|-----------|-------------|------------|------------|------------|------------|------------|------------|------------|--------------|--------------|--------------|
| | Milestones (Zero date - 23.08.13) | Enab. works start | | | Erec. Start | | | | | | | | Unit-1 Commn | Unit-2 Commn | Unit-3 Commn |
| Material Management | | 10 | 20 | 20 | 30 | 30 | 30 | 30 | 30 | 30 | 20 | 20 | 20 | 10 | 12 |
| Enabling works | | 10 | 20 | 30 | 30 | 10 | | | | | | | | | |
| Mechanical works | | | | | 40 | 80 | 90 | 115 | 115 | 115 | 100 | 80 | 60 | 60 | 48 |
| Electrical, C&I works | | | | | | | | 20 | 40 | 40 | 60 | 80 | 80 | 60 | 48 |
| Piping works | | | | | | | 40 | 60 | 60 | 90 | 70 | 70 | 50 | 30 | 12 |
| Critical lift works | | | 20 | 30 | 30 | 30 | 20 | | | | | | | | |
| Total | | 20 | 60 | 80 | 130 | 150 | 180 | 225 | 245 | 275 | 250 | 250 | 210 | 160 | 120 |

| | | | |
|--|-------------------------------------|--|------------------------|
|  | Proj Engg & Systems Divn | 4x93.1MW STGs for HMD + 3x90.3MW STGs for DMD | Site Facilities |
| BHEL Hyderabad, India | | Annexure-7 to Construction Design and Management Health and Safety (CDM H&S) Plan | Page 1 of 3 |

Annexure-7

Site Facilities

i. Contractor offices

Offices

- Conventional/Pre-Engineered Building(PEB) /Porta cabin buildings of size approx. 150 SQM
- Field offices (Porta cabins) of approx. size – 20' x10' near to work site – 2 Numbers
- Porta Cabin toilet block – 1 Number

BHEL Contractor offices

- Field offices (Porta cabins) of size – 20' x10' near to work site – 3 Numbers

Stores

Closed Shed for storage of materials

- Conventional/PEB of approx.. size 30 M(L) x 15M.(W) x 5.25M Height – 2 Numbers

Open Storage & FabricationYard

- 12750 SQM for Hazira Manufacturing Division (inclusive of closed store)
- 10500 SQM for Dahej Manufacturing Division (inclusive of closed store)

The preliminary layout for the above mentioned facilities for Hazira & Dahej locations are shown below in this document.

ii ES&H interfaces and Site Security


Watch and ward of BHEL's stores, open yard, fabrication yard, site spot:
Adequate security personnel will be deployed round the clock.

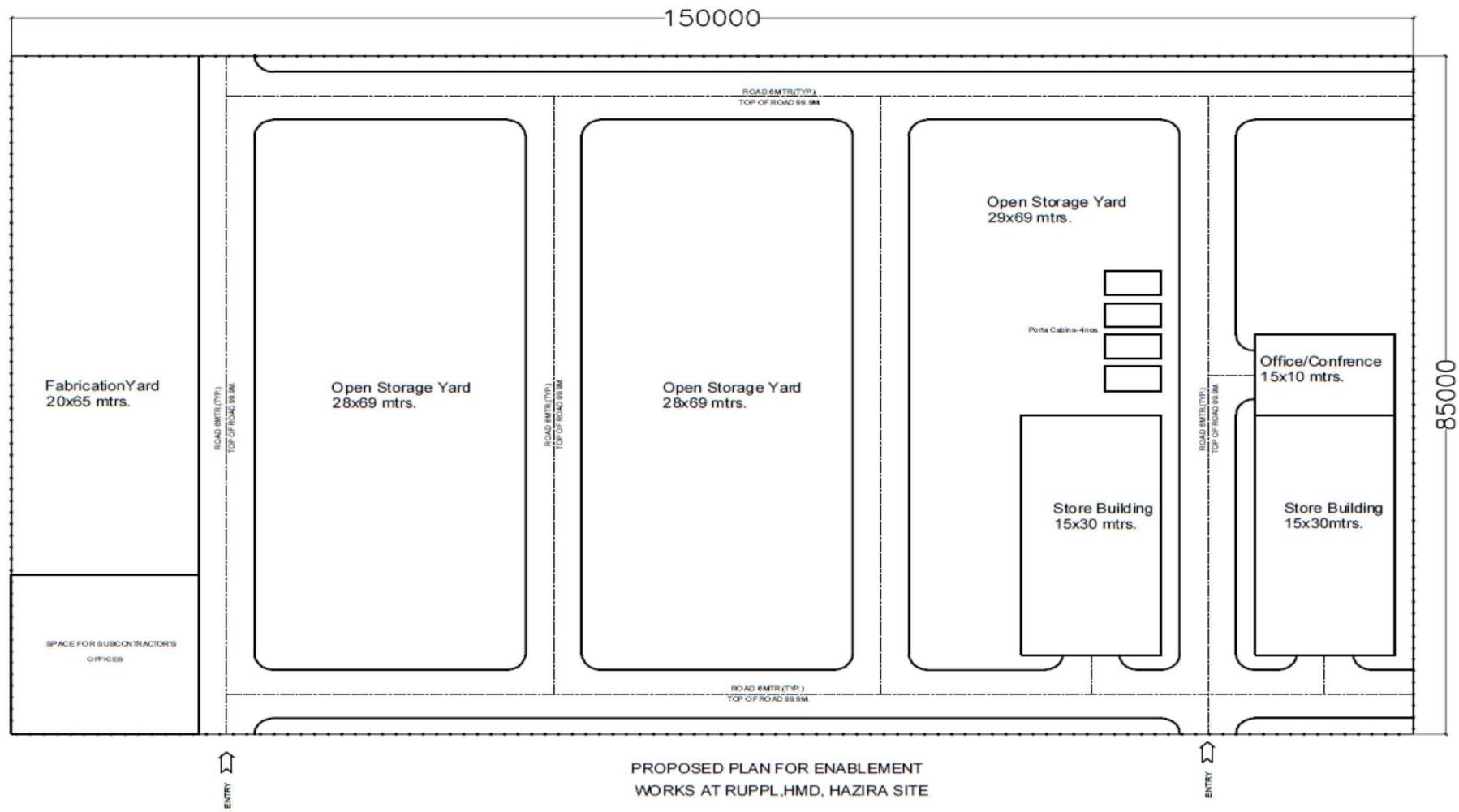
iii Erection coordination between Hazira and Dahej

Construction Manager of each site will co-ordinate for resources to match priority and schedule.

iv Camp location and labour access

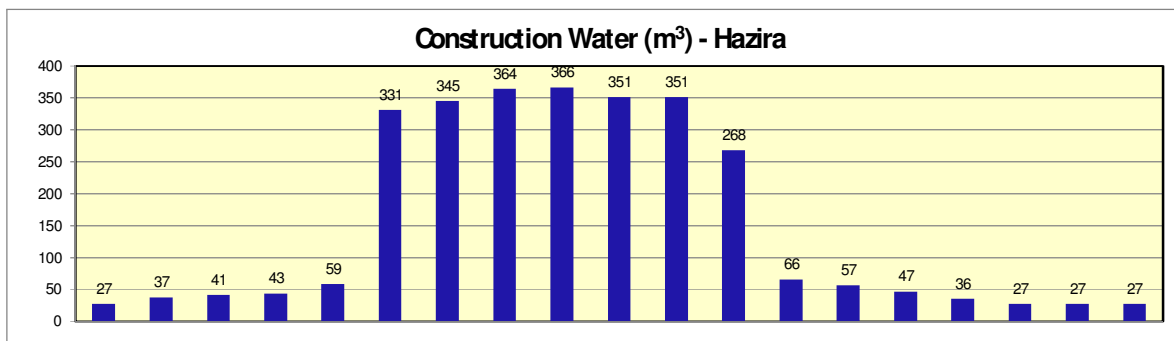
It is estimated that around 340 labour will be required to be accommodated in camp. Customer to allocate space with adequate drinking water, electricity facilities.

| | | |
|--|--|------------------------|
|  Proj Engg & Systems Divn | 4x93.1MW STGs for HMD + 3x90.3MW STGs for DMD | Site Facilities |
| BHEL Hyderabad, India | Annexure-7 to Construction Design and Management Health and Safety (CDM H&S) Plan | Page 2 of 3 |



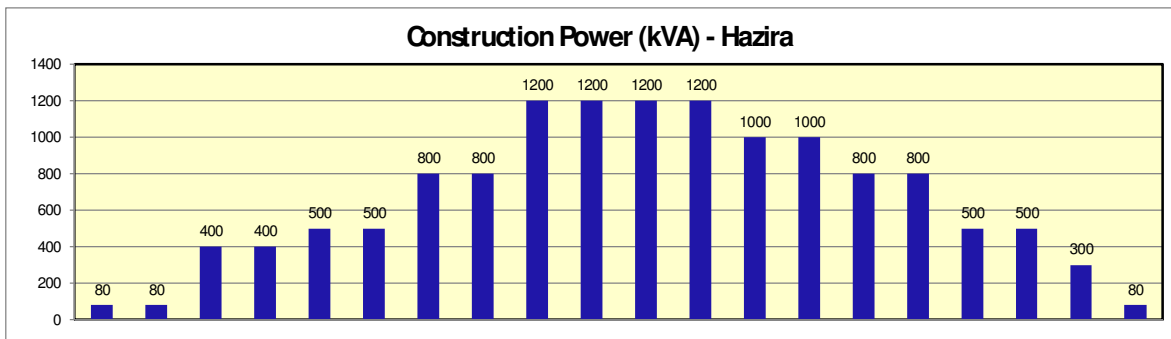
Tentative water & power requirement for 4x95MW Hazira Manufacturing Division site(for DMD to be considered as 90% of HMD)

| Major activities | Unit | Qty | Water Qty per unit, m ³ | Water Qty, m ³ | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 | Oct-14 | Nov-14 | Dec-14 | Jan-15 | Feb-15 | Mar-15 | Apr-15 | May-15 | Jun-15 | Jul-15 | Aug-15 | Sep-15 | Oct-15 | Nov-15 | Remarks | |
|-------------------------------------|------|-----|------------------------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---|
| | | a | b | a x b | | | | | | | | | | | | | | | | | | | | | | |
| Construction purposes | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DM Water | | | | | | | | | | | | | | | | | | | | | | | | | | |
| De-aerator tank | | | | | | | | | | | 275 | 275 | | | | | | | | | | | | | | Assumed to re-use the water from one tank to another. If not permitted, the quantity shall be doubled for DM water. |
| De-aerator header | | | | | | | | | | | | | | | 75 | 75 | | | | | | | | | | |
| Condenser | | | | | | | | | | | | | 290 | 290 | | | | | | | | | | | | |
| Service water | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Storage tank | | | | | | | | | | | | | | | 197 | 197 | 197 | | | | | | | | | |
| Piping | day | | 25 | | | | | | | 10 | 15 | 25 | 25 | 25 | 25 | 25 | 20 | 15 | 10 | 5 | | | | | | |
| Cont. Machinery maintenance | day | | 10 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| Safety | day | | 5 | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | |
| Miscellaneous | day | | 10 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| Office, stores & canteen | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Office, stores, canteen | nos. | | 0.03 | | 0.78 | 0.78 | 0.78 | 2.22 | 2.94 | 4.86 | 5.58 | 7.02 | 8.46 | 9.24 | 10.32 | 10.35 | 9.27 | 9.27 | 7.77 | 5.88 | 3.72 | 0.78 | 0.78 | 0.78 | | |
| Labour colony | nos. | | 0.05 | | 1.3 | 1.3 | 1.3 | 3.7 | 4.9 | 8.1 | 9.3 | 11.7 | 14.1 | 15.4 | 17.2 | 17.25 | 15.45 | 15.45 | 12.95 | 9.8 | 6.2 | 1.3 | 1.3 | 1.3 | | |
| Site infrastructure | m2 | | | | | | 10 | 10 | 10 | 10 | | | | | | | | | | | | | | | | |
| Drinking purpose | day | | 0.005 | | 0.13 | 0.13 | 0.13 | 0.37 | 0.49 | 0.81 | 0.93 | 1.17 | 1.41 | 1.54 | 1.72 | 1.73 | 1.55 | 1.55 | 1.30 | 0.98 | 0.62 | 0.13 | 0.13 | 0.13 | | |
| Total | | | | | 27 | 27 | 37 | 41 | 43 | 59 | 331 | 345 | 364 | 366 | 351 | 351 | 268 | 66 | 57 | 47 | 36 | 27 | 27 | 27 | | |



Construction Power

| Gen. lifting | E&C | Total |
|--------------|------|-------|
| 80 | 80 | 80 |
| 80 | 80 | 80 |
| 400 | 400 | 400 |
| 400 | 400 | 400 |
| 500 | 500 | 500 |
| 500 | 500 | 500 |
| 800 | 800 | 800 |
| 800 | 800 | 800 |
| 1200 | 1200 | 1200 |
| 1200 | 1200 | 1200 |
| 1200 | 1200 | 1200 |
| 1200 | 1200 | 1200 |
| 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 |
| 800 | 800 | 800 |
| 800 | 800 | 800 |
| 500 | 500 | 500 |
| 500 | 500 | 500 |
| 300 | 300 | 300 |
| 80 | 80 | 80 |



Project Details

| | |
|---------------------------|---|
| Customer | M/s. Reliance Utilities & Power Pvt. Ltd. |
| Consultant | M/s. Bechtel, USA |
| Contractor | M/s. Bharat Heavy Electricals Limited |
| Project | 4x93.1MW STGs for HMD + 3x90.3MW STGs for Hazira & Dahej Manufacturing Division |
| Document Reference | HSE Construction Design and Management Health and Safety (CDM H&S) Plan for STG and TCE |

| REV | DATE | DESCRIPTION OF REVISION | PREP'BY (BHEL) | REV' & APP' BY (BHEL) | APP'BY (CLIENT/PMC) |
|-----|------|-------------------------|----------------|-----------------------|---------------------|
| | | | | | |
| | | | | | |



OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENTAL (HSE) POLICY

We at PE&SD/BHEL are committed to provide Safe, Healthy and Environmental friendly atmosphere and prevention of injury and ill health in all our endeavours and strive to continually improve these through ::

- *Compliance with applicable Legislation and Regulations of Occupational Health, Safety and Environment.*
- *Minimising risks arising from hazards in Occupational Health & Safety*
- *Minimising pollution and waste generation.*
- *Maximising Conservation of natural resources.*
- *Periodic review of our Objectives, targets and HSE Management System for their adequacy and effectiveness.*
- *Creating awareness amongst our Employees, Suppliers and Stake holders through communication and Training.*

Dt :: 16.01.2013


Arvind Gupta
Executive Director-PE&SD

Project Engineering & Systems Division,
Bharat Heavy Electricals Limited,
R C Puram, Hyderabad 502 032

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1.0 PURPOSE

The purpose of this Safety and Health Plan is to provide for the systematic identification, evaluation, and prevention and control of general construction hazards, specific job hazards and potential hazards that may arise from foreseeable conditions during construction ,installation and servicing of power plant.

2.0 REFERENCES

Building and other construction works 1996
Factories Act 1948
Health & Safety Manual of BHEL

3.0 POLICIES

HSE Policy shall be implemented by site management throughout the construction activity.

Our company's Health & Safety and Environment policies are described here under: -

3.1 HEALTH & SAFETY POLICY

It is the policy of BHEL – PE&SD to:

1. Provide safe working environments, and to perform all company activities for installation of Power Plants in a manner that reduces risk to all employees and to all other workers.
2. Comply with applicable Legislation and other requirements concerning Occupational Health and Safety Ensure continual improvements in Occupational Health and Safety Performance through Periodic Review of Objectives and Control procedures.
3. Foster awareness amongst Employees, Vendors and other interested parties on Occupational Health and Safety Aspects.

4.0 TERMS AND DEFINITIONS

4.1 DEFINITIONS

ACCIDENT

An unplanned, undesired event or condition that, results in harm to people or damage to plant / equipment.

INCIDENT

Any undesired event or condition that could have resulted in harm to people or damage to property or the environment or loss.

AUDIT

A systematic and Independent examination of the Health and Safety management systems and their outcomes to determine the effectiveness of the Health & Safety management system.

COMMUNICATION

It is the process of conveying information to other party or parties, so it can be understood correctly and acted upon.

NEAR MISS

An unexpected, unwanted event not causing loss, injury or illness but which under slightly altered conditions can lead to an accident.

FATAL

Death resulting from an accident.

MAN HOURS WORKED

The total hours worked by all employees working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contractor labors.

FIRST AID CASES

First aid cases are where the injured person is given medical treatment and discharge immediately for reporting on duty, without counting any lost time.

LOST TIME INJURY (LTI)

Any work injury which renders the injured person unable to perform his regular job or an alternative restricted work assignment on the next scheduled work day after the day on which the injury occurred.

MEDICAL TREATMENT CASE (MTC)

A Medical Treatment Case is any work-related injury that involves neither Lost Workdays nor Restricted Workdays but which requires treatment by, or under the specific order of, a physician or could be considered as being in the province of a physician.

HEALTH & SAFETY REVIEW

A formal recorded management evaluation of the effectiveness of the Construction Health & Safety management systems and identification of actions for continual improvement.

SUB-STANDARD PRACTICE OR CONDITIONS

Deviation from a standard practice or conditions.

4.2 TYPE OF INCIDENT / ACCIDENT & THEIR REPORTING

All body Injury, damage to property or other loss that may arise out of or in consequence of the execution and completion of works shall be reported to client and relevant govt. agencies.

The two categories of accidents, which are as follows: -

Non Reportable Cases (minor / non LTA cases)

An accident, where the injured person are disabled for less than 24 hours.

Reportable Cases (major / LTA cases)

In this case the injured person is disabled for 24 hours or more and is not able to perform his duty.

LOST WORKDAYS – DAYS AWAY FROM WORK

The total number of calendar days on which the injured person was temporarily unable to work as a result of lost workday case or permanent partial disability.

FREQUENCY RATE

Frequency rate is the number of Lost Time Accident (LTA) per two Million Man hours worked. Mathematically, the formula read as: -

$$\frac{\text{Number of LTA}}{\text{Total Man Hours Worked}} \times 2,000,000$$

SEVERITY RATE

Severity rate is the Number of days lost due to Lost Time Injury (LTI) per two Million Man hours worked. Mathematically, the formula reads as: -

$$\frac{\text{Days lost due to LTI}}{\text{Total Man Hours Worked}} \times 2,000,000$$

4.3 VARIOUS TERMS USED

| | |
|----------------------|---|
| COMPANY | RELIANCE INDUSTRIES LIMITED (RIL) |
| BECHTEL | Bechtel Corporation USA |
| HSE COMMITTEE | Committee of management supervisors and employees, which aims to promote zero accident performance. |
| CONTRACTOR | BHARAT HEAVY ELECTRICALS LIMITED |
| NCR | Non Conformance Report - this addresses an act of violation carried out by an individual/a group of people against any clause of a written procedure. |
| SUBCONTRACTOR | Subcontractor to CONTRACTOR |
| PPE | Personal Protective Equipment. |
| SITE | The location where the work is to be constructed within the plot plan. |

5.0 ORGANISATION AND RESPONSIBILITIES

Every employee whether he or she at work-site or office has a responsibility to themselves, to the other employee, and to the company to work safely. This responsibility includes the elimination of hazards wherever possible, and reporting actual or potential hazards to management Supervisors and executives are accountable for maintaining good standard of safety and compliance of all safety procedures in the performance of every activity.

The fact that the company has assigned a Safety Officer does not release managers/engineers / supervisors from their safety responsibilities in any way. The Safety Officer is available to assist and guide them in implementing the company's safety policy.

5.1 RESPONSIBILITIES

Responsibilities of Construction Manager –

Construction Managers are responsible for maintaining a good standard of safety at the construction sites. He is obligated to comply with central, state and local laws having jurisdiction over the work and the site. Duties of Construction Manager shall include:

- Provide safe working conditions.
- Perform all activities in ways that eliminate risk of injury or health impairment to any employee/workman.
- Maintain all areas in ways that eliminates risk to public.
- Eliminate risk of damage to property and equipment.
- Plan construction activities so that work is performed in accordance with established safety laws, procedures and guidelines.
- Assist in the preparation, notification and monitoring of the work site safety program.
- Establish post and maintain all work site safety and health notices, signs, etc.
- Regularly conduct work site inspections to identify unsafe or potentially unsafe conditions and/or activities of personnel.
- Make recommendations for both immediate and future improvements in above conditions. Follow up on such recommendations in order to ensure continuing improvements.
- Be knowledgeable of all applicable local, state laws and BOCW Acts & rules procedures, regulations and standards.

- Be aware of all procedures needed to deal with industrial hygiene issues
- Conduct monthly safety review meetings and ensure participation of all members.
- Ensure that proper safety equipment and protective devices are available, well maintained and used whenever required.
- Instruct all package-in-charges in safety requirements and make certain that each of them passes the instruction to their workmen.
- Review all accidents, oversee correction of all unsafe practices and send accident reports
- Ensure conformance of safety standards by all subcontractors as required in the work orders issued to them
- Coordinate the organization and development of emergency systems such as, first aid, fire protection, fire alarm and evacuation etc
- Provide for the protection of the public from site operations
- Regularly attempt to ensure safe performance and enforce all compliances by others at site including subcontractors and their employees.
- Attend HSE meetings, as & when scheduled by RUPL / Bechtel.

Responsibilities of Site Safety Coordinator-

The site safety coordinator is responsible for assisting Construction Manager for implementation of safety systems and procedures.

In all matters related to safety, he shall work in close liaison with RUPL / Bechtel and his duties shall include:

- Familiarize all employees with company safety program, and applicable state, local and Building and Other Construction Workers Act 1996 (BOCW), procedures and standards.
- Implement the company Safety program and monitor compliances.
- Assist each site employee with compliance with all company and BOCW safety and health policies and regulations.
- Organize and conduct training programs for site employees and contractor's workmen.
- Conduct site inspections to identify unsafe conditions and / or actions of work site personnel. Make verbal and written recommendations for both immediate and future

correction. Follow up for implementation of corrections. Issue warnings of persistent, uncorrected unsafe conditions. Maintain daily safety observation register.

- Coordinate deployment of emergency systems such as, first aid, fire protection, fire alarm and evacuation etc
- Pursue health-related and hygiene-related activities and impart education with respect to it.
- Assist Construction Manager in the implementation of the site-specific safety program.
- Ensure that daily toolbox safety meetings & management site walkthroughs are conducted.
- Assist the Construction Managers in the establishment and maintenance of all worksite notices, signs, banners and posters etc
- Maintain all accident reporting and other safety documentation, including preparation of reports, notification to all parties and accident investigation reporting.
- Represent company management during any local, state or third party inspections at site.
- Coordinate monthly safety review meetings and preparation of weekly safety reports, quarterly fire safety reports, accident reports and manpower reports.

Responsibilities of BHEL Site Employees:

All employees must familiarize themselves with this safety plan as well as company's safety rules and procedures as per annexure and comply with them in every respect. Workmen, supervisory staff and management personnel at all levels are responsible for taking immediate correction action when a violation is observed. All employees are responsible for compliance in their area of operations.

- Each employee will be responsible for safety in his area of work.
- All safety equipment issued by company must always be used as intended.
- Company property and all equipment must not be damaged, removed or misused.
- Employees must be familiar with and observe all safety rules, procedures and policies as these may change from time to time
- All employees will ensure that all rules and procedures are complied with in their area of operations and immediately enforce appropriate corrective measures

whenever violations are noticed.

Responsibilities of Sub-contractors:

Each sub-contractor is completely responsible for the safety and health of the workmen and their employees in their employment. He shall also be responsible for safety of BHEL property and other equipment issued to him for carrying out the work and creates unsafe conditions for others. Each sub-contractor is required to comply with the requirements of the safety program as incorporated in their respective sub-contract agreements, and with all laws regulations, and requirements of local, state and BOCW, the owner / PMC and every other agency having jurisdiction over the work.

- Each sub-contractor is required to submit to the Construction Manager copies of their respective safety plan prior to start of work. Each sub contractor will:
- Abide by all company and site safety rules
- Participate in all periodic safety meetings and site safety inspections
- Appoint one representative with responsibility to take corrective actions on the notified safety violations and respond to them
- Provide necessary personal protective equipment required for the work
- Provide an adequate first aid kit for use by its employees/workmen
- Provide a list of employees qualified in first aid who may be available to administer first aid.
- Notify all other contractors when their activities could possibly affect the health or safety of employees of other contractors/agencies
- Report all injuries, accidents and any unsafe conditions to Construction Manager.

6.0 HSE PROCEDURES FOR CONSTRUCTION ACTIVITIES

6.1 HSE OBJECTIVES

Objectives

We seek to provide a workplace that is free of occupational injuries and illnesses. We believe that a safe and healthy workplace is essential to achieve high quality and productivity necessary to complete erection/commissioning targets. To achieve our long term goal of zero injury, we have set following objectives:

- Provide sufficient information, instructions, training and supervision to enable all personnel including contractors' workmen to minimize hazards and contribute positively to their own and workplace safety
- Continuously support, promote and provide sufficient resources for the effective implementation of Health and Safety Policy
- Develop safe systems of work for erection, commissioning, servicing handling and storage of materials and maintain tools and plants in good and healthy condition.
- Develop and implement systematic program for examination of work activities to identify hazards and accident prevention
- Exchange health and safety information with subcontractors 'and monitor and evaluate their performance.
- Continuously improve our injury rate over previous years.

6.2 TOOLBOX MEETING

Each site engineer / work supervisor shall conduct daily toolbox meetings to discuss health and safety issues before commencement of any activity. Work Supervisors shall lead these meetings. This meeting shall be no longer than 5-10 minutes of duration and items covered at these meetings shall include:

- Hazards and its control applicable to the particular activity.
- Safety measures / controls to be adopted during executing the job

Any important information / happening related to particular activity.

6.3 ACCIDENT INVESTIGATION, REPORTING AND RECORDS:

Every accident or injury of any kind and at any level of severity must be immediately reported by the employees in their work area (whether to BHEL employee or to the contractor's workmen) to the site safety coordinator, Activity in-charge, or Construction Manager, even if it is believed that the Incident / accident to be minor.

For any injury to any employee or to the contractor's workmen, the safety coordinator shall report the accident in accident safety format, to RUPPL/ Bechtel.

In the case of serious injury requiring hospitalization or fatality, communication should be made to RUPPL / Bechtel immediately with submission of accident report within 24 hrs and detail investigation report may be forwarded in accident safety format within two days.

Every site shall maintain record of accidents / incidents at site, and must be available for inspection by representatives of statutory agencies / officials visiting site from RUPPL / Bechtel. Site safety coordinator must maintain these records.

Accident Investigation Procedure:

The purpose of the investigation procedure is to find out root cause of accident / incident & not to find out faults, so as to avoid recurrences, in future.

BHEL Site in-charge shall constitute a committee of at-least 2 site engineers within 24 hours of such accidents. The investigation shall aim at finding out the basic unsafe acts / conditions that have caused the accidents. Immediately after all appropriate emergency measures, first aid and damage containment measures have been taken, every effort shall be made by the committee to:

- Preserve physical evidence
- Take photographs
- Take statement from accident victim(s) and eyewitnesses and any one who may have knowledge of possible cause(s) of accidents

The committee shall also recommend measures to prevent recurrence of similar accidents.

Accident Investigation Report:

The investigation committee on completion of the all investigations shall prepare and submit the report to the Construction Manager. The report shall also include measures to be taken at site to prevent similar accidents in future.

The construction Manager shall forward the copy of the investigation report to RUPPL / Bechtel.

6.4 HSE INSPECTIONS & REVIEW:

Each worksite must be regularly analyzed on continuing basis in order to identify actual or potentially hazardous conditions. It is the responsibility of the Construction Manager to administer the complete Worksite Safety Plan through the Package in-charges and in a manner coordinated with the Site Safety Coordinator.

It is the responsibility of all BHEL supervisors and engineers to regularly observe worksites, tools, equipment and storage area daily and take all appropriate actions necessary to eliminate or control any hazard that are identified. If it goes beyond their authority, the Safety Coordinator/Activity In-charge should be asked for assistance.

In addition to inspecting worksite and work areas for unsafe conditions, they should also observe operations, work procedures and workmen actions. Unsafe activities must be eliminated and workmen should be told about safe procedures.

The safety coordinator should make both scheduled and surprise inspections. He should discuss the results of the inspections with Activity In-charges and Construction Manager. The safety co-coordinator should forward the results of scheduled and unscheduled inspections to activity in-charges and Construction manager for corrective actions.

Any unsafe conditions / actions of 'workmen must be brought to that subcontractors notice for immediate attention.

6.5 PERMIT TO WORK SYSTEM (PTW)

Certain work connected with Construction shall be carried out under a Work Permit System where the risk ranking is high.

- The most formal method of ensuring safe working practices - safe systems of work - is to have a permit-to-work procedure. A permit-to-work system shall ensure that a trained authorized person shall pre-assess the hazardous circumstances involved and then prescribe the conditions and limits for the work to take place.
- The permit certificate requires acknowledgement by the performing authority (team leader) that is responsible for doing the work to indicate that working conditions and limits are thoroughly understood.

Work Permit Requirement

Work permit systems are the most formal method of ensuring safe systems of working. Their use shall be reserved for work where there are potential hazards and that the precautions necessary for that work need positive enforcement.

Definitions

Issuing Authority

Is the person who signs a Work Permit and authorizes the work to start, provided that all the prescribed special conditions have been or shall be complied with. He shall ensure that all supporting documentation has been obtained and is properly completed before the Work Permit is signed.

Performing Authority

Is the person who 'receives' the Work Permit. Normally a supervisor of the operatives carries out the work. He shall ensure that he, and all the operatives involved, understands the conditions, limitations, and precautions necessary as stipulated in the Work Permit, and that these are complied with.

Description and Limitations of Permits

Description

There are different Work Permit Forms to cover Construction Works. These are:

- The Cold Work Permit (After commissioning)
- The Hot Work Permit (After commissioning)
- The Excavation Permit
- The Electrical Isolation Work Permit
- The Height Work Permit (for working above 4 m ht.)
- Radiation permit.
- Erection/lifting permit.
- Road blockade permit.
- Night works permit.
- Hydro test / pneumatic test

Procedures for Work Permit Issue

a) Requirement

Work Permits are required for all work carried out within the site.

b) Application

An application for a Work Permit shall be given to the Issuing Authority.

c) Preparation and Issue

The Issuing Authority shall prepare Work Permits. All sections of the Work Permit Form must be completed.

Where necessary, the Issuing Authority, or his delegate, shall arrange for a gas test of the Vessel or area. When the Issuing Authority is satisfied that all conditions and precautions have been complied with, he may sign and issue the permit original to the applicant. The Recipient shall sign the Acknowledgement Section of the Permit.

d) Acknowledgement

All Work Permit categories require a formal acknowledgement from the Recipient where he is required to sign the Permit Form, acknowledging that he understands all the conditions, precautions and restraints imposed by the Issuing Authority. And that these conditions etc., have been fully explained to the operatives who shall carry out the work. The 'Acknowledgement' section shall be signed at the time of issue.

e) Posting, Suspension, Completion and Cancellation

All Permits are automatically suspended upon emergency alarms sounding. Before work re-commences after an alarm stoppage, permission must be obtained from the Issuing Authority. When all work is finished, the person in charge of the work, normally the recipient of the Work Permit shall sign the 'Work completed' section of the Form and return it. When the Issuing Authority has received the completed Permit it shall automatically be cancelled.

f) Validity

A Work Permit is only valid until the time / date shown. Normally a Work Permit shall be issued for a period not exceeding 12 hours. Each Permit may be extended on a 12-hour basis. The permits shall be presented for re-validation each day before work commences. A Work Permit ceases to be valid upon the sounding of an emergency alarm.

6.6 FIRST AID TRAINING

BHEL will arrange in-house training in basic first aid from time to time (once in a year). Construction Manager shall contact local Red Cross/Area hospitals or fire departments for arranging above training program. Participation by every site employee should be encouraged.

6.7 HSE COMMUNICATION

HSE MEETINGS

Construction Manager shall conduct regular safety meetings to:

- Orient all sub contractors and their workmen to site requirements and objectives.
- Identify areas that require special concerns and determine the best corrective actions for each situation.
- To review the safety shortfalls / Safety deviation report / safety audit findings and other observations made during the previous meeting
- To identify corrective / preventive actions
- To review the response of Tool Box Meeting

6.8 PERSONAL PROTECTIVE EQUIPMENT

BHEL will provide all necessary standard personal protective equipment (as per National & International Standard) on each work site for use by company employees. All subcontractors on the site are required to provide personal protective equipment in manners adequate for the type of work being performed by them.

6.9 Welding and Gas Cutting Operations

(After commissioning)

- No welding or torch operations are to be performed by any subcontractor without a proper hot work permit in confined areas, storage areas etc.
- When possible, items to be welded, cut, heated, etc. shall be moved to a safe

location free of combustible or flammable material. If this is not possible, then all combustibles/flammables that can be removed from the area will be removed and a positive means of confining arcs and sparks generated by the process will be taken and additional person(s) will be stationed as fire watch for the area(s) still exposed.

- Appropriate fire-fighting equipment is to be available in close proximity of any welding and gas cutting operations at all times.
- Drums, tanks, and similar containers that have contained flammable or toxic material shall not be welded, cut, or heated until they have been made safe by water filling, thorough cleansing, or similar accepted practices. The container must also be ventilated during the welding, cutting, or heating process.
- Proper ventilation is required for any welding or torch operations performed in a confined space.
- Any welding or gas cutting operations performed on metals of toxic compounds or coating such as zinc, stainless steel, lead, cadmium, chromium, and beryllium must be properly ventilated and/or proper respiratory protection must be worn by any person that could be exposed to fumes, vapors, and gasses created by the welding and gas cutting processes.
- Wherever it is practical, all arc welding operations shall be shielded to prevent direct light rays or sparks from contacting persons in the vicinity or from reaching areas normally used to travel through or into the vicinity. Where this is not practical, persons who must be in the area are to use proper eye and skin protection. Other persons who are not participating in the welding or gas cutting operations are not to be allowed into the hazard zone.
- Welders and other employees who are exposed to arc welding radiation must wear suitable clothing and protective apparel to prevent burns and other types of ultraviolet radiation damage to the skin.
- Arc welding machines must be shut down when being moved or when they are not in continuous use.
- Electrode holders left unattended must have electrodes removed and must not be left where they might contact employees or conducting objects.
- Welders must guard against allowing materials adjacent to or behind them to reflect radiation back toward them or towards others in the area. Reflected radiation can cause skin burns and eye flash burns.
- Compressed gas cylinders must always be secured from tipping or falling, whether in use, in storage or in transit. The cylinders must always be secured

upright, except during times when actually being hoisted or carried.

- Valve caps must be in place when cylinders are not in use. Valve caps must never be used for lifting the cylinder vertically.
- Regulators must be removed when cylinders are not in use or are in transit, unless the cylinder is firmly secured on a special carrier designed for this purpose.
- Cylinders being transported by a powered vehicle must be secured in an upright position.
- Cylinders containing oxygen or fuel gasses must not be taken into confined spaces.
- Oxygen cylinders shall be stored a minimum of (6) meters from fuel gas cylinders or must have an approved firewall between them.
- Torches must only be lit by approved strikers; never with matches, cigarette lighters, or hot work.

6.10 COMPRESSED GAS :

- All cylinder valves must be closed when any work is finished and when any cylinders are empty or being moved.
- Valve protection caps must be placed and secured properly before gas cylinders are transported, moved or stored.
- Compressed gas cylinders must be secured in an upright position with chain or other appropriate means.
- All cylinders must be kept at a safe distance from welding or cutting operations or shielded from safe.
- All cylinders must be placed where they cannot become part of the electrical circuit.
- Oxygen and acetylene must not be stored together.
- Oxygen and fuel gas regulators, hoses and associated equipment must not be altered and must be in proper working order while in use.
- Compressed air can be extremely dangerous if allowed to penetrate the skin. As such, the use of compressed air to clean off yourself or other workers is strictly prohibited.

- Compressed air used for cleaning purposes may not exceed 2Kg/cm² only in conjunction with personnel protective equipment that is designed for that application.

6.11 SCAFFOLDS :

- All scaffolds must be erected / dismantled by scaffolding crew under direct supervision of competent scaffolding supervisors.
- All scaffolds will be capable of supporting 4 times maximum intended load and erected on sound, rigid footing, capable of carrying the maximum intended load without settling or displacement.
- Guard rails and toe boards will be installed on all open sides and ends of platforms more than (4) meter above ground or floor.
- Scaffold planks will extend over end supports not less than 6 inches nor more than 12 inches. Scaffolding and accessories with defective parts will be immediately repaired or replaced.
- All platforms are to be tightly planked for the full width of the scaffold, except as may be necessary for entrance openings. Platforms will be secured in place.
- On suspension scaffolds designed for a working load of 500 pounds, no more than two workers are permitted to work on the scaffold simultaneously. On suspension scaffolds with a working load of 750 pounds, no more than three workers are permitted on the scaffold simultaneously. Each employee on the scaffold must use an approved safety harness attached to a lifeline. The lifeline is to be securely attached to substantial members of the structure (not the scaffold itself) or to securely rigged lines, which will safely suspend a worker in event of a fall.

6.12 Excavation:

- Preplanning of every excavation by the responsible supervisor is required in order to prevent problems with items such as underground utilities, overhead utility lines, surfaced drainage, substructures and superstructures, excessive noise laws, environmental impact laws, medical and/or emergency response facilities, potential for hazardous atmosphere, communications and back-up availability, and normal amounts of vibration in the area.
- Dewatering as required to sustain a dry excavation must be initiated and maintained while work is being performed.
- Persons working in or around an excavation must be alert to any unnatural or

suspicious changes in the excavation. Any observation or concern must be reported to their immediate supervisor immediately. Such concerns may include cracks in walls or surface, water seepage, suspicious odors, change in surrounding vibrations, incoming drainage etc.

- Prior to starting any work in the excavation area, the immediate supervisor shall inspect the excavation for possible hazards and to see that all safety regulations are met. Additional inspections will be made throughout the day as required by changing conditions and at the beginning of each new workday or work shift.
- At the end of the work shift or when the work area must be left unattended at any time, the immediate supervisor shall perform a walk-around inspection of the area assuring that no hazardous or unsafe conditions are left exposed or unprotected.

6.13 CRANES AND HOISTING EQUIPMENTS:

- On every crane or piece of hoisting equipment notices of all rated load capacities, recommended operating speeds, and any hazard warnings or special instructions must be conspicuously posted. All instructions and warning must be visible from the equipment operator's station.
- All areas within swing radius of cranes that are potentially accessible by pedestrian, vehicular, or equipment movement must be barricaded to prevent anyone or any vehicle or equipment from being struck by the crane or hoisting equipment, or its load(s).
- Except where electrical distribution and transmission lines have been de-energized and visible grounded, or where insulating barriers not a part of or an attachment to the equipment or machinery have been erected to prevent within 15 ft. of any power line.
- Cranes will be inspected before use by the operator. Any defects must be corrected before use. Logs of crane inspection must be kept with the crane.
- Hydras shall only be allowed for loading & unloading works & shall not be allowed to transport materials in project roads.

6.14 Temporary electrical installations:

The following guidelines are to be considered the absolute minimum requirements to be supplemented by requirements of all applicable codes and standards for such work; Wiring and Branch Circuits Must be protected by a proper amperage over current device such as a HRC fuse or circuit breaker. Such installations must be located so as to prevent physical damage to the wire conductors & panels.

- Portable electric lights used in wet or potentially wet locations must be either low voltage type (12 volts or less) or protected by a GFI (ground fault interrupter).

- Must be visually checked before each use and periodically while in use to assure their original integrity is maintained. Cords with cuts, breaks, deep abrasions, etc. shall be taken out of service immediately. Repairs to extension cords shall only be performed by qualified/ licensed electricians.
- Must not be allowed to lie in wet or potentially wet areas.
- Every electric line or cable of unknown origin that is discovered or exposed during a digging, drilling, probing, or similar operation is to be considered as energized and life threatening. The senior company employee on the site will ensure that all necessary safety precautions are taken in order to isolate the line from all workers and the public. Such precautions may include halting the operation if appropriate. The senior company employee on the site is to then contact the proper authorities to have the line identified and either confirmed to be abandoned and/or made safe for continuing the work.
- Any and all underground lines that are discovered or become severed must be considered energized on both sides, and be treated accordingly.
- In general, equipment or machinery being moved or transported must maintained minimum clearances of 25 ft to all power lines. If equipment or machinery operates within 25 ft. of energized power lines, one of the following must occur before beginning work.

6.15 First Aid and Medical Check-Up:

- The contractor is responsible for providing first aid and medical treatment for their workmen .
- The contractor is required to provide its own first aid kit conspicuously located in the vicinity of each of his work area, and readily accessible at all times.
- The contractor shall arrange for medical examination of all workmen before their employment and thereafter at periodic intervals. The details of the pre-employment medical checkup and medical checkup to be conducted at periodic intervals.

6.16 HEALTH & HYGIENE

DRINKING WATER

Drinking water shall be provided and maintained at suitable places. It should be accessible to labour and employees with sufficient supply of cold fit for drinking. All water supply or storage shall be away from any latrine drain or other source of pollution. Regular analysis of water (as recommended by client/PMC- once in a quarter) shall be done to ensure its potability.

LATRINES AND URINALS

Latrines shall be provided in every work place.

Where female is employed there shall be a separate latrine for females. Where males are employed there shall be latrine for males. Every latrine shall be so partitioned off as to secure privacy and shall have a proper door and fastenings.

Where workers of both sexes are employed there shall be displayed outside each block of latrine and urinal a notice in the language understood by the majority of the workers. '**For men only**' or '**For women only**'. The latrine and urinal shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.

EATING FACILITIES (IN PLANT CATERING)

Meals shall be provided within a non-metallic container and shall be consumed only in the designated messing area. Proper waste disposal facilities shall be provided. Waste shall be removed immediately from the site after the lunch period and the area kept neat and clean at all times.

GOOD HOUSE KEEPING

Used canisters, trash or other materials shall be collected and removed daily. Flammable materials will be properly stored. Areas will be maintained free of tripping hazards or excess materials.

PROVISION OF REST SHELTER

At every place there shall be provided free of cost four suitable sheds, two for meals and the other two for rest separately.

6.17 OCCUPATIONAL HEALTH

- i) All operations shall be identified that can adversely affect the health of workers and mitigation measures shall be implemented.
- ii) To eliminate radiation hazard, it shall be ensured that Tungsten electrodes used for Gas Tungsten Arc Welding shall not contain Thorium.
- iii) Inhalation of air borne contaminants like silica, asbestos, gases, fumes, etc. shall be avoided by using appropriate respiratory protective devices.
- iv) Improper lifting, carrying, pushing & pulling of heavy loads shall be avoided. Wherever possible, manual handling shall be replaced by mechanical lifting equipments.
- v) Power driven hand-held tools shall be maintained in good working condition to minimize their vibrating effects and personnel using these tools shall be taught how to operate them safely & how to maintain good circulation in hands'.

6.18 SMOKING

The rules in effect at the Work site and contractors corporate guidelines shall determine the project policy towards smoking. Smoking shall be prohibited at all locations designated by "NO SMOKING" signs. The use of matches, other than safety matches or transportation of them into area shall be prohibited.

6.19 SAFETY PROMOTIONAL ACTIVITIES –

AWARENESS PROGRAMS- Safety training, Demos etc. will be given to workers from time to time, at least once in a fortnight, while motivational programs shall be conducted at least once in a month.

DISPLAY BOARDS- Display boards / sign boards & safety posters will be displayed at prominent places in adequate nos. so that worker can adopt safety culture and in language which is understandable to workers.

7.0 EMERGENCY PROCEDURES:

The emergency procedures described in this section have been prepared with the intention for actions to be taken in the event of serious injury, property damage or other catastrophe. Such emergency procedures may include -

- Necessary action to be taken
- Who should be responsible to take those actions?
- The names of all individuals who should be notified
- The location of emergency equipment and supplies

7.1 General Emergency Procedure:

- All emergencies are to be handled by the highest-ranking person present, and to be assisted by whoever may be available.
- The ranking person shall delegate responsibility for making emergency telephone calls.
- Emergency phone numbers are to be displayed at conspicuous location throughout the work place and office.
- The ranking person present shall determine the need for an ambulance or other emergency equipment.

In all emergencies, the RHQ shall be notified immediately by phone, upon completion of any necessary first aid treatment.

7.2 Fire Procedure:

- Make a safe attempt to extinguish the fire.

- Also, immediately notify the fire tender
- Have a site employee meet the fire tender at the site gate to direct them to the location of fire.
- Keep all spectators and non-essential personnel away from the fire.
- If explosives, oil etc materials are involved, immediately evacuate all personnel.

7.3 EMERGENCY PLANNING AND PREPAREDNESS

Procedures to clearly define the action to be taken in the event of an emergency or potential emergency shall be drawn up. The emergency procedures shall be regularly reviewed and updated. All visitors arriving on site shall be instructed on the emergency arrangements prior to being allowed on site. Practice drills for identified emergency situations, including rescue operations shall be undertaken.

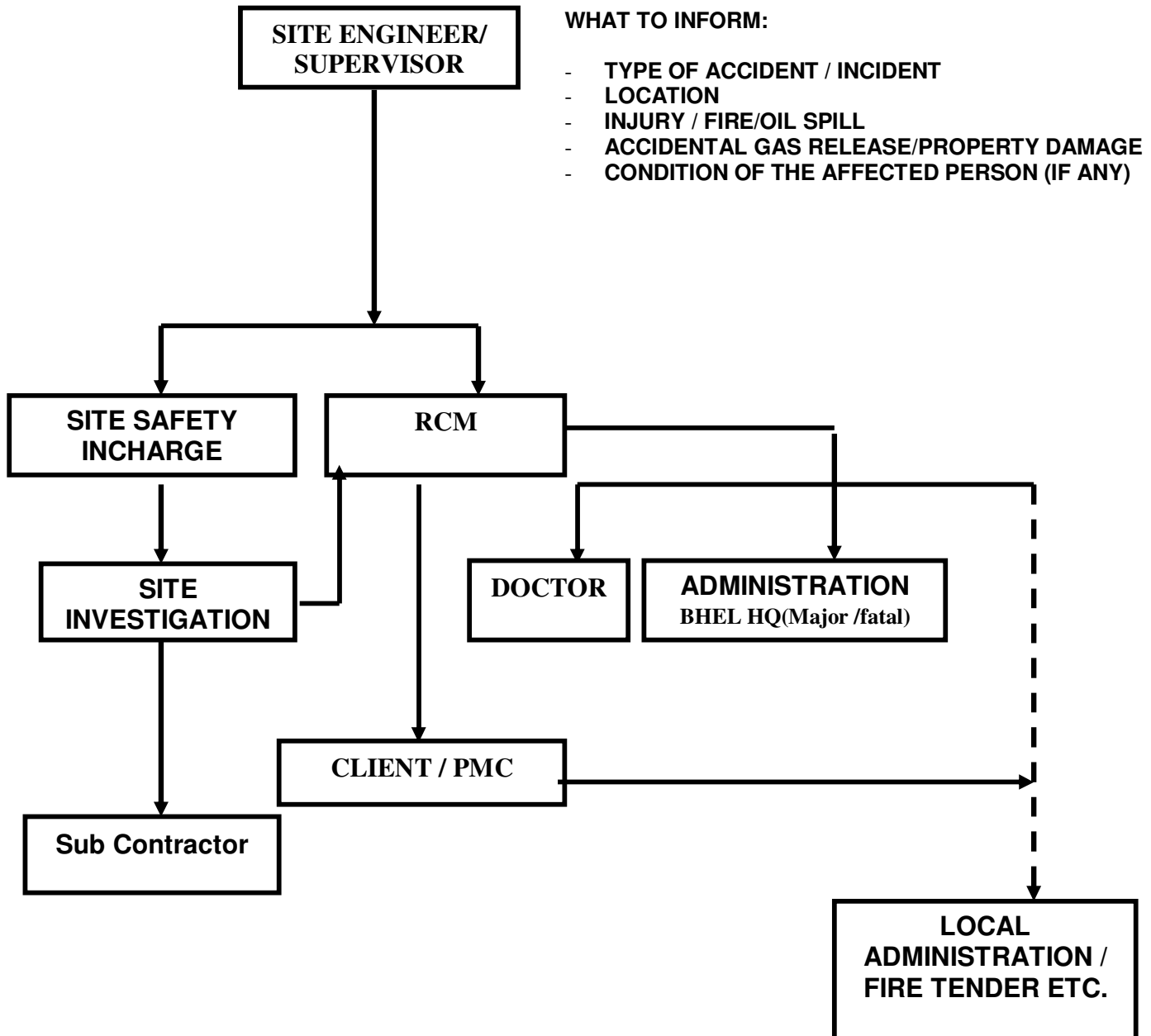
Foreseeable emergencies would include, but not necessarily be limited to:

- Fire,
- Accident
- Gas release
- Natural calamities
- Security alerts.

In order to ensure an adequate response to emergency situations it shall be ensured that an adequate number of suitably trained personnel are appointed who are competent in the use of firefighting equipment and provision of First Aid. Each site office shall produce and implement suitable fire safety plans which shall detail the actions to be taken on discovering fire, as well as the duties of Fire Wardens, evacuation procedures and roll calls.

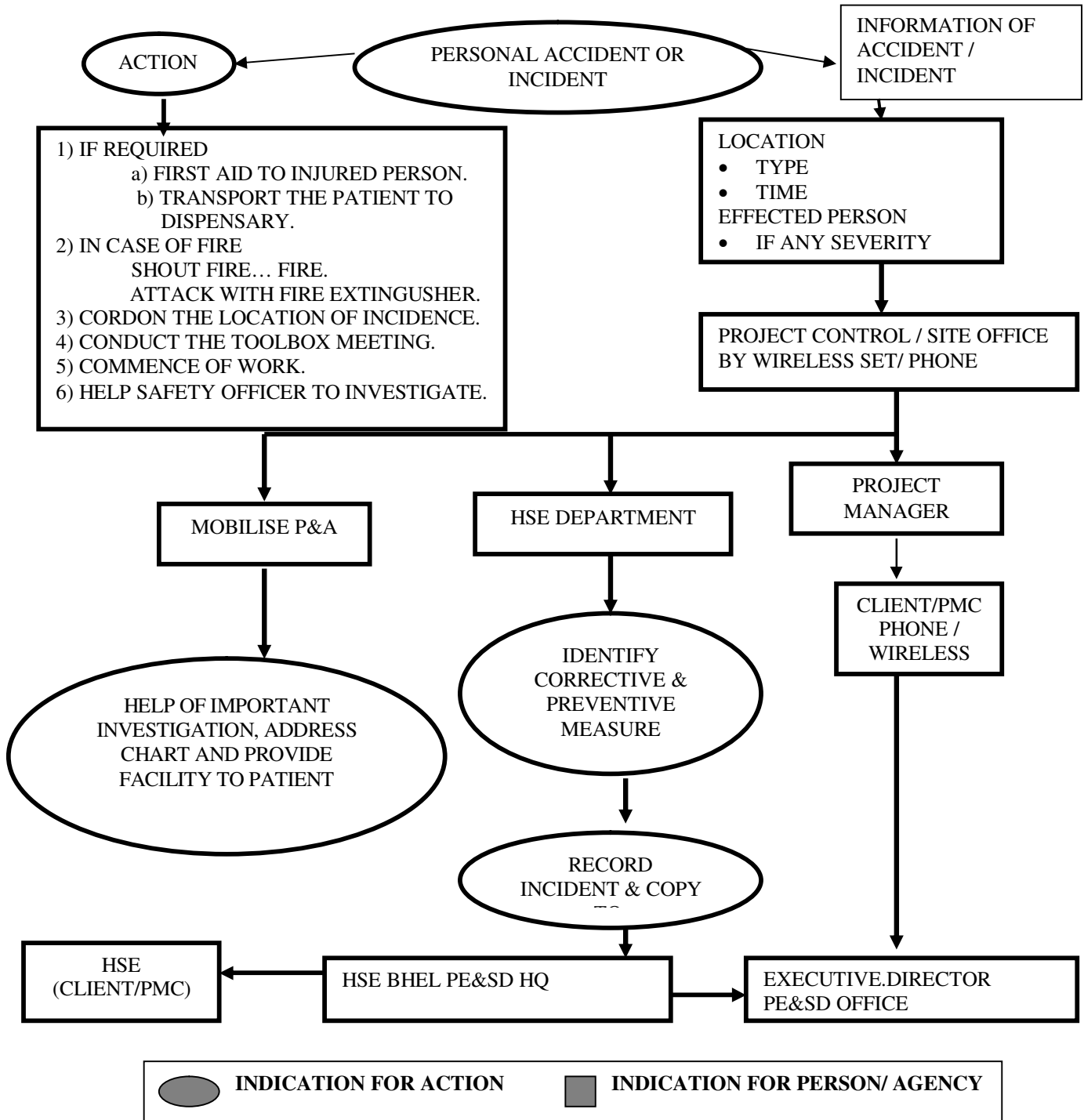
EMERGENCY COMMUNICATION CHANNEL

Emergency communication channel in case of emergency shall be followed as below:



EMERGENCY ACTION PLAN

Detailed action plan as below shall be followed in an event of emergency.



8.0 SECURITY PLAN

8.1 PHYSICAL BARRIERS

Premises such as the office / lay down area shall be enclosed with a physical barrier such as a fence or wall. Entrances shall be provided through which vehicles and personnel shall be controlled.

8.2 ACCESS CONTROL

Access to the project area shall be controlled at the gate provided on the perimeter fence. shall provide security guards to monitor entry of all employees .

8.3 CONTROLLING MOVEMENT OF MATERIALS

The main purpose of security is protecting the assets of any organization from the risks of fire, theft, sabotage and vandalism. Therefore close attention by security shall be given to the movement of materials both in and out of the premises.

Entry of vehicles (Particularly delivery trucks) shall be checked. Delivery notes shall be examined and loads shall be directed to the authorized recipient and where necessary an escort shall be provided. Vehicle entry and exit shall be recorded by security. Hydras shall never be used for transportation of materials at project roads.

Any materials to be removed from the area shall be the subject of a material movement gate pass. Security shall examine such materials against the material movement gate pass and if in order shall allow it to proceed by countersigning the pass with his signature, date and time. A copy of such pass shall be maintained by security.

9. HSE Induction Training:

BHEL will provide training to workmen in safe work practices. All new workmen employed by its sub contractors shall have to undergo job induction training. The workers shall be permitted to work at the construction sites only on successful completion of training.

9.1 Training and competence:

BHEL shall also arrange periodic training programs for the benefits of workers.

10. Site safety committee:

Safety Committee will be formed with BHEL site in-charge as chairman and Safety in-charge as Secretary. All BHEL site functional heads at site & site in-charge of contractors shall be members of the committee. Wherever possible the customer representative may be invited to participate in the deliberations of the committee.

11. Work at height:

For doing work at height all the safety measures will be followed and safety training will be given from time to time. Scaffoldings will be provided at height so that worker can do their work safely.

12. Lifting Operations:

All the lifting materials are lifted by cranes and all the cranes are inspected from time to time. As well as safety measures will be followed. All tools tackles, lifting appliances; material-handling equipment etc used by the contractor shall be of safe design and construction. These shall be tested and certificates of fitness will be obtained before deploying at site.

13. Radiation Safety:

At the site where radiation testing is going to happen will be done by only authorized persons . All safety related equipment will be provided to them and that area will be vacated so that no worker come in contact of radiation .

14. Painting /Grit Blasting:

Painting and grit blasting will be done in separate area that will be cordoned off to ensure a healthy working environment around the place. All safety measures will be followed during painting/grit blasting.

15. RISK ASSESSMENT:

15.1 Hazard

Risk assessment is the systematic identification of the hazards associated with construction work and the evaluation of the risks associated with those hazards. A hazard - risk assessment must take account of all the work activities and consideration must also be given to anyone else who could be affected by the work activities.

15.2 HAZARD OBSERVATION AREAS

All Health, Safety & Environmental hazards that may be present during the Contractor’s construction activities include:

| SAFETY | HEALTH | ENVIRONMENTAL |
|---|--|---|
| <ul style="list-style-type: none"> • Fire • Toxic gas • Falling from height • Dropped objects/materials Handling. • Excavation collapse • Incorrect use of tools • Unsafe driving of vehicles leading accident • Failure of lifting gear (in case of any lifting operation) | <ul style="list-style-type: none"> • Catering problems • Water problems • Animal / Insect Bites, etc. • Hygiene • Sanitation • Noise • Sickness • Others | <ul style="list-style-type: none"> • Oil Spills • Atmospheric Emissions • Waste disposal • Hazardous and toxic waste disposal • Others |

| | | |
|--|--|--|
| <ul style="list-style-type: none"> • Accident due to equipment • Scaffolding | | |
|--|--|--|

Hazard identification shall be conducted prior to commencement of construction for the reduction of potential major hazards and the preparation of procedures. The objective being to ensure the risk associated with construction is as low as reasonably practicable.

15.3 Risk Assessment

Risk assessment analysis process will identify certain activities for which safe systems of work are required to ensure that the activities are properly controlled and executed safely and without risk to health and the environment.

All such safe systems of work will clearly identify the objective, the sequence of operations, foreseeable hazards, precautionary and protective measures required and will be easily understood by the personnel who are to supervise and carry out the work.

15.4 HAZARD CONTROL

For each identified hazard work supervisor must stipulate the systems to prevent the hazard and minimize the consequences. These shall include:


- Maintenance of equipment
- Inspection of equipment
- Personnel protective equipment
- Fire and gas detection and firefighting equipment
- Scaffolding
- Excavation support
- Competence and training of personnel
- Inspection of facilities, catering, accommodation etc
- Local doctor with appropriate medical supplies
- Emergency plans and procedures
- Oil spill clean up
- Hazardous and toxic waste management
- Regular audits

16. HSE Audit:

Periodic Health Safety and Environment audit shall be conducted at site as per client requirement.

17. Formats

The formats for various Work Permit Form, check lists, Trainings, Tool Box Meetings, etc. will be finalized as per RUPPL/BECHTEL's requirement at the time of execution of the work.

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|  Proj Engg & Systems Divn | 4x93.1MW STGs for HMD + 3x90.3MW STGs for DMD | Material Management |
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Annexure-10

Material Management

i. Material Deliveries

List of deliverables will be made at the beginning of the project and before commencement of deliveries from various manufacturing units/vendor shops. This list will be up dated depending on the revision in project requirement/Engineering inputs/product changes.

All efforts will be made to ensure sequential dispatch of material to match with the project/erection schedule. Dispatch of various materials will be made so as to supply them in the sequence of erection.

ii. Material Receipt

On receipt of materials, material Identification shall be carried out using any of the following documents as applicable:


- Railway Receipt (RR)/Lorry Way Bill (LWB)/ other similar document.
- Material Loading Advice.
- Packing Slip/ List.
- Shipping List/ Completion Schedule
- Purchase Order
- Drawings or any other relevant documents.

Inspection shall be carried out to verify physical condition and quantity of packings/ items in line with documents referred as above. In case of any apparent physical damage or quantity shortage of packings/ items, it shall be recorded on RR/LR & intimated to originator.

Details of material shall be entered in Day Book along with Date of receipt and source of supply.

All materials received shall be inspected at the earliest to verify physical condition/correctness of material and quantity in line with above documents.

In case of any discrepancy (e.g. short supply/ excess supply/ wrong supply/ damage of material) observed during receipt inspection, Site in charge or his nominee shall raise Material Discrepancy Report (MDR) in format on concerned agencies supplying the material.

| | | |
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MDR NUMBERING SCHEME:

XXX: XX: X: XXXX: Running Serial

XXX : Site Code

XX : MU Code (MU codes are as per SP-10)

X : Set No.

e.g. UKT: TP: 6: 0001 for Ukai site, Trichy Unit, Ukai TPS Unit-6, 1st MDR

All kinds insurance for materials damages during transit, storage, erection and commissioning is in the scope of RUPPL. To facilitate RUPPL/BECHTEL settle insurance claims for damages to the materials occurred during transit, storage, erection and commissioning, BHEL will inform them at the earliest after any damages to the materials is noticed.

Non conformity observed on materials shall be recorded in Day Book/ Stock Register and such materials shall be suitably identified to ensure that nonconforming materials are not used till cleared for use.

Non-conforming materials not usable shall be identified and stored separately in areas earmarked for such purpose.

Issue of materials for erection and commissioning shall be against authorized Requisition cum Issue Voucher. Material Identification and Traceability shall be maintained.

iii. Material Storage

Storage and preservation of materials shall be done in closed, semi closed and open storage areas as per guidelines issued by Engineering Centre or given in respective equipment manuals. Heavy Equipment's, viz. Turbine, Generator, Condenser, Stator and other such items as suggested by Engineering Center will be directly unloaded either on respective foundations or near to their installation site to suit project schedule, duplicity of storage space, risks, etc

iv. Fabrication and Laydown area

Fabrication area as marked in the attached plan will be developed wherein all kinds of piping, structural and other fabrication will be carried out. While majority of fabrication works will be done in this area, certain unavoidable fabrication works will also be done at works spot.

v. Staging area of construction and equipment

As per drawing no. 0-381-01-01529/530 Sheet 03, STG hall layout at 13.0 M level for Hazira and Dahej, common laydown and maintenance bay is earmarked between grid A to B. The same shall be used for steam turbine laydown.