

Hazop study Number: DHDS-2 Node : DHDS-2 H2S and H2 Cold separator to Recycle Gas Compressor.

P and I Dwg. No. : Dwg\_asjhbj1256445-fdr6

Description of design intention: DHDS-2: To Recycle un-reacted H2S and Maintain System Pr.

Existing controls:

Units:

Control Range:

| HAZOP GUIDE WORD     | LIKELY DEVIATION                    | LIKELY CAUSES   | LIKELY CONSEQUENCES                       | PRESENT CONTROLS & THEIR LIMITATIONS  | RECOMMENDATION FOR BETTER HAZARD CONTROL |
|----------------------|-------------------------------------|-----------------|---|---|--|
| (1) NO (NOT OR NONE) | No/less pressure                    | Mug Compr fails | System Pr. Diminished-> Reaction affected | Stand by Mug manually started within 10 to 15 mins. Else shut down.Pressure AL, ALL Exist | None.                                    |
| RISK LEVEL:          | Risk level: NO DAMAGE and NO CHANCE |                 | Category                                  | Operability.  | SIL/LOP: <b>N.A.</b>                     |
| Action by:           | None.                               |                 |   |   |  |

Hazop study Number: DHDS-1 Node : DHDS-1: Sauer Diesel AVU-1 or OMS Tank to Catalytic Reactor

P and I Dwg. No. : Dwg\_asjhbj1256445-fdr6

Description of design intention: DHDS-1: Remove sulphur

Existing controls:

Units:

Control Range:

| HAZOP GUIDE WORD     | LIKELY DEVIATION                         | LIKELY CAUSES  | LIKELY CONSEQUENCES             | PRESENT CONTROLS & THEIR LIMITATIONS                              | RECOMMENDATION FOR BETTER HAZARD CONTROL |
|----------------------|--|--|---------------------------------|---|--|
| (1) NO (NOT OR NONE) | No/ less feed                            | Feed pump trip, Fail Open CV-FC-105 Fails or Stuck Mid way.No or less Fuel gas | Interlock with Furnace to Trip. | AL, ALL at 52 m3 Hr.By pass operated till FC Replaced.FSSS Exists | Provide flow Transmitter and Indicator.  |
| RISK LEVEL:          | Risk level: MEDIUM DAMAGE and LOW CHANCE |  | Category                        | None.   | SIL/LOP: <b>1</b>                        |
| Action by:           | None.                                    |  |                                 |   |  |

|             |                                     |          |   |   |                      |
|-------------|-------------------------------------|----------|---|---|----------------------|
| (2) MORE OF | More feed                           | FC fails | Pump Rpm Rises-> Pump trip-> Plant stops. | AH, AHH existBypass operated till FC replaced | None.                |
| RISK LEVEL: | Risk level: NO DAMAGE and NO CHANCE |          | Category                                  | Operability.                                  | SIL/LOP: <b>N.A.</b> |
| Action by:  | None.                               |          |   |   |                      |

|             |  |      |          |              |                   |
|-------------|--|------|----------|--------------|-------------------|
| (5) PART OF | N.A.   | N.A. | N.A.     | None.        | None.             |
| RISK LEVEL: | Risk level: HIGH DAMAGE and MEDIUM HIGH CHANCE |      | Category | Operability. | SIL/LOP: <b>3</b> |
| Action by:  | None.  |      |          |              |                   |

Hazop study Number: DHDS-3 Node : DHDS-3: Treated Diesel to Stripper

P and I Dwg. No. : Dwg\_asjhbj1256445-fdr6

Description of design intention: DHDS-3: To recover dissolved H2S.

Existing controls:

Units:

Control Range:

| HAZOP GUIDE WORD  | LIKELY DEVIATION            | LIKELY CAUSES                             | LIKELY CONSEQUENCES  | PRESENT CONTROLS & THEIR LIMITATIONS | RECOMMENDATION FOR BETTER HAZARD CONTROL |
|---|-----------------------------|---|--|--------------------------------------|--|
| (1) NO (NOT OR NONE)  | No/Less Steam               | Steam Fails<br>FC-503 Fails/Stuck Mid way | Fail Open<br>Stripper stops<br>By interlock<br>Manually<br>Stripper to be stopped<br>Reduce through put to stop increase in level of VV103 | None.<br>By pass provided            | None.                                    |
| RISK LEVEL: Risk level: MEDIUM DAMAGE and LOW CHANCE      Category: None.      SIL/LOP: 1 |                             |   |  |                                      |  |
| Action by:  |                             |   |  |                                      |  |
| (2) MORE OF   | Steam controller stuck open | More Steam                                | Stripper to Temp Rise-> Diesel gets evaporated reducing Diesel Yield.  | Steam is by FC-701 with Bypass       | NA                                       |
| RISK LEVEL: Risk level: LOW DAMAGE and LOW CHANCE      Category: None.      SIL/LOP: 1    |                             |   |  |                                      |  |
| Action by: None.  |                             |   |  |                                      |  |

Hazop study Number: DHDS-4      Node : DEHDS-4: H2S Hazard

P and I Dwg. No. : Dwg\_asjhbj1256445-fdr6

Description of design intention: DHDS-4: Detection and Protection of Employees

Existing controls:

Units:

Control Range:

| HAZOP GUIDE WORD | LIKELY DEVIATION       | LIKELY CAUSES                   | LIKELY CONSEQUENCES   | PRESENT CONTROLS & THEIR LIMITATIONS  | RECOMMENDATION FOR BETTER HAZARD CONTROL   |
|------------------|------------------------|---------------------------------|---|---|--|
| (2) MORE OF      | Diffusion from flanges | Normally Diffusion from flanges | Detectors cannot detect as H2S diffused gets diluted below detection level of Detectors | Detectors in Field at different locations and shift wise hand held detectors use d to detect leaks..Normally Average H2S level in the Field remains Below detection limit 10 ppm alarm. | 1. To detect even minutest Traces of H2S diffusions from Flanges it is Recommended to Use Lead Chromate fine Powder dispersed in Epoxy Resin and Copper or MS-Wire dipped and dried and this wire wound round Each Flange carrying H2S and Tied up. Even minutest undetectable amount of H2S diffusion turns Yellow Lead Chromate in to Black Lead Sulphide. Then you can remove the Lead chromate Lead Chromate wire Get the flange Sealed.<br>2. Also use a Lead Acetate Paper strip pinned on to all employees working in H2S area. There will be |

some brownish colour developed and Lab. Should calibrate the Colour to assess the amount of H2S Exposure.  
 3. Rotate Persons every 3-Years or earlier as feasible.

RISK LEVEL: Risk level: LOW DAMAGE and MEDIUM CHANCE

Category None.

SIL/LOP: 1

Action by: None.

| HAZOP team: Name, Designation, Department           | SIL | Generalized View                                     |
|---|-----|--|
| 1. Dr. Ram S Hamsagar, Chairperson                  | 4   | Potential for fatalities in the community            |
| 2. Sunil Hamsagar Software operation and simulation | 3   | Potential for multiple fatalities                    |
| 3. Panel Operators                                  | 2   | Potential for major serious injuries or one fatality |
|   | 1   | Potential for minor injuries                         |

Hazop study Number: DHDS-1

Node : DHDS-1: Sauer Diesel AVU-1 or OMS Tank to Catalytic Reactor

P and I Dwg. No. : Dwg\_asjhbj1256445-fdr6

Description of design intention: DHDS-1: Remove sulphur

Existing controls:

Units:

Control Range:

| HAZOP GUIDE WORD     | LIKELY DEVIATION | LIKELY CAUSES  | LIKELY CONSEQUENCES             | PRESENT CONTROLS & THEIR LIMITATIONS                              | RECOMMENDATION FOR BETTER HAZARD CONTROL |
|----------------------|------------------|--|---------------------------------|---|--|
| (1) NO (NOT OR NONE) | No/ less feed    | Feed pump trip, Fail Open CV-FC-105 Fails or Stuck Mid way.No or less Fuel gas | Interlock with Furnace to Trip. | AL, ALL at 52 m3 Hr.By pass operated till FC Replaced.FSSS Exists | Provide flow Transmitter and Indicator.  |

RISK LEVEL: Risk level: MEDIUM DAMAGE and LOW CHANCE

Category None.

SIL/LOP: 1

Action by: None.

Hazop study Number: DHDS-4

Node : DEHDS-4: H2S Hazard

P and I Dwg. No. : Dwg\_asjhbj1256445-fdr6

Description of design intention: DHDS-4: Detection and Protection of Employees

Existing controls:

Units:

Control Range:

| HAZOP GUIDE WORD | LIKELY DEVIATION       | LIKELY CAUSES                   | LIKELY CONSEQUENCES   | PRESENT CONTROLS & THEIR LIMITATIONS  | RECOMMENDATION FOR BETTER HAZARD CONTROL   |
|------------------|------------------------|---------------------------------|---|---|--|
| (2) MORE OF      | Diffusion from flanges | Normally Diffusion from flanges | Detectors cannot detect as H2S diffused gets diluted below detection level of Detectors | Detectors in Field at different locations and shift wise hand held detectors use d to detect leaks..Normally Average H2S level in the Field remains Below detection limit 10 ppm alarm. | 1. To detect even minutest Traces of H2S diffusions from Flanges it is Recommended to Use Lead Chromate fine Powder dispersed in Epoxy Resin and Copper or MS-Wire dipped and dried and this wire wound round Each Flange carrying H2S and Tied up. Even minutest undetectable amount of H2S diffusion turns Yellow Lead Chromate in to Black Lead Sulphide. Then you can remove the Lead chromate Lead Chromate wire Get the flange Sealed.<br>2. Also use a Lead Acetate Paper strip pinned on to all employees working in H2S area. There will be |

some brownish colour developed and Lab. Should calibrate the Colour to assess the amount of H2S Exposure.  
3. Rotate Persons every 3-Years or earlier as feasible.

RISK LEVEL: Risk level: LOW DAMAGE and MEDIUM CHANCE Category None. SIL/LOP: 1  
Action by: None.

| HAZOP team: Name, Designation, Department           | SIL | Generalized View                                     |
|---|-----|--|
| 1. Dr. Ram S Hamsagar, Chairperson                  | 4   | Potential for fatalities in the community            |
| 2. Sunil Hamsagar Software operation and simulation | 3   | Potential for multiple fatalities                    |
| 3. Panel Operators                                  | 2   | Potential for major serious injuries or one fatality |
|   | 1   | Potential for minor injuries                         |

| Risk Levels for HAZOP                          | Count | Risk Levels for HAZOP | SIL/LOP: |
|--|-------|-----------------------|----------|
| Risk level: HIGH DAMAGE and MEDIUM HIGH CHANCE | 1     | Very Highly Critical  | 3        |
| Risk level: LOW DAMAGE and LOW CHANCE          | 1     | Medium Low Critical   | 1        |
| Risk level: LOW DAMAGE and MEDIUM CHANCE       | 1     | Medium Critical       | 1        |
| Risk level: MEDIUM DAMAGE and LOW CHANCE       | 2     | Medium Critical       | 1        |
| Risk level: NO DAMAGE and NO CHANCE            | 2     | Safe                  | N.A.     |

| HAZOP team: Name, Designation, Department           | SIL | Generalized View                                     |
|---|-----|--|
| 1. Dr. Ram S Hamsagar, Chairperson                  | 4   | Potential for fatalities in the community            |
| 2. Sunil Hamsagar Software operation and simulation | 3   | Potential for multiple fatalities                    |
| 3. Panel Operators                                  | 2   | Potential for major serious injuries or one fatality |
|   | 1   | Potential for minor injuries                         |

Hazop study Number: DHDS-1 Node : DHDS-1: Sauer Diesel AVU-1 or OMS Tank to Catalytic Reactor  
P and I Dwg. No. : Dwg\_asjhbj1256445-fdr6

**RECOMMENDATION FOR BETTER HAZARD CONTROL**

Provide flow Transmitter and Indicator. Action Date 12/01/2015 Action Taken YES  
Action By: None.

Hazop study Number: DHDS-4 Node : DEHDS-4: H2S Hazard  
P and I Dwg. No. : Dwg\_asjhbj1256445-fdr6

**RECOMMENDATION FOR BETTER HAZARD CONTROL**

1. To detect even minutest Traces of H2S diffusions from Flanges it is Recommended to Use Lead Chromate fine Powder dispersed in Epoxy Resin and Copper or MS-Wire dipped and dried and this wire wound round Each Flange carrying H2S and Tied up. Even minutest undetectable amount of H2S diffusion turns Yellow Lead Chromate in to Black Lead Sulphide. Then you can remove the Lead chromate Lead Chromate wire Get the flange Sealed.  
2. Also use a Lead Acetate Paper strip pinned on to all employees working in H2S area. There will be some brownish colour developed and Lab. Should calibrate the Colour to assess the amount of H2S Exposure.  
3. Rotate Persons every 3-Years or earlier as feasible.

Action Date Action Taken NO  
Action By: None.

**HAZOP team: Name, Designation, Department**

1. Dr. Ram S Hamsagar, Chairperson
2. Sunil Hamsagar Software operation and simulation
3. Panel Operators

Hazop study Number: DHDS-4

Node : DEHDS-4: H2S Hazard

P and I Dwg. No. : Dwg\_asjhb1256445-fdr6

**RECOMMENDATION FOR BETTER HAZARD CONTROL**

1. To detect even minutest Traces of H2S diffusions from Flanges it is Recommended to Use Lead Chromate fine Powder dispersed in Epoxy Resin and Copper or MS-Wire dipped and dried and this wire wound round Each Flange carrying H2S and Tied up. Even minutest undetectable amount of H2S diffusion turns Yellow Lead Chromate in to Black Lead Sulphide. Then you can remove the Lead chromate Lead Chromate wire Get the flange Sealed.
2. Also use a Lead Acetate Paper strip pinned on to all employees working in H2S area. There will be some brownish colour developed and Lab. Should calibrate the Colour to assess the amount of H2S Exposure.
3. Rotate Persons every 3-Years or earlier as feasible.

Hazop study Number: DHDS-1

Node : DHDS-1: Sauer Diesel AVU-1 or OMS Tank to Catalytic Reactor

P and I Dwg. No. : Dwg\_asjhb1256445-fdr6

**RECOMMENDATION FOR BETTER HAZARD CONTROL**

Provide flow Transmitter and Indicator.

**HAZOP team: Name, Designation, Department**

1. Dr. Ram S Hamsagar, Chairperson
2. Sunil Hamsagar Software operation and simulation
3. Panel Operators



**HAMS-GPS : RBI (Risk Based Investigation) Matrix**

For ABC Co.

[Licensed to : HAMSAGARS]

| Chance levels -----> |       |       |       |      | Total | %     |
|----------------------|-------|-------|-------|------|-------|-------|
|                      | 0     | 0     | 0     | 0    | 0     | 0.00  |
|                      | 0     | 0     | 0     | 0    | 1     | 14.29 |
|                      | 0     | 1     | 0     | 0    | 1     | 14.29 |
|                      | 0     | 1     | 2     | 0    | 3     | 42.86 |
|                      | 2     | 0     | 0     | 0    | 2     | 28.57 |
| <b>Total</b>         | 2     | 2     | 2     | 0    | 1     | 7     |
| <b>%</b>             | 28.57 | 28.57 | 28.57 | 0.00 | 14.29 | 100   |

| Risk Levels        | Total | %     |
|--------------------|-------|-------|
| <b>HIGH</b>        | 1     | 14.29 |
| <b>MEDIUM HIGH</b> | 0     | 0.00  |
| <b>MEDIUM</b>      | 2     | 28.57 |
| <b>Low</b>         | 2     | 28.57 |
| <b>SAFE</b>        | 2     | 28.57 |
| <b>Total</b>       | 7     | 100   |

**Applications of RBI-Risk Matrix: Following are the applications of an RBI-Risk matrix**

1. As an indicator of the risk level of the installation,
2. To establish risk mitigation measures and evaluate their effects
3. To compare units and processes on the basis of risk,
4. To develop trends of risk development of a unit over time and during its life cycle.

Number of Risk (Damage-Consequence) level areas.

**Number of Risk (Damage-Consequence) level areas**

| Nodes   | HIGH     | MEDIUM HIGH | MEDIUM   | LOW      | SAFE     |
|---|----------|-------------|----------|----------|----------|
| DHDS-1: Sauer Diesel AVU-1 or OMS Tank to Catalytic | 1        | 0           | 1        | 0        | 1        |
| DHDS-2 H2S and H2 Cold separator to Recycle Gas     | 0        | 0           | 0        | 0        | 1        |
| DHDS-3: Treated Diesel to Stripper                  | 0        | 0           | 1        | 1        | 0        |
| DEHDS-4: H2S Hazard                                 | 0        | 0           | 0        | 1        | 0        |
| <b>TOTAL</b>  | <b>1</b> | <b>0</b>    | <b>2</b> | <b>2</b> | <b>2</b> |

**Applications of RBI-Risk Matrix: Following are the applications of an RBI-Risk matrix**

1. As an indicator of the risk level of the installation.
2. To establish risk mitigation measures and evaluate their effects.
3. To compare units and processes on the basis of risk
4. To develop trends of risk development of a unit over time and during its life cycle.

|                    |   |         |   |   |         |
|--------------------|---|---------|---|---|---------|
| <b>SAFE</b>        | 2 | x 100 / | 7 | = | 28.57 % |
| <b>LOW</b>         | 2 | x 100 / | 7 | = | 28.57 % |
| <b>MEDIUM</b>      | 2 | x 100 / | 7 | = | 28.57 % |
| <b>MEDIUM HIGH</b> | 0 | x 100 / | 7 | = | 0.00 %  |
| <b>HIGH</b>        | 1 | x 100 / | 7 | = | 14.29 % |