Full report where all guidewords used.

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:	N.A.	N.A.	N.A.	N.A.	N.A.
Units:	N.A.	N.A.	N.A.	N.A.	N.A.
Control Range:	N.A.	N.A.	N.A.	N.A.	N.A.

LIKELY DEVIATION	LIKELY CAUSES	LIKELY CONSEQUENCES	PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL

HAZOP GUIDE WORDS: (1) NO (NOT OR NONE)

N.A.	N.A.	N.A.	None.	None.

Risk level: LOW DAMAGE and MEDIUM CHANCE Category None. SIL/LOP: 1

Action by: None.

HAZOP GUIDE WORDS: (2) MORE OF

N.A.	N.A.	N.A.	None.	None.

Risk level: NO DAMAGE and NO CHANCE Category None. SIL/LOP: N.A.

Action by: None.

HAZOP GUIDE WORDS: (3) LESS OF

1. Less decontamination	1. Decontamination process incomplete	1. Toxic, fire, explosion Hazard to person vessel entry	To be added by user	1. Decontamination to be under direct supervision of senior person

Risk level: NO DAMAGE and NO CHANCE Category None. SIL/LOP: N.A.

Action by: None.

HAZOP GUIDE WORDS: MORE THAN OR AS WELL

N.A.	N.A.	N.A.	None.	None.

Risk level: NO DAMAGE and NO CHANCE Category None. SIL/LOP: N.A.

Action by: None.

HAZOP GUIDE WORDS: (6) REVERSE OF

N.A.	N.A.etrhrethrht	N.A.n	None.jtyjt	None.tyjtj hrh 1

Risk level: NO DAMAGE and NO CHANCE Category None. SIL/LOP: N.A.

Action by: None.

HAZOP GUIDE WORDS: (9) ALL

N.A.	N.A.	N.A.	None.	None.

Risk level: NO DAMAGE and NO CHANCE Category None. SIL/LOP: N.A.

Action by: None.

HAZOP GUIDE WORDS: (13) SAMPLING SYSTEM

				Full report where all guidewords used.
N.A.	N.A.	N.A.	None.	None.

Risk level: NO DAMAGE and NO CHANCE | Category: None. | SIL/LOP: N.A.

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 ABC

Description of design intention: DHDS-1: Sauer Diesel AVU-1 or OMS Tank to Catalytic Reactor

Existing controls:	N.A.	N.A.	N.A.	N.A.	N.A.
Units:	N.A.	N.A.	N.A.	N.A.	N.A.
Control Range:	N.A.	N.A.	N.A.	N.A.	N.A.

LIKELY DEVIATION	LIKELY CAUSES	LIKELY CONSEQUENCES	PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL

HAZOP GUIDE WORDS: (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: LOW DAMAGE and MEDIUM HIGH CHANCE | Category: Engineering | SIL/LOP: 2

Action by: Operation and QC

HAZOP GUIDE WORDS: (2) MORE OF

More feed	FC fails	Pump Rpm Rises-> Pump trip-> Plant stops.	AH, AHH existBypass operated till FC replaced	None.

Risk level: LOW DAMAGE and MEDIUM CHANCE | Category: Communication. | SIL/LOP: 1

Action by: None.

HAZOP GUIDE WORDS: (3) LESS OF

1. low pressure	1. Defective compressor, 2. Trip setting at low pressure	1. Generally no hazard, 2. Batch may be affected	To be added by user	1. Compressor/trip inspection and maintenance

Risk level: NO DAMAGE and NO CHANCE | Category: None. | SIL/LOP: N.A.

Action by: None.

HAZOP GUIDE WORDS: MORE THAN OR AS WELL

1. Less cooling	1. Cooling fluid temperature high	1. Batch may be affected	To be added by user	1. High/Low cooling fluid temperature alarm, 2. Maintenance of cooling system

Risk level: MEDIUM DAMAGE and LOW CHANCE | Category: General. | SIL/LOP: 1

Action by: None.

HAZOP GUIDE WORDS: (5) PART OF

N.A.	N.A.	N.A.	None.	None.

Risk level: NO DAMAGE and NO CHANCE | Category: None. | SIL/LOP: N.A.

Action by:

HAZOP GUIDE WORDS: (13) SAMPLING SYSTEM

1. Liquid spill	1. Sampler error	1. Fire/Explosion /Toxic hazard	To be added by user	1. Training in sampling, Use of PPE

Risk level: MEDIUM DAMAGE and MEDIUM CHANCE | Category: None. | SIL/LOP:

2

Action by: Operation department

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

P and I Dwg. No. : Dwg_asjhbj1256445-fdr6 vfd

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

Existing controls:	N.A.	N.A.	N.A.	N.A.	N.A.
Units:	N.A.	N.A.	N.A.	N.A.	N.A.
Control Range:	N.A.	N.A.	N.A.	N.A.	N.A.

LIKELY DEVIATION	LIKELY CAUSES	LIKELY CONSEQUENCES	PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL
HAZOP GUIDE WORDS:	**(1) NO (NOT OR NONE)**			
No/Less Steam	Steam FailsFail Open FC-503 Fails/Stuck Mid way	Stripper stopsBy interlock Manually Stripper to be stoppedReduce through put to stop increase in level of VV103	None. By pass provided	None.

Risk level: MEDIUM DAMAGE and MEDIUM CHANCE Category None. SIL/LOP: 2

Action by: Operation department

HAZOP GUIDE WORDS:	**(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: 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: DEHDS-4: H2S HazardBatch charging flammable liquid

Existing controls:	N.A.	N.A.	N.A.	N.A.	N.A.
Units:	N.A.	N.A.	N.A.	N.A.	N.A.
Control Range:	N.A.	N.A.	N.A.	N.A.	N.A.

LIKELY DEVIATION	LIKELY CAUSES	LIKELY CONSEQUENCES	PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL
HAZOP GUIDE WORDS:	**(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. 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: LOW DAMAGE and MEDIUM CHANCE		Category	None.	SIL/LOP: 1
Action by:	None.			

HAZOP team: Name, Designation, Department
1. Dr. Ram S Hamsagar, Chairperson 2. Sunil Hamsagar Software operation and simulation 3. Panel Operators 4. Safety officers

SIL	Generalized View
4	Potential for fatalities in the community
3	Potential for multiple fatalities
2	Potential for major serious injuries or one fatality
1	Potential for minor injuries

Only where recommendations appear.

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:	N.A.	N.A.	N.A.	N.A.	N.A.
Units:	N.A.	N.A.	N.A.	N.A.	N.A.
Control Range:	N.A.	N.A.	N.A.	N.A.	N.A.

LIKELY DEVIATION	LIKELY CAUSES	LIKELY CONSEQUENCES	PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL
1. Less decontamination	1. Decontamination process incomplete	1. Toxic, fire, explosion Hazard to person vessel entry	To be added by user	1. Decontamination to be under direct supervision of senior person

HAZOP GUIDE WORD: (3) LESS OF

Risk level: NO DAMAGE and NO CHANCE | Category: None. | SIL/LOP: **N.A.**

Action by: None.

HAZOP GUIDE WORD: (6) REVERSE OF

N.A.	N.A.etrhrethrht	N.A.n	None.jtyjt	None.tyjtj hrh 1

Risk level: NO DAMAGE and NO CHANCE | Category: None. | SIL/LOP: **N.A.**

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 ABC

Description of design intention: DHDS-1: Sauer Diesel AVU-1 or OMS Tank to Catalytic Reactor

Existing controls:	N.A.	N.A.	N.A.	N.A.	N.A.
Units:	N.A.	N.A.	N.A.	N.A.	N.A.
Control Range:	N.A.	N.A.	N.A.	N.A.	N.A.

LIKELY DEVIATION	LIKELY CAUSES	LIKELY CONSEQUENCES	PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL
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.

HAZOP GUIDE WORD: (1) NO (NOT OR NONE)

Risk level: LOW DAMAGE and MEDIUM HIGH CHANCE | Category: Engineering | SIL/LOP: **2**

Action by: Operation and QC

HAZOP GUIDE WORD: (3) LESS OF

1. low pressure	1. Defective compressor, 2. Trip setting at low pressure	1. Generally no hazard, 2. Batch may be affected	To be added by user	1. Compressor/trip inspection and maintenance

Risk level: NO DAMAGE and NO CHANCE | Category: None. | SIL/LOP: **N.A.**

Action by: None.

Only where recommendations appear.

HAZOP GUIDE WORD: **MORE THAN OR AS WELL**

1. Less cooling	1. Cooling fluid temperature high	1. Batch may be affected	To be added by user	1. High/Low cooling fluid temperature alarm, 2. Maintenance of cooling system

Risk level: MEDIUM DAMAGE and LOW CHANCE | Category: General. | SIL/LOP: 1

Action by: None.

HAZOP GUIDE WORD: **(13) SAMPLING SYSTEM**

1. Liquid spill	1. Sampler error	1. Fire/Explosion /Toxic hazard	To be added by user	1. Training in sampling, Use of PPE

Risk level: MEDIUM DAMAGE and MEDIUM CHANCE | Category: None. | SIL/LOP: 2

Action by: Operation department

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

P and I Dwg. No. : Dwg_asjhbj1256445-fdr6

Description of design intention: DEHDS-4: H2S HazardBatch charging flammable liquid

Existing controls:	N.A.	N.A.	N.A.	N.A.	N.A.
Units:	N.A.	N.A.	N.A.	N.A.	N.A.
Control Range:	N.A.	N.A.	N.A.	N.A.	N.A.

LIKELY DEVIATION	LIKELY CAUSES	LIKELY CONSEQUENCES	PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL

HAZOP GUIDE WORD: **(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. 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: LOW DAMAGE and MEDIUM CHANCE | Category: None. | SIL/LOP: 1

Action by: None.

HAZOP team: Name, Designation, Department
1. Dr. Ram S Hamsagar, Chairperson 2. Sunil Hamsagar Software operation and simulation 3. Panel Operators 4. Safety officers

SIL	Generalized View
4	Potential for fatalities in the community
3	Potential for multiple fatalities
2	Potential for major serious injuries or one fatality
1	Potential for minor injuries

LOP / SIL summary.

Risk Levels for HAZOP	Count	Risk Levels for HAZOP	SIL/LOP:
Risk level: LOW DAMAGE and LOW CHANCE	1	Medium Low Critical	1
Risk level: LOW DAMAGE and MEDIUM CHANCE	3	Medium Critical	1
Risk level: LOW DAMAGE and MEDIUM HIGH CHANCE	1	Highly critical	2
Risk level: MEDIUM DAMAGE and LOW CHANCE	1	Medium Critical	1
Risk level: MEDIUM DAMAGE and MEDIUM CHANCE	2	Highly critical	2
Risk level: NO DAMAGE and NO CHANCE	8	Safe	N.A.

HAZOP team: Name, Designation, Department

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

SIL	Generalized View
4	Potential for fatalities in the community
3	Potential for multiple fatalities
2	Potential for major serious injuries or one fatality
1	Potential for minor injuries

Action By Report (Full report).

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 ABC

RECOMMENDATION FOR BETTER HAZARD CONTROL

1. Compressor/trip inspection and maintenance

Action By: None. Action Date Action Taken NO

1. High/Low cooling fluid temperature alarm, 2. Maintenance of cooling system

Action By: None. Action Date 22-Nov-18 Action Taken NO

1. Training in sampling, Use of PPE

Action By: Operation department Action Date 12-Jul-18 Action Taken NO

Provide flow Transmitter and Indicator.

Action By: Operation and QC Action Date 15-Dec-16 Action Taken YES

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

RECOMMENDATION FOR BETTER HAZARD CONTROL

1. Decontamination to be under direct supervision of senior person

Action By: None. Action Date Action Taken NO

None.tyjtj
hrh
1

Action By: None. Action Date 02-May-14 Action Taken YES

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 By: None. Action Date Action Taken NO

HAZOP team: Name, Designation, Department

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

Just Recommendations only.

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.

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 ABC

RECOMMENDATION FOR BETTER HAZARD CONTROL

1. Compressor/trip inspection and maintenance

1. High/Low cooling fluid temperature alarm, 2. Maintenance of cooling system

1. Training in sampling, Use of PPE

Provide flow Transmitter and Indicator.

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

RECOMMENDATION FOR BETTER HAZARD CONTROL

1. Decontamination to be under direct supervision of senior person

None.tyjtj
hrh
1

HAZOP team: Name, Designation, Department

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

Date : Friday, December 21, 2018

HAMS-GPS : RBI (Risk Based Investigation) Matrix

For ABC Co.

[Licensed to : HAMSAGARS]

Severity levels ----------> \ Chance levels ---------->						Total	%
	0	0	0	0	0	0	0.00
	0	1	0	0	0	1	6.25
	0	3	2	0	0	5	31.25
	0	1	1	0	0	2	12.50
	8	0	0	0	0	8	50.00
Total	8	5	3	0	0	16	
%	50.00	31.25	18.75	0.00	0.00		100

Risk Levels	Total	%
HIGH	0	0.00
MEDIUM HIGH	0	0.00
MEDIUM	4	25.00
Low	4	25.00
SAFE	8	50.00
Total	16	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 Reactor	0	0	3	1	2
DHDS-2 H2S and H2 Cold separator to Recycle Gas Compressor.	0	0	0	1	6
DHDS-3: Treated Diesel to Stripper	0	0	1	1	0
DEHDS-4: H2S Hazard	0	0	0	1	0
TOTAL	0	0	4	4	8

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.

SAFE	8	x 100 /	16	=	50.00 %
LOW	4	x 100 /	16	=	25.00 %
MEDIUM	4	x 100 /	16	=	25.00 %
MEDIUM HIGH	0	x 100 /	16	=	0.00 %
HIGH	0	x 100 /	16	=	0.00 %