HAMS-GPS : HAZOP S	-			Da	te : Friday, December 21, 2018
				Full rep	port where all guidewords used.
Hazop study Number: DI	HDS-2	Node :	DHDS-2	H2S and H2 Cold separator	to Recycle Gas Compressor.
P and I Dwg. No. : Dv	vg_asjhbj1256445-fdr6				
Description of design intent	ion: DHDS-2: To Recycle	e un-reacted H2S an	d Maintain S	System Pr.	
Existing controls: N.	A. N.A.	N.A		N.A.	N.A.
Units: N.	A. N.A.	N.A	۱.	N.A.	N.A.
Control Range: N.	A. N.A.	N.A	۱.	N.A.	N.A.
	LIKELY CAUSES			PRESENT CONTROLS & THEIR LIMITATIONS	
HAZOP GUIDE WORDS:	(1) NO (NOT OR NOM	IE)			
N.A.	] [N.A.	N.A.		None.	None.
Risk level: LOW DAMAGE	and MEDIUM CHANCE		Category	None.	SIL/LOP: 1
Action by: None.			Outogoly		
HAZOP GUIDE WORDS:	(2) MORE OF				
N.A.	] [N.A.	N.A.		None.	None.
Risk level: NO DAMAGE a	nd NO CHANCE		Category	None.	SIL/LOP: N.A.
Action by: None.			outogory		N.A.
HAZOP GUIDE WORDS:	(3) LESS OF				
1. Less decontamination	1. Decontamination process incomplete	1. Toxic, fire, expl Hazard to person entry		To be added by user	1. Decontamination to be under direct supervision of senior person
Risk level: NO DAMAGE a	nd NO CHANCE		Category	None.	SIL/LOP: N.A.
Action by: None.					
HAZOP GUIDE WORDS:					
N.A.	] [N.A.	] N.A.		None.	None.
Risk level: NO DAMAGE a	nd 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 a	nd NO CHANCE		Category	None.	SIL/LOP: N.A.
Action by: None.					
HAZOP GUIDE WORDS:			1		
N.A.	N.A.	N.A.		None.	None.
Risk level: NO DAMAGE a	nd NO CHANCE		Category	None.	SIL/LOP: N.A.
Action by: None.					
HAZOP GUIDE WORDS:	(13) SAMPLING SYS	ТЕМ			

Page: 1 of 4

				Full rep	port 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			category		0.2,2011 N.A.
Hazop study Number:	DHDS-1	Node :	DHDS-1	Sauer Diesel AVU-1 or OM	IS Tank to Catalytic Reactor
P and I Dwg. No. :	Dwg_asjhbj1256445-fdr6 ABC				
Description of design inte	ntion: DHDS-1: Sauer Die	sel AVU-1 or OMS Tank	to Catal	ytic Reactor	
Existing controls:	N.A.	N.A.		N.A.	N.A.
-	N.A.	N.A.		N.A.	N.A.
Control Range:	N.A. N.A.	N.A.		N.A.	N.A.
				11	
		LIKELY CONSEQUENC	ES	PRESENT CONTROLS & THEIR LIMITATIONS	
HAZOP GUIDE WORDS	: (1) NO (NOT OR NO				
No/ less feed	Feed pump trip, Fail Open	Interlock with Furnace	e to	AL, ALL at 52 m3 Hr.By	Provide flow Transmitter and
	CV-FC-105 Fails or Stuck Mid way.No or less Fuel gas	Trip.		pass operated till FC Replaced.FSSS Exists	Indicator.
Risk level: LOW DAMAG	E and MEDIUM HIGH CHANC	E (	Category	Engineering	SIL/LOP: 2
Action by: Oper	ration and QC				
HAZOP GUIDE WORDS	: (2) MORE OF				
More feed	FC fails	Pump Rpm Rises-> P trip-> Plant stops.	Pump	AH, AHH existBypass operated till FC replaced	None.
Risk level: I OW DAMAG	E and MEDIUM CHANCE	· · · · ·	Cotogony		SIL/LOP:
Action by: None			Category	ooninanoaton.	SIL/LOP. <b>1</b>
·					
1. low pressure	1. Defective compressor, 2. Trip setting at low pressure	1. Generally no hazar 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 affec	cted	To be added by user	1. High/Low cooling fluid temperature alarm, 2. Maintenance of cooling system
Risk level: MEDIUM DAM	AGE and LOW CHANCE		Category	General.	SIL/LOP: 1
Action by: None	9				
HAZOP GUIDE WORDS	(5) PART OF				
N.A.	N.A.	N.A.		None.	None.
Risk level: NO DAMAGE Action by:	and NO CHANCE		Category	None.	SIL/LOP: N.A.
HAZOP GUIDE WORDS	: (13) SAMPLING SYS	TEM			
1. Liquid spill	1. Sampler error	1. Fire/Explosion /Tox	kic	To be added by user	1. Training in sampling, Use of PPE
	AGE and MEDIUM CHANCE		Catagori	None.	SIL/LOP:
		Page: 2	Category of 4		

			Full rep	oort where all guidewords used.
Action by: Opera	tion department			2
	HDS-3	Node : DHDS-	-3: Treated Diesel to Stripper	
P and I Dwg. No. : Di	wg_asjhbj1256445-fdr6 vfd			
Description of design intent	tion: DHDS-3: To recover	r dissolved H2S.		
Existing controls:	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 CAUSES		PRESENT CONTROLS & THEIR LIMITATIONS	
HAZOP GUIDE WORDS:	(1) NO (NOT OR NOM	NE)		
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.
	AGE and MEDIUM CHANCE	Catego	None.	SIL/LOP: 2
HAZOP GUIDE WORDS:	(2) MORE OF			
Steam controller stuck oper	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	Catego	ry None.	SIL/LOP: 1
Action by: None.				
Hazop study Number: D	HDS-4	Node : DEHD	S-4: H2S Hazard	
P and I Dwg. No. : D	wg_asjhbj1256445-fdr6			
Description of design intent	ion: DEHDS-4: H2S Haz	ardBatch charging flammable I	iquid	
Existing controls:	A. N.A.	N.A.	N.A.	N.A.
Units: N	A. N.A.	N.A.	N.A.	N.A.
Control Range:	.A. N.A.	N.A.	N.A.	N.A.
	LIKELY CAUSES	LIKELY CONSEQUENCES	PRESENT CONTROLS & THEIR LIMITATIONS	
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 leaksNormally 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

Full report where all guidewords used. 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 SIL **Generalized View** 1. Dr. Ram S Hamsagar, Chairperson 4 Potential for fatalities in the community 2. Sunil Hamsagar Software operation and simulation 3. Panel Operators Potential for multiple fatalities 3 4. Safety officers 2 Potential for major serious injuries or one fatality

1

Potential for minor injuries

HAMS-GPS : HAZOP S	tudy for: - ABC Co.					
[Licensed to : HAMSAGARS	Date : Friday, December 21, 201					
	Only where recommendations appear.					
Hazop study Number: DH	IDS-2	Node : DHDS-2	2 H2S and H2 Cold separator	to Recycle Gas Compressor.		
P and I Dwg. No. : Dw	/g_asjhbj1256445-fdr6					
Description of design intention	on: DHDS-2: To Recycle	un-reacted H2S and Maintain	System Pr.			
Existing controls:	A. N.A.	N.A.	N.A.	N.A.		
Units: N.A	A. N.A.	N.A.	N.A.	N.A.		
Control Range: N./	A	N.A.	N.A.	N.A.		
LIKELY DEVIATION	LIKELY CAUSES		PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL		
HAZOP GUIDE WORD:	(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 ar	nd 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		
Risk level: NO DAMAGE ar	nd NO CHANCE	Category	None.	SIL/LOP: N.A.		
Action by: None.			L			
Hazop study Number: DH	IDS-1	Node : DHDS-	1: Sauer Diesel AVU-1 or OMS	S Tank to Catalytic Reactor		
P and I Dwg. No. : Dw	/g_asjhbj1256445-fdr6 ABC					
Description of design intention	on: DHDS-1: Sauer Diese	el AVU-1 or OMS Tank to Cata	lytic Reactor			
Existing controls:	A. N.A.	N.A.	N.A.	N.A.		
Units: N.A	A. N.A.	N.A.	N.A.	N.A.		
Control Range: N./	A. N.A.	N.A.	N.A.	N.A.		
LIKELY DEVIATION			PRESENT CONTROLS & THEIR LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL		
HAZOP GUIDE WORD:	(1) NO (NOT OR NON	IE)				
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: Operati	on 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 ar	nd NO CHANCE	Category	None.	SIL/LOP: N.A.		
Action by: None.		Page: 1 of 3				

HAZOP GUIDE WOR	NORE THA	N OR AS	WELL				
1. Less cooling	1. Cooling fluid temperature hig	h	1. Batch may be a	affected	To be adde		1. High/Low cooling fluid temperature alarm, 2. Maintenance of cooling system
Risk level: MEDIUM DA Action by: No		ANCE		Category		General.	SIL/LOP: 1
HAZOP GUIDE WOR	RD: (13) SAMPL	ING SYS	TEM				
1. Liquid spill	1. Sampler erro	r	1. Fire/Explosion hazard	/Toxic	To be adde	d by user	1. Training in sampling, Use of PPE
Risk level: MEDIUM DA	AMAGE and MEDIUM	CHANCE		Category		None.	SIL/LOP: 2
Action by: Op	eration department						
Hazop study Number:	DHDS-4		Node :	DEHDS	-4: H2S Haz	ard	
P and I Dwg. No. :	Dwg_asjhbj1256445	-fdr6					
Description of design in	tention: DEHDS-	4: H2S Haza	ardBatch charging f	lammable lio	quid		
Existing controls:	N.A.	N.A.	N.A	۸.	N.A	•	N.A.
Units:	N.A.	N.A.	N.A	۸.	N.A		N.A.
Control Range:	N.A.	N.A.	N./	۹.	N.A	۱.	N.A.
		AUSES				T CONTROLS LIMITATIONS	RECOMMENDATION FOR BETTER HAZARD CONTROL
HAZOP GUIDE WOR	RD: (2) MORE O	F					
Diffusion from flanges	Normally Diffus	on from	Detectors cannot H2S diffused gets below detection le Detectors	diluted	wise hand use d to de leaksNorn H2S level i	cations and shift held detectors tect nally Average h the Field slow detection	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
Risk level: LOW DAMA	GE and MEDIUM CH	ANCE		Category		None.	diffusion turns Yellow Lead Chromate in to Black Lead Sulphide. Then you can remove the Lead chromate Lead Chromate wire Get the flange Sealed.

## HAZOP team: Name, Designation, Department

- Dr. Ram S Hamsagar, Chairperson
  Sunil Hamsagar Software operation and simulation
  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

# HAMS-GPS : HAZOP Study for : - ABC Co.

[Licensed to : HAMSAGARS]

Date : Friday, December 21, 2018

LOP / SIL summary.

Risk Levels for HAZOP	Co	ount	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		3	Safe	N.A.	
HAZOP team: Name, Designation, Department	SIL		Generali	ized View	
1. Dr. Ram S Hamsagar, Chairperson 2. Sunil Hamsagar Software operation and simulation	4	Potential for fatalities in the communi			
3. Panel Operators	3	Potential for n		ultiple fatalities	
4. Safety officers	2	P	otential for major serio	us injuries or one fatality	
	1		Potential for	minor injuries	

HAMS-GPS : HAZO	P Study for : - ABC Co.					
[Licensed to : HAMSAG	ARS]				Dat	e : Friday, December 21, 201
						Action By Report (Full report).
Hazop study Number:	DHDS-1	Node :	DHDS	-1: Sauer Die	esel AVU-1 or OM	S Tank to Catalytic Reactor
P and I Dwg. No. :	Dwg_asjhbj1256445-fdr6 ABC					
	RECOMMENDATI	ON FOR BETT	ER HA	ZARD CON	TROL	
1. Compressor/trip insp	pection and maintenance					
Action By: None.		Action Date			Action Taken	NO
1. High/Low cooling flu	id temperature alarm, 2. Maintenance o	of cooling system				
Action By: None.		Action Date		22-Nov-18	Action Taken	NO
1. Training in sampling	, Use of PPE					
Action By: Operation	n department	Action Date		12-Jul-18	Action Taken	NO
Provide flow Transmitte	er and Indicator.					
Action By: Operation	n and QC	Action Date		15-Dec-16	Action Taken	YES
Hazop study Number:	DHDS-2	Node :	DHDS	-2 H2S and ⊦	I2 Cold separator	to Recycle Gas Compressor.
P and I Dwg. No. :	Dwg_asjhbj1256445-fdr6					
	RECOMMENDATI	ON FOR BETTI	ER HA	ZARD CON	TROL	
1. Decontamination to	be under direct supervision of senior pe	erson				
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 :	DEHD	S-4: H2S Haz	zard	
P and I Dwg. No. :	Dwg_asjhbj1256445-fdr6					
RECOMMENDATION FOR BETTER HAZARD CONTROL						
Resin and Copper or M	itest Traces of H2S diffusions from Flar IS-Wire dipped and dried and this wire in turns Yellow Lead Chromate in to Bla	wound round Eac	h Flang	e carrying H2	2S and Tied up. E	ven minutest undetectable
	etate Paper strip pinned on to all empl plour to assess the amount of H2S Exp		H2S are	ea. There will	be some brownis	h colour developed and Lab.
	ry 3-Years or earlier as feasible.					
Action By: None.		Action Date			Action Taken	NO
HAZOP team: N	Name, Designation, Department					
1. Dr. Ram S Hamsaga	r, Chairperson					

Sunil Hamsagar Software operation and simulation
 Panel Operators
 Safety officers

#### HAMS-GPS : HAZOP Study for : - ABC Co.

[Licensed to : HAMSAGARS]

Date : Friday, December 21, 2018

Just Recommendations only.

Hazop study Number: DHDS-4

DEHDS-4: H2S Hazard Node :

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. 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

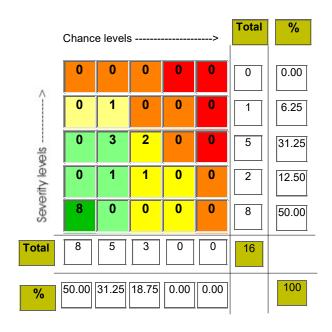
3. Panel Operators

Safety officers

For ABC Co.

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

#### [Licensed to : HAMSAGARS]





1. As an indicator of the risk level of the installation,

To establish risk mitigation measures and evaluate their effects
 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.



## HAMS-GPS : HAZOP Study for : - ABC Co.

### [Licensed to : HAMSAGARS]

Date : Friday, December 21, 2018

Number of Risk (Damage-Consequence) level areas.

Number of Ri	sk (Damage-Consequence) level areas
Nodes	HIGH MEDIUM MEDIUM LOW SAFE
DHDS-1: Sauer Diesel AVU-1 or OMS Tank to Catalytic Reactor	
DHDS-2 H2S and H2 Cold separator to Recycle Gas Compressor.	
DHDS-3: Treated Diesel to Stripper	
DEHDS-4: H2S Hazard	
1	TOTAL 0 4 4 8
Applications of RBI-Risk Matrix: Following are the applications of an RBI-Risk matrix	SAFE      8      x 100 /      16      =      50.00 %
1. As an indicator of the risk level of the installation.	LOW 4 x 100 / 16 = 25.00 %
2. To establish risk mitigation measures and evaluate their effects.	MEDIUM    4 $x \ 100 \ /$ 16    =    25.00 \ \%      MEDIUM HIGH    0 $x \ 100 \ /$ 16    =    0.00 \ \%
3. To compare units and processes on the basis of risk	MEDIUM HIGH    0 $x \ 100 \ /$ 16    =    0.00 \ \%      HIGH    0 $x \ 100 \ /$ 16    =    0.00 \ \%
4 To develop trends of risk development of a unit over time	

4. To develop trends of risk development of a unit over time and during its life cycle.