



JOGI SafeTech Pvt. Ltd.

An ISO 9001:2015 Certified Organization

Report on

**HAZOP STUDY OF
NEW TANK FARM FACILITY**



Prepared for:



M/s. ARTSON ENGINEERING LIMITED, HYDERABAD




Doc. No.: 2018/JSPL/038/HAZOP/050

Rev. No.: 00; 20th Aug, 2018

	HAZOP STUDY REPORT FOR NEW TANK FARM FACILITY			
	Doc. No.:	2018/JSPL/038/HAZOP/050	Rev. No.:	
M/s. Artson Engineering Limited, Hyderabad				

DOCUMENT DETAILS

TITLE	HAZOP Study Report of New Tank Farm Facility	JOGI SafeTech Pvt. Ltd. A-701/702, Shreeji Arcade, B/h. Bhulka Bhavan School, Anand Mahal Road, Adajan, Surat, Gujarat (India) - 395009. Ph.: 0261 - 6451411 Mo.: +91 7405480710 Email: safety@jogisafetech.com Website: www.jogisafetech.com
FOR	ARTSON ENGINEERING LIMITED Ground Floor, Mithona Towers 1-7-80 to 87, Prenderghast Road, Secunderabad, Hyderabad- 500003, Telangana State	
HAZOP SESSION	Date: 13 th Aug, 2018 Place: GMR Conference Room	

DOC. NO.	2018/JSPL/038/HAZOP/050	REVISION NO.	00
DATE OF ISSUE	20 th Aug, 2018	HAZOP CHAIRMAN	Nilesh Jugal
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SUMMARY

M/s. JOGI SafeTech Pvt. Ltd. conducted HAZOP Study of New Tank Farm Facility for M/s. Artson Engineering Limited. The main objective of this study was to systematically identify as many foreseeable hazards and operational concerns as possible. This report presents the findings of the HAZOP study along with the recommendations.

REV.	DATE	STATUS	DESCRIPTION
00	20 th Aug, 2018	Final Report	--
00	18 th Aug, 2018	Draft Report	Issued for comments



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EXECUTIVE SUMMARY:



Introduction: M/s. Artson Engineering Limited, Hyderabad has engaged M/s. JOGI SafeTech Pvt. Ltd. to conduct HAZOP Study of its New Tank Farm Facility. The HAZOP was performed on 13th Aug, 2018 at the site of GMR conference Room, Hyderabad.

Objective: The main objective of this study was to systematically identify as many foreseeable hazards and operational concerns as possible. This report details the findings of HAZOP Study of New Tank Farm Facility of M/s. GMR Hyderabad International Airport Limited, Shamshabad.

HAZOP Recommendations: The findings of the HAZOP Study are the recommendations which has been given for protection against possible hazards. Various recommendations made for the different nodes are represented in the following table.



Table 1: HAZOP Recommendations

Recommendations	Places Used
1. A Pressure Transmitter to be installed in pump discharge line and interlock to be configured to trip the pump in case of cavitations.	Causes: 1.3.1, 1.4.1, 1.4.2, 2.2.1, 2.4.2
2. LEL Detectors with Alarms to be installed in Unloading facility for early detection of leakage and to prevent major fire.(OISD-117)	Causes: 1.7.1
3. Earthing relay Switch to be provided to stop transferring when earthing continuity is broken.(Ref. OISD-RP-110)	Causes: 1.3.1, 1.8.1
4. Interlock to be configured to stop transferring operation (stop all pumps and close MOV in Receiving Tank) if discharge header pressure is LL	Causes: 2.3.1
5. Provision to be made for safe transferring and storage of inventory gathered in dyke due to Spillage/Leakage. Provision of one Redundant Tank to be considered.	Causes: 2.7.1, 2.15.1
6. Need of Flame Arrester in Atmospheric vents to be considered.	Causes: 2.9.1, 2.10.1
7. Provision of Nitrogen blanketing with PVRV and Flame arrester is recommended as per OISD-STD-108.	Causes: 2.11.1, 2.13.1, 2.16.1

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Recommendations	Places Used
8. Adequacy of Existing Lightening Arrester to be evaluated considering operational site/chemicals being handled and applicable statutes and guidelines. As per OISD-STD-180 and IEC 62305.	Causes: 2.12.1
9. Provision of Auto Operated DVs (Deluge Valves) configured with LEL meters inside Dyke to be considered.	Causes: 2.11.1, 2.16.1
10. A schedule of periodic changeover of pump to be prepared for equal distribution of operational load among all available pumps.	Causes: 1.4.2
11. Periodic inspection & replacement of hoses to be done to ensure integrity of unloading hoses.	Causes: 1.7.2
12. SOP to ensure that unloading is started only after ensuring that master switch of pump is turned OFF.	Causes: 1.7.3
13. A practice to dissipate static charge at security gate (at entry) by making arrangement of connecting the tanker with nearby earth pit to be introduced. (Highest static generation is due to turbulence during transit).	Causes: 1.8.1
14. MOVs in filling line, withdrawal line and circulation line to configured for remote operation-from a safe distance from tanks as well as from SCADA.	Causes: 2.15.1
15. Periodic cleaning of peripheral vegetation to be done.	Causes: 2.16.2
16. Peripheral areas to be covered with sand/grit.	Causes: 2.16.2
17. The Operation to be started after PSSR (Pre Start Up Safety Review).	Causes: 3.1.1
18. SOP to be prepared for all activities. SOP to be prepared for all manual activities after conducting HIRA (Hazards Identification & Risk Assessment).	Causes: 3.1.1
19. All Electrical installations to be done considering HAC (Hazardous Area Classification) as per OISD-STD-113.	Causes: 3.1.1
20. On-Site Emergency Plan to be prepared considering worst case scenario as per OISD 168.	Causes: 3.1.1

Recommendations	Places Used
21. Adequacy of existing fire fighting facility to be evaluated considering the upcoming expansion to comply OISD 117.	Causes: 3.1.1
22. P & IDs to be updated as per final scheme.	Causes: 3.1.1
23. Size of existing suction line to be evaluated for adequacy for suction supply to existing and upcoming pumps.	Causes: 3.1.1
24. SIMOPS (Simultaneous Operations) to be prepared to ensure safe fabrication, construction, erection, commissioning and integration /hook-up) of upcoming facilities.	Causes: 3.1.1
25. Site should consider at least TWO assembly points and TWO emergency exits as per OISD 168.	Causes: 3.1.1
26. All underground piping to be provided with Cathodic protection as per OISD (Refer OISD 188).	Causes: 3.1.1
27. Earthing diagrams to be prepared for all upcoming Earth Pits as per IS 3043. Periodic checking of resistance to be conducted.	Causes: 3.1.1
28. First Aid fire fighting equipments to be installed in compliance to PESO guidelines.	Causes: 3.1.1
29. MOC (Management of change) procedure to be followed for any change in facility or process.	Causes: 3.1.1
30. Periodic inspection and calibration to be done for TSVs. Provision to isolate TSVs to be made.	Causes: 3.1.1

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1. INTRODUCTION OF THE COMPANY

M/s. Artson Engineering Limited (AEL) is a majority owned subsidiary of TATA Projects Limited (TPL). Tata Projects is one of India's fastest growing Industrial & Urban Infrastructure companies and owns 75% of paid-up equity shares of AEL. The balance 25% shares are owned by Indian Public. (BSE Stock Code: 522134)

Artson team is well experienced in executing EPC / Construction contracts in Tankages, piping and mechanical Static equipments. AEL has executed many large and prestigious Projects in Oil Refinery Tankages, Piping & Mechanical packages, Chemical, O & G, Refinery Product storage & Distribution Terminals, Cross-country Pipelines and Mechanical equipment construction projects in Metals, Mining, Power etc.



With its ASME U, U2, S, R, NB certified manufacturing facility located in Nasik, Artson is equipped to manufacture high quality/ certified pressure vessels, columns, heat exchangers and other process equipment.

In addition to its Nasik manufacturing facility, AEL has invested in large fabrication yards located in Nagpur, Jamshedpur & Ranchi to cater to Structural steel fabrication and maintenance / erection services for variety of process plants including O&G, Steel and Thermal Power.

AEL is certified with Quality Management System (ISO 9001:2008), Environment Management System (ISO 14001:2004) and BS (OHSAS 18001:2007) for Occupational Health & Safety Management system. We have impeccable safety records at manufacturing units and project sites.

2. DOCUMENT SCOPE

The scope of this document is limited to HAZOP Study carried out for M/s. Artson Engineering Limited of its New Tank Farm Facility at GMR Hyderabad International Airport, Shamshabad.

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3. HAZOP METHODOLOGY

3.1 Purpose

A HAZOP study is a formal systematic procedure used to review the design and operation of a potentially hazardous installation. It is used to identify deviations from normal safe operation, which could lead to hazardous or operability problems and to define any actions necessary to deal with such deviations.

3.2 HAZOP Pre-concessions

Throughout the HAZOP session, the following rules were adopted:

1. No design work / quantitative analysis are to be performed during HAZOP meeting.
2. Equipment is deemed suitable for the specified design conditions.
3. In principle, only single failure results in hazards – no double jeopardy.
4. All process vents, discharge lines from PSVs/PSEs are routed properly and situated at appropriate height which is appropriate to disperse the gases to non-hazardous concentration. Also, the vents are provided with flame arresters if required.
5. Plant is well maintained and operated in accordance with acceptable standards.
6. Failures of instrument gauges were not considered.
7. Mechanical protection devices (PSVs, rupture discs) are expected to work.
8. If there is more than one train/pass, study of one typical node shall be carried out.
9. Single check valve is used unless reverse flow may cause pressure to exceed test pressure.
10. The following items were not considered:
 - Operator's negligence (except common human error)
 - Natural calamity (e.g. flood, earthquake)
 - Objects falling from sky
 - Sabotage
11. The following are deemed as protection / safeguard:
 - Interlock / shutdown system / trip
 - Alarm system for operator action
 - Sample monitoring system
 - Operating instruction and operating manuals
 - SOPs

3.3 Parameter and Guideword

The P & I diagram describe how the plant is intended to operate. A parameter is an aspect of the process that describes it physically, chemically or in terms of its consequences. The intention of each relevant parameter is defined and then operational deviations were discussed by applying one or more guide words along with the governing parameters.



For the cause effect scenario thus emerging, the system was examined to see if adequate protective measures have been provided. If the protection was felt to be inadequate or no- existent, remedial measures were suggested.

The exercise was repeated with all the guide words for the P & ID node under consideration. Sometimes the application of a particular guide word would not yield a conceivable or realistic scenario. Under such a circumstance, the analysis was stopped as no meaningful results would be derived from it.

The results of this synthetic analysis for all the nodes have been tabulated in the HAZOP study worksheets. Each node was systematically and critically examined using a set of guide words and parameters. The guide words are listed below:

Table 2: List of Guidewords and Parameters

Guideword	Parameter
NO	Flow
LESS	Flow, Pressure, Level, Temperature
MORE	Flow, Pressure, Level, Temperature
AS WELL AS	Contamination, Corrosion, Erosion, Service Failure
PART OF	Composition Change
REVERSE	Flow
OTHER	Leakage, Spillage, Quality, Static Electricity

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4. HAZOP SESSION

4.1 Session Details

The HAZOP Session was carried out on 13th Aug, 2018 at the site of GMR Hyderabad International Airport, Limited. The main objective of this HAZOP study was to systematically identify as many foreseeable hazards and operational concerns as possible. At the start of the HAZOP study, the HAZOP chairman briefed the team on the HAZOP process and identified the guidewords to be used.

HAZOP was recorded in full using 'PHA Pro (Version: 6.0)' software. The worksheet was visually projected so that all team members could see the progress of the discussions as they were being recorded by the HAZOP Scribe who was an engineering personnel from M/s. JOGI SafeTech Pvt. Ltd.

4.2 HAZOP Team Members

The team was led by a highly experienced HAZOP chairman who is also a process engineer. The HAZOP team from M/s. Artson Engineering Limited and from M/s. GMR Hyderabad International Airport Limited consisted of a safety engineer, mechanical engineer, maintenance engineer, operation engineer, electrical engineer, and project & design engineer.

Following table list out the names of the members who had participated to impart their technical knowledge to successfully complete this HAZOP study.

Table 3: List of HAZOP Team Members

Sr. No.	Name	Designation
1.	Mr. Nilesh Jugal	HAZOP Chairman
2.	Mr. Vishal Patoliya	HAZOP Scribe
3.	Mr. Madhusudan Rao	GM (Engg.)
4.	Mr. Ashok Yedla	AM - PMT
5.	Mr. Radhakrishnan	GMR- PMT
6.	Mr. Prabhat	Head- Safety
7.	Mr. Joseph Samuel	Tank farm In-charge
8.	Mr. Sudhir Parida	Manager-Safety
9.	Mr. Kirit Dutt	Sr. Safety Engineer

4.3 Nodes and Drawings

The number of nodes identified from the P & ID(s) along with their description which were reviewed during the HAZOP Study are mentioned in the following table.

Also, the list of P & ID(s) / Drawings reviewed during the session is also shown in same table along with the number of the respective P & ID/Drawing.



Table 4: List of Nodes and Drawings

Node No.	Node Description	Drawing No.
1.	Unloading from TT	IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001
2.	Pump Discharge to Storage Tank	IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001
3.	General	IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001



4.4 HAZOP Worksheet

The full HAZOP study is detailed in the HAZOP worksheets given in Annexure - I.

It contains a complete list of the probable causes, their consequences and the necessary available safeguards along with the recommendations, if required.

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ANNEXURE - I (HAZOP WORKSHEET)



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Node: 1. Unloading from TT

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Unloading Bay No. 6/7/8, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
1. High Level (TT)	1.1. No Credible cause (Unloading by gravity)			
2. Low Level(TT)	2.1. No Credible Deviation (Part of normal operation)			
3. High Flow	3.1. High suction pressure (More Draught)	3.1.1. High internal friction leading to generation of static charge	3.1.1.1. Operational vigilance	1. A Pressure Transmitter to be installed in pump discharge line and interlock to be configured to trip the pump in case of cavitations. 3. Earthing relay Switch to be provided to stop transferring when earthing continuity is broken.(Ref. OISD-RP-110)
			3.1.1.2. Personal Vigilance	
		3.1.1.3. Good Earthing practices		
		3.1.2. Damage to pump internals due to cavitations		
		3.1.3. Ingress of ambient air leading to pump cavitations	3.1.3.1. Standby Pump	



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Node: 1. Unloading from TT

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Unloading Bay No. 6/7/8, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
4. Low Flow	4.1. End of Transfer (Normal Operation)	4.1.1. Ingress of ambient air leading to pump cavitations	4.1.1.1. Operational vigilance	1. A Pressure Transmitter to be installed in pump discharge line and interlock to be configured to trip the pump in case of cavitations.
			4.1.1.2. Personal Vigilance	
	4.2. Blockage in the Suction line	4.2.1. Damage to pump internals due to cavitations	4.2.1.1. Operational vigilance	1. A Pressure Transmitter to be installed in pump discharge line and interlock to be configured to trip the pump in case of cavitations.
			4.2.1.2. Personal Vigilance	10. A schedule of periodic changeover of pump to be prepared for equal distribution of operational load among all available pumps.
5. Reverse Flow	5.1. Negative differential Pressure	5.1.1. Overflow from the TT	5.1.1.1. NRV in discharge line	
		5.1.2. Damage to pump internals		



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Node: 1. Unloading from TT

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Unloading Bay No. 6/7/8, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
6. Misdirected Flow	6.1. No Credible cause			
7. Other(Leakage/ Spillage)	7.1. Gaskets/Flanges leakage	7.1.1. Fire and Explosion	7.1.1.1. Personal Vigilance 7.1.1.2. Adequate Fire Fighting facilities have been installed	2. LEL Detectors with Alarms to be installed in Unloading facility for early detection of leakage and to prevent major fire.(OISD-117)
	7.2. Loose Connections/worn out threads	7.2.1. Fire and Explosion	7.2.1.1. Personal Vigilance	11. Periodic inspection & replacement of hoses to be done to ensure integrity of unloading hoses.
	7.3. Maneuvring the Tanker while Unloading Hose is connected	7.3.1. Fire and Explosion	7.3.1.1. Personal Vigilance 7.3.1.2. Wheel Chokes are provided 7.3.1.3. Master switch is turned OFF while unloading	12. SOP to ensure that unloading is started only after ensuring that master switch of pump is turned OFF.



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Node: 1. Unloading from TT

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Unloading Bay No. 6/7/8, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
8. Static Electricity	8.1. Handling of flammable chemicals	8.1.1. Source of ignition (may give rise to fire/ VCE)	8.1.1.1. Earthing and Bonding	3. Earthing relay Switch to be provided to stop transferring when earthing continuity is broken.(Ref. OISD-RP-110)
				13. A practice to dissipate static charge at security gate (at entry) by making arrangement of connecting the tanker with nearby earth pit to be introduced. (Highest static generation is due to turbulence during transit).
9. Contamination	9.1. Under Quality Material	9.1.1. Quality issues	9.1.1.1. QC check	
	9.2. Ingress of foreign material	9.2.1. Damage to pump internals	9.2.1.1. Strainer in pump suction line.	



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Node: 2. Pump Discharge to Storage Tank

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
1. High Pressure	1.1. Blocked Outlet (MOV/NRV/Isolation Valve malfunction)	1.1.1. Wear and Tear Leading to leakage from flange joints	1.1.1.1. MOV feedback is available on SCADA	
			1.1.1.2. PC 9211/ PC 9221	
2. Low Pressure	2.1. No Suction	2.1.1. Cavitation	2.1.1.1. Personal Vigilance	1. A Pressure Transmitter to be installed in pump discharge line and interlock to be configured to trip the pump in case of cavitations.
3. High Flow	3.1. Leakage in downstream	3.1.1. Fire and Explosion	3.1.1.1. Adequate Fire Fighting facilities have been installed	4. Interlock to be configured to stop transferring operation (stop all pumps and close MOV in Receiving Tank) if discharge header pressure is LL
4. Low Flow	4.1. Blocked Outlet (MOV/NRV/Isolation Valve malfunction)	4.1.1. Wear and Tear Leading to leakage from flange joints	4.1.1.1. MOV feedback is available on SCADA	
			4.1.1.2. PC 9211/ PC 9221	



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Node: 2. Pump Discharge to Storage Tank

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
	4.2. No Suction	4.2.1. Cavitation	4.2.1.1. Personal Vigilance	1. A Pressure Transmitter to be installed in pump discharge line and interlock to be configured to trip the pump in case of cavitations.
	4.3. Pump failure	4.3.1. Transferring Delay	4.3.1.1. Standby Pump 4.3.1.2. Alarm on Pump stoppage/failure	
	4.4. Discharge Filter choke	4.4.1. Transferring Delay	4.4.1.1. Differential Pressure is measured 4.4.1.2. Alarm on SCADA on high differential pressure	
5. Reverse Flow	5.1. Negative differential Pressure	5.1.1. Damage to pump internals	5.1.1.1. NRV at both Ends (At pump discharge and near Tank inlet)	



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Node: 2. Pump Discharge to Storage Tank

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
6. Misdirected Flow	6.1. MOV passing	6.1.1. High High Level in Receiving Tank (Unintended)	6.1.1.1. Alarm at High Level	
			6.1.1.2. Interlock to close MOV and stop Pump at High High Level	
			6.1.1.3. Level Switch to stop MOV and Pump at High High Level	
	6.2. Wrong Line Up (Human Error)	6.2.1. High High Level in Receiving Tank (Unintended)	6.2.1.1. Alarm at High Level	
			6.2.1.2. Interlock to close MOV and stop Pump at High High Level	
			6.2.1.3. Level Switch to stop MOV and Pump at High High Level	



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Node: 2. Pump Discharge to Storage Tank

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
7. High Level of Storage	7.1. More Filling	7.1.1. Overflow leading to Spillage/Leakage and consequential Fire/Explosion	7.1.1.1. Alarm at High Level	5. Provision to be made for safe transferring and storage of inventory gathered in dyke due to Spillage/Leakage. Provision of one Redundant Tank to be considered.
			7.1.1.2. Interlock to close MOV and stop Pump at High High Level	
			7.1.1.3. Level Switch to stop MOV and Pump at High High Level	
			7.1.1.4. Dyke of Adequate capacity for secondary containment	
			7.1.1.5. Adequate Fire Fighting facilities have been installed	
8. Low Level of Storage Tank	8.1. Consumption	8.1.1. No adverse effects	8.1.1.1. Low Level switch to close the MOVs in Tank Outlet Lines	



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Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
9. High Pressure in Tank	9.1. Filling Operation	9.1.1. Tank bulging	9.1.1.1. Three Nos. vents	6. Need of Flame Arrester in Atmospheric vents to be considered.
10. Low Pressure in Tank	10.1. Consumption	10.1.1. Tank Implusion	10.1.1.1. Three Nos. vents	6. Need of Flame Arrester in Atmospheric vents to be considered.
11. Other (Internal Fire)	11.1. Formation of Flammable mixture inside the Tank	11.1.1. Fire and Explosion	11.1.1.1. Foam injection Nozzles	7. Provision of Nitrogen blanketing with PVRV and Flame arrester is recommended as per OISD-STD-108.
			11.1.1.2. Sprinkler Rings	9. Provision of Auto Operated DVs (Deluge Valves) configured with LEL meters inside Dyke to be considered.
12. Other (Lightening)	12.1. Natural disaster (specify)	12.1.1. Fire and Explosion	12.1.1.1. Lightening Arrester at Mast	8. Adequacy of Existing Lightening Arrester to be evaluated considering operational



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Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
				site/chemicals being handled and applicable statutes and guidelines. As per OISD-STD-180 and IEC 62305.
13. High Temperature in Tank	13.1. High Ambient Temperature	13.1.1. High Vapour generation	13.1.1.1. No effective safeguard	7. Provision of Nitrogen blanketing with PVRV and Flame arrester is recommended as per OISD-STD-108.
14. Low Temperature in Tank	14.1. No Credible cause			
15. Other (leakage from storage tank)	15.1. Wear and tear	15.1.1. Spillage leading to fire/explosion	15.1.1.1. Dyke of Adequate capacity for secondary containment	14. MOVs in filling line, withdrawal line and circulation line to configured for remote operation-from a safe distance from tanks as well as from SCADA.



	HAZOP STUDY REPORT FOR NEW TANK FARM FACILITY			
	Document No.:	2018/JSPL/038/HAZOP/050	Revision No.:	
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Node: 2. Pump Discharge to Storage Tank

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220

Deviation	Causes	Consequences	Safeguards	Recommendations
				5. Provision to be made for safe transferring and storage of inventory gathered in dyke due to Spillage/Leakage. Provision of one Redundant Tank to be considered.
16. Other (External Fire)	16.1. Fire in nearby tank	16.1.1. Vaporisation of tank contents leading to fire/VCE	16.1.1.1. wire mesh in vents	7. Provision of Nitrogen blanketing with PVRV and Flame arrester is recommended as per OISD-STD-108.
				9. Provision of Auto Operated DVs (Deluge Valves) configured with LEL meters inside Dyke to be considered.
	16.2. Fire in peripheral dry grass/vegetation	16.2.1. Vaporisation of tank contents leading to fire/VCE	16.2.1.1. wire mesh in vents	15. Periodic cleaning of peripheral vegetation to be done.
				16. Peripheral areas to be covered with sand/grit.

	HAZOP STUDY REPORT FOR NEW TANK FARM FACILITY			
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Node: 2. Pump Discharge to Storage Tank

Drawings: IMC/HYD/GMR/GENLAY/01; AEL/2586/A1/PID-001

Equipment ID: Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220



Deviation	Causes	Consequences	Safeguards	Recommendations
17. Other (Quality)	17.1. High water content in fuel	17.1.1. Quality issues	17.1.1.1. SLCV 7032 will close if water content is high	

Node: 3. General

Drawings: AEL/2586/A1/PID-001; IMC/HYD/GMR/GENLAY/01

Equipment ID: Unloading Bay No. 6/7/8, Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220.

Deviation	Causes	Consequences	Safeguards	Recommendations
1.	1.1.			17. The Operation to be started after PSSR (Pre Start Up Safety Review). 18. SOP to be prepared for all activities. SOP to be prepared for all manual activities after conducting HIRA (Hazards Identification & Risk Assessment).



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Node: 3. General

Drawings: AEL/2586/A1/PID-001; IMC/HYD/GMR/GENLAY/01

Equipment ID: Unloading Bay No. 6/7/8, Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220.

Deviation	Causes	Consequences	Safeguards	Recommendations
				19. All Electrical installations to be done considering HAC (Hazardous Area Classification) as per OISD-STD-113.
				20. On-Site Emergency Plan to be prepared considering worst case scenario as per OISD 168.
				21. Adequacy of existing fire fighting facility to be evaluated considering the upcoming expansion to comply OISD 117.
				22. P & IDs to be updated as per final scheme.
				23. Size of existing suction line to be evaluated for adequacy for suction supply to existing and upcoming pumps.



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Node: 3. General

Drawings: AEL/2586/A1/PID-001; IMC/HYD/GMR/GENLAY/01

Equipment ID: Unloading Bay No. 6/7/8, Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220.

Deviation	Causes	Consequences	Safeguards	Recommendations
				<p>24. SIMOPS (Simultaneous Operations) to be prepared to ensure safe fabrication, construction, erection, commissioning and integration /hook-up) of upcoming facilities.</p> <p>25. Site should consider at least TWO assembly points and TWO emergency exits as per OISD 168.</p> <p>26. All underground piping to be provided with Cathodic protection as per OISD (Refer OISD 188).</p> <p>27. Earthing diagrams to be prepared for all upcoming Earth Pits as per IS 3043. Periodic checking of resistance to be conducted.</p>

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Node: 3. General

Drawings: AEL/2586/A1/PID-001; IMC/HYD/GMR/GENLAY/01

Equipment ID: Unloading Bay No. 6/7/8, Tank No. 4, Tank No. 5, Tank No. 6, Pump 9210, Pump 9220.

Deviation	Causes	Consequences	Safeguards	Recommendations
				28. First Aid fire fighting equipments to be installed in compliance to PESO guidelines.
				29. MOC (Management of change) procedure to be followed for any change in facility or process.
				30. Periodic inspection and calibration to be done for TSVs. Provision to isolate TSVs to be made.



**HAZOP STUDY REPORT FOR
NEW TANK FARM FACILITY**





Doc. No.: 2018/JSPL/038/HAZOP/050 Rev. No.: 00

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ANNEXURE - II (ATTENDANCE SHEET)



Doc Title	Attendance Sheet			
Doc No.	JSPL/HAZOP/004/F-03			
Subject	HAZOP Study	Client	GMR & ARTSON Engg. Limtd.	
Date	13/08/2018	Time	12:00 PM.	

Sr.	Name	Designation	Dept.	Contact No.	Email-Id	Sign
1.	JOSEPH SAMUEL	TANK FARM I/c	RELIANCE	9849322255	joseph.samuel@nil.com	
2.	Sudhir Parida	manager-safety	RELIANCE	9949066704	Sudhir.parida@re.com	
3.	Radhakrishnan	GMR-PMT	AHIAL	8978809911	radhakrishnan.ganesan@gmrgroup.in	
4.	Ashok Yedla	P.A.M	PMT	8008863838	ashok.yedla@gmrgroup.in	
5.	PRABHAT	Head-Safety	PMT	9908088622	Prahatkishore@gmrgroup.in	
6.	KIRTI DUTT	Sr. Safety Engr	GIADL	8500896674	kirtidutt.kotpall@gmrgroup.in	
7.	C.SARA BABU	RC 02	ARTSON	9652544255	csbabu@artson.net	
8.	Anirban Chatterjee	Mgr-Safety	Artson	8291288771	anirban.Chatterjee@artson.net	
9.	M Madhusudhan Rao	G.M. Engr	AEL	9948091830	m.madhusudhanrao@artson.net	
10.	Nilesh Jangal	Director	Jogi	9825656499	SAFETY@JOGISAFETECH.COM	
11.						
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REFERENCES:



1. P & ID(s) studied on site before and during the session.
2. Process description studied on site before/during the session.
3. HAZOP Application Guide – BS IEC 61882:2001.

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DISCLAIMER

The consulting services conducted by **JOGI SafeTech Pvt. Ltd.** (the “Company”) were performed using generally accepted guidelines, standards, and/or practices, which the Company considers reliable. Although the Company performed its consulting services pursuant to reliable and generally accepted practices in the industry, the Company does not guarantee or provide any representations or warranties with respect to Client’s use, interpretation or application of the findings, conclusions, and/or suggestions of the consulting services provided by the Company.

Moreover, the findings, conclusions, and the suggestions resulting from the consulting service are based upon certain assumptions, information, documents, and procedures provided by the Customer. As such, in no event and under no circumstance shall the company be liable for special, indirect, punitive or consequential damages of any nature whatsoever, including without limitation, any lost revenue or profits of the customer or its customers, agents and distributors, resulting from, arising out of or in connection with, the services provided by the company. The Customer agrees that the Company shall have no liability for damages, which may result from Client’s use, interpretation or application of the consulting services provided by the Company.

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END OF REPORT



JOGI SafeTech Pvt. Ltd.

An ISO 9001:2015 Certified Organization

Report on

**HAZID STUDY OF
AVIATION TURBINE FUEL STORAGE FACILITY**



Prepared for:



M/s. ARTSON ENGINEERING LIMITED, HYDERABAD




Doc. No.: 2018/JSPL/038/HAZID/051

Rev. No.: 00; 20th Aug, 2018

	HAZID STUDY REPORT FOR AVIATION TURBINE FUEL STORAGE FACILITY			
	Doc. No.:	2018/JSPL/038/HAZID/051	Rev. No.:	
M/s. Artson Engineering Limited, Hyderabad				

DOCUMENT DETAILS

TITLE	HAZID Study Report of Aviation Turbine Fuel Storage Facility	JOGI SafeTech Pvt. Ltd. A-701/702, Shreeji Arcade, B/h. Bhulka Bhavan School, Anand Mahal Road, Adajan, Surat, Gujarat (India) - 395009. Ph.: 0261 - 6451411 Mo.: +91 7405480710 Email: safety@jogisafetech.com Website: www.jogisafetech.com
FOR	ARTSON ENGINEERING LIMITED Ground Floor, Mithona Towers 1-7-80 to 87, Prenderghast Road, Secunderabad, Hyderabad- 500003, Telangana State	
HAZID SESSION	Date: 14 th Aug, 2018 Place: GMR Conference Room	

DOC. NO.	2018/JSPL/038/HAZID/051	REVISION NO.	00
DATE OF ISSUE	20 th Aug, 2018	HAZID CHAIRMAN	Nilesh Jugal
PREPARED BY	Vishal Patoliya <i>Assistant Engineer</i>		
REVIEWED BY	Disha Jethva <i>Head - Projects</i>		
APPROVED BY	Nilesh Jugal <i>Director</i>		

SUMMARY

M/s. JOGI SafeTech Pvt. Ltd. conducted HAZID Study of Aviation Turbine Fuel Storage Facility for M/s. Artson Engineering Limited. The main objective of this study was to brainstorm and identify existing or potential hazards associated with the Project works that have the potential to affect personnel, assets, production or the environment. This report presents the findings of the HAZID study along with the recommendations.

REV.	DATE	STATUS	DESCRIPTION
00	20 th Aug, 2018	Final Report	--
00	18 th Aug, 2018	Draft Report	Issued for comments





	HAZID STUDY REPORT FOR AVIATION TURBINE FUEL STORAGE FACILITY			
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EXECUTIVE SUMMARY:



Introduction: M/s. Artson Engineering Limited, Hyderabad has engaged M/s. JOGI SafeTech Pvt. Ltd. to conduct HAZID Study of its Aviation Turbine Fuel Storage Facility. The HAZID was performed on 14th Aug, 2018 at the site of GMR conference Room, Hyderabad.

Objective: The main objective of this study was to brainstorm and identify existing or potential hazards associated with the Project works that have the potential to affect personnel, assets, production or the environment. This report details the findings of HAZID Study of Aviation Turbine Fuel Storage Facility of M/s. GMR Hyderabad International Airport Limited, Shamshabad.

HAZID Recommendations: The findings of the HAZID Study are the recommendations which has been given for protection against possible hazards. Various recommendations made for the different nodes are represented in the following table.

Table 1: HAZID Recommendations

Recommendations	Places Used
1. Verification to be done for coverage of all areas.	Causes: 1.1.1.3.1
2. JSA/HIRA to be conducted for manual activities.	Causes: 1.2.1.4.1
3. Training for safe work practices should be imparted regularly.	Causes: 1.2.1.4.1
4. Transport emergency plan to be prepared considering loading/unloading transportation and vehicular moving.	Causes: 1.2.1.5.1
5. A natural slop shall be maintained in storm water drain channel to avoid stagnation/ backflow of water.	Causes: 1.1.1.6.1
6. Pathway to be marked on road	Causes: 1.3.1.3.1
7. Vehicular routes to be defined and followed.	Causes: 1.3.1.3.1
8. Concave mirrors to be placed at turnings.	Causes: 1.3.1.3.1
9. All construction activities for upcoming facility to be controlled by appropriate methodology like SIMOPs or Method statement.	Causes: 1.2.1.5.1

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1. INTRODUCTION OF THE COMPANY

M/s. Artson Engineering Limited (AEL) is a majority owned subsidiary of TATA Projects Limited (TPL). Tata Projects is one of India's fastest growing Industrial & Urban Infrastructure companies and owns 75% of paid-up equity shares of AEL. The balance 25% shares are owned by Indian Public. (BSE Stock Code: 522134)

Artson team is well experienced in executing EPC / Construction contracts in Tankages, piping and mechanical Static equipments. AEL has executed many large and prestigious Projects in Oil Refinery Tankages, Piping & Mechanical packages, Chemical, O & G, Refinery Product storage & Distribution Terminals, Cross-country Pipelines and Mechanical equipment construction projects in Metals, Mining, Power etc.

With its ASME U, U2, S, R, NB certified manufacturing facility located in Nasik, Artson is equipped to manufacture high quality/ certified pressure vessels, columns, heat exchangers and other process equipment.

In addition to its Nasik manufacturing facility, AEL has invested in large fabrication yards located in Nagpur, Jamshedpur & Ranchi to cater to Structural steel fabrication and maintenance / erection services for variety of process plants including O&G, Steel and Thermal Power.



AEL is certified with Quality Management System (ISO 9001:2008), Environment Management System (ISO 14001:2004) and BS (OHSAS 18001:2007) for Occupational Health & Safety Management system. We have impeccable safety records at manufacturing units and project sites.

Google Image of the Facility is shown below:



2. DOCUMENT SCOPE

The scope of this document is limited to HAZID Study carried out for M/s. Artson Engineering Limited of its Aviation Turbine Fuel Storage Facility at GMR Hyderabad International Airport, Shamshabad.

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3. HAZID METHODOLOGY

3.1 Purpose

The purpose of the workshop was to brainstorm and identify existing or potential hazards associated with the Project works that have the potential to affect personnel, assets, production or the environment. These hazards were assessed taking into consideration existing policies and procedures and in some cases where it was considered appropriate, additional mitigation measures and actions were assigned for resolution, close out and monitoring.



The objectives of the HAZID were to:

- Identify and systematically assess all major hazards and potential incident events associated with the identified construction activities, with a focus on HSE and equipment hazards.
- Evaluate the identified risks.
- Where necessary, make recommendations to eliminate or reduce risks.
- Assess Major Accident Events (MAEs).
- Record the workshop findings.
- Include results in the implementation procedures.
- Provide a basis for the ongoing monitoring and closure of associated actions.

3.2 Method Statement

HAZID is a brainstorming activity which is used to gather information from well experienced personnel from operations, engineering, project management and HSE staff together to identify, the issues surrounding the facility. The HAZID workshop study is typically performed in below mentioned steps.

- The facility was divided into a number of 'subsystems' based on the layout and the process.
- Apply the Guideword from the HAZID checklist for selected system.
- If the hazard is possible continue or apply another Guideword.
- Brainstorm the causes for the hazards.
- Evaluate the consequences and qualitatively assess the risk.
- Identify Safeguards to control/mitigate the hazards.
- Recommend if the safeguards are not sufficient.



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3.3 Parameter and Guideword



Following Sections, Sub Hazards and guidewords were used during HAZID workshop;

Table 2 : List of HAZID Guidewords

Section		Sub hazards		Guide words	
1.1.	External and Environmental hazards	1.1.1.	Natural and environmental hazards	1.1.1.1.	Climate extremes
				1.1.2.1.	Cyclone
				1.1.3.1.	Lightning
				1.1.4.1.	Earthquakes
				1.1.5.1.	Subsidence
				1.1.6.1.	Flood
				1.1.7.1.	Other(Ingress of Animals)
		1.1.2.	Created (Man made) hazards	1.1.2.1.	Security hazards
		1.1.3.	Effect of the facility on the surrounding	1.1.3.1.	Proximity to population
				1.1.3.2.	Adjacent land use
				1.1.3.3.	Proximity to transport corridors
		1.1.4.	Infrastructure	1.1.4.1.	Normal communications
				1.1.4.2.	Communications for contingency planning
		1.1.5.	Environmental damage	1.1.5.1.	Continuous plant discharge to air
				1.1.5.2.	Continuous plant discharges to water
1.1.5.3.	Continuous plant discharges to soil				
1.1.5.4.	Contaminated Ground				
1.1.5.5.	Other				

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Section		Sub hazards		Guide words	
1.2.	Health hazards	1.2.1.	Health hazards	1.2.1.1.	Asphyxiation hazards
				1.2.1.2.	Toxic
				1.2.1.3.	Physical
				1.2.1.4.	Working hazards
				1.2.1.5.	Transport
1.3.	Project implementation issues	1.3.1.	Contracting strategy	1.3.1.1.	Prevailing influence
				1.3.1.2.	Other
				1.3.1.3.	Other
		1.3.2.	Competency	1.3.2.1.	Level of indigenous training

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4. HAZID SESSION

4.1 Session Details

The HAZID Session was carried out on 14th Aug, 2018 at the site of GMR Hyderabad International Airport, Limited. The main objective of this study was to brainstorm and identify existing or potential hazards associated with the Project works that have the potential to affect personnel, assets, production or the environment. At the start of the HAZID study, the HAZID chairman briefed the team on the HAZID process and identified the guidewords to be used.

HAZID was recorded in full using 'PHA Pro (Version: 6.0)' software. The worksheet was visually projected so that all team members could see the progress of the discussions as they were being recorded by the HAZID Scribe who was an engineering personnel from M/s. JOGI SafeTech Pvt. Ltd.



4.2 HAZID Team Members

The team was led by a highly experienced HAZID chairman who is also a process engineer. The HAZID team from M/s. Artson Engineering Limited and from M/s. GMR Hyderabad International Airport Limited consisted of a safety engineer, mechanical engineer, maintenance engineer, operation engineer, electrical engineer, and project & design engineer.

Following table list out the names of the members who had participated to impart their technical knowledge to successfully complete this HAZID study.

Table 3: List of HAZID Team Members

Sr. No.	Name	Designation
1.	Mr. Nilesh Jogonal	<i>HAZID Chairman</i>
2.	Mr. Vishal Patoliya	<i>HAZID Scribe</i>
3.	Mr. Madhusudan Rao	<i>GM (Engg.)</i>
4.	Mr. Ashok Yedla	<i>AM - PMT</i>
5.	Mr. Radhakrishnan	<i>GMR- PMT</i>
6.	Mr. Prabhat	<i>Head- Safety</i>
7.	Mr. Joseph Samuel	<i>Tank farm In-charge</i>
8.	Mr. Sudhir Parida	<i>Manager-Safety</i>
9.	Mr. Kirit Dutt	<i>Sr. Safety Engineer</i>

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4.3 Nodes and Drawings

The facility consists of Tanker unloading activity, Pump activity, storage of ATF etc. Hence the entire facility has considered as a single node. The node identified and reviewed during HAZID in detail is listed in the below table and the HAZID worksheets and the HAZID worksheets are attached in Appendix-II



Table 4: List of Nodes and Drawings

Node No.	Node Description	Drawing No.	Equipment ID
1.	Facility layout	IMC/HYD/GMR/GENLAY/01	The Facility consist of Transferring of ATF, Storage of ATF etc.

4.4 HAZID Worksheet

The full HAZID study is detailed in the HAZID worksheets given in Annexure - II.

It contains a complete list of the probable causes, their consequences and the necessary available safeguards along with the recommendations, if required.

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ANNEXURE - I (PLOT PLAN)



HAZID STUDY REPORT FOR AVIATION TURBINE FUEL FACILITY



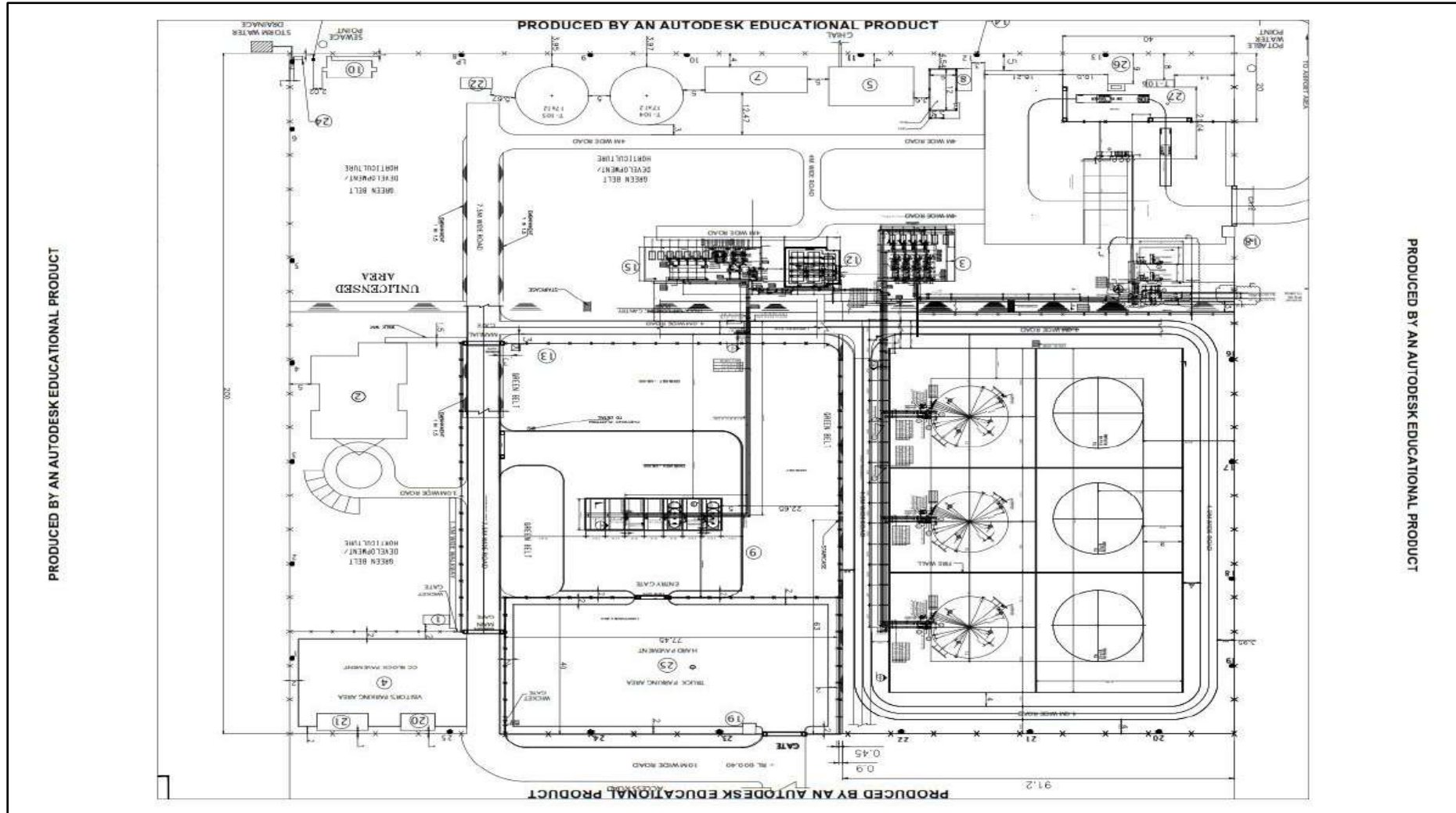
Document No.:



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ANNEXURE - II (HAZID WORKSHEET)



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Node: 1. General

Section: 1.1. External and environmental hazards

Sub hazards: 1.1.1. Natural and environmental hazards

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.1.1.1. Climate extremes (Temperature)	1.1.1.1.1. Geographical Location in tropical zone	1.1.1.1.1.1. Shrinkage of pipeline and structures	1.1.1.1.1.1.1. Design considers temperature variations.	
1.1.1.2. Cyclone	1.1.1.2.1. Geographical Location in tropical zone	1.1.1.2.1.1. Structural Damage	1.1.1.2.1.1.1. Structural design validated by standards accepted by good engineering practices.	
		1.1.1.2.1.2. Erosion		
1.1.1.3. Lightning	1.1.1.3.1. Average frequency of lightning flashes in this area is 1.9 per km ² per year	1.1.1.3.1.1. Structural Damage	1.1.1.3.1.1.1. Lightning arrestors are installed at one place	1. Verification to be done for coverage of all areas.
		1.1.1.3.1.2. Electrocutation		
1.1.1.4. Earthquakes	1.1.1.4.1. Geographical location falls in Seismic Zone-2	1.1.1.4.1.1. Collapse of structures	1.1.1.4.1.1.1. Appropriate design consideration	
1.1.1.5. Subsidence	1.1.1.5.1. Soil Characteristic	1.1.1.5.1.1. Collapse of structures	1.1.1.5.1.1.1. Soil study will be carried out and structural design shall be based on the findings of soil study.	



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Node: 1. General

Section: 1.1. External and environmental hazards

Sub hazards: 1.1.1. Natural and environmental hazards

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.1.1.6. Flood	1.1.1.6.1. Heavy Rains & Level difference in the facility-some facilities are below the flood levels experienced in past.	1.1.1.6.1.1. Disruption	1.1.1.6.1.1.1. Periodic cleaning of drain	5. A natural slop shall be maintained in storm water drain channel to avoid stagnation/ backflow of water.
		1.1.1.6.1.2. Operation stopped	1.1.1.6.1.2.1. Process and storm water drain shall be routed to OWS and then oil is recycled.	
		1.1.1.6.1.3. Underground tanks will be flooded leading to emergence of flammable fuels on the surface.	1.1.1.6.1.3.1. UG Tanks are sealed and vents are located at safe height of 2 m.	
1.1.1.6.1.3.2. MCC/PCC rooms are located at elevated position (protecting them from ingress of rain water)				
1.1.1.7. Other (Ingress of animals)	1.1.1.7.1. Presence of animals in surrounding area	1.1.1.7.1.1. Property damage	1.1.1.7.1.1.1. Personal vigilance	
			1.1.1.7.1.1.2. Barricade: Proper barricade wall has been constructed on the periphery of the premises to avoid ingress of wild animals.	

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Node: 1. General

Section: 1.1. External and environmental hazards

Sub hazards: 1.1.2. Created (Man made) hazards



Guide Word	Causes	Consequences	Safeguards	Recommendations
1.1.2.1. Security hazards	1.1.2.1.1. No credible cause			

Node: 1. General

Section: 1.1. External and environmental hazards

Sub hazards: 1.1.3. Effect of the facility on the surrounding

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.1.3.1. Proximity to population	1.1.3.1.1. Human occupancy near factory premises	1.1.3.1.1.1. Societal Risk	1.1.3.1.1.1.1. Nearest Population is at a distance of 6 KM	
1.1.3.2. Adjacent land use	1.1.3.2.1. Nearby Activities	1.1.3.2.1.1. Risk to peripheral activities	1.1.3.2.1.1.1. Considerable distance from surrounding occupancies	
1.1.3.3. Proximity to transport corridors	1.1.3.3.1. No credible cause (facility is located well away from transport corridors).			



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Node: 1. General

Section: 1.1. External and environmental hazards

Sub hazards: 1.1.4. Infrastructure

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.1.4.1. Normal communications	1.1.4.1.1. Any leakage or fire in the facility	1.1.4.1.1.1. Injury, Death	1.1.4.1.1.1.1. Alarms or Siren is available in the premises	
1.1.4.2. Communications for contingency planning	1.1.4.2.1. No means of communication during emergency	1.1.4.2.1.1. Failure in taking protective active in case of emergency.	1.1.4.2.1.1.1. Connected with state highway	
			1.1.4.2.1.1.2. Proper means of communication are available	
			1.1.4.2.1.1.3. Company vehicle is available	
			1.1.4.2.1.1.4. Official dialogue with the neighbouring companies.	



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Node: 1. General

Section: 1.1. External and environmental hazards

Sub hazards: 1.1.5. Environmental damage

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.1.5.1. Continuous plant discharge to air	1.1.5.1.1. No environmental discharge from the facility			
1.1.5.2. Continuous plant discharges to water	1.1.5.2.1. Discharge of process streams	1.1.5.2.1.1. Water Pollution	1.1.5.2.1.1.1. All the drains from the facility are routed through OWS.	
1.1.5.3. Continuous plant discharges to soil	1.1.5.3.1. Disposal of fuel	1.1.5.3.1.1. Soil Pollution	1.1.5.3.1.1.1. No fuel is disposed directly to soil. All samples and other drains are collected and recycled.	
1.1.5.4. Contaminated ground	1.1.5.4.1. NA			
1.1.5.5. Other	1.1.5.5.1. Peripheral Fire	1.1.5.5.1.1. Fire in factory premises	1.1.5.5.1.1.1. Sufficient distance from peripheral facilities	



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Node: 1. General

Section: 1.2. Health hazards

Sub hazards: 1.2.1. Health hazards

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.2.1.1. Asphyxiation hazards	1.2.1.1.1. Confined space entry	1.2.1.1.1.1. Death	1.2.1.1.1.1.1. PTW system is in place	
1.2.1.2. Toxic	1.2.1.2.1. Toxic emission (of fuel vapor)	1.2.1.2.1.1. Adverse Health effects	1.2.1.2.1.1.1. Well ventilated area	
			1.2.1.2.1.1.2. During sampling adequate antistatic PPEs are worn by person (Gloves, Goggles).	
1.2.1.3. Physical	1.2.1.3.1. Fall from height	1.2.1.3.1.1. Injury, Death	1.2.1.3.1.1.1. Work at height procedures are in place	
	1.2.1.3.2. Working in low ventilated/ high temp. area	1.2.1.3.2.1. Heat Stroke	1.2.1.3.2.1.1. Fall arrestors have been installed and same will installed at all locations wherever a person is expected to climb on the tank top.	
	1.2.1.3.3. Fall of structures	1.2.1.3.3.1. Injury, Death	1.2.1.3.3.1.1. PPEs (Helmet)	



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Node: 1. General

Section: 1.2. Health hazards

Sub hazards: 1.2.1. Health hazards

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.2.1.4. Working hazards	1.2.1.4.1. Manual Operations	1.2.1.4.1.1. Injury	1.2.1.4.1.1.1. Safe work practices are in places	2. JSA/HIRA to be conducted for manual activities.
			1.2.1.4.1.1.2. SOPs	3. Training for safe work practices should be imparted regularly.
			1.2.1.4.1.1.3. Mandatory PPEs (Helmet, Safety Shoes, Jacket)	
1.2.1.5. Transport	1.2.1.5.1. Heavy vehicular movement	1.2.1.5.1.1. Accidents resulting to Injury, Death	1.2.1.5.1.1.1. Separate access/entry for construction activity.	4. Transport emergency plan to be prepared considering loading/unloading transportation and vehicular moving.
			1.2.1.5.1.1.2. All vehicles are provided with spark arrestor before entry.	
		1.2.1.5.1.2. Material Loss	1.2.1.5.1.2.1. Administrative control: All vehicles are having reverse horns.	

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Node: 1. General

Section: 1.2. Health hazards

Sub hazards: 1.2.1. Health hazards



Guide Word	Causes	Consequences	Safeguards	Recommendations
				methodology like SIMOPs or Method statement.

Node: 1. General

Section: 1.3. Project implementation issues

Sub hazards: 1.3.1. Contracting strategy

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.3.1.1. Prevailing influence	1.3.1.1.1. Contractor issues	1.3.1.1.1.1. Interruption in execution	1.3.1.1.1.1.1. Good HR Policies	
1.3.1.2. Other	1.3.1.2.1. Excavation	1.3.1.2.1.1. Electrocutation	1.3.1.2.1.1.1. Personal vigilance	
			1.3.1.2.1.1.2. Signage	
			1.3.1.2.1.1.3. Excavation Procedure in place	
			1.3.1.2.1.1.4. Underground cable have been properly marked by permanent marker posts.	

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Node: 1. General

Section: 1.3. Project implementation issues

Sub hazards: 1.3.1. Contracting strategy

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.3.1.3. Other	1.3.1.3.1. Vehicular Movement	1.3.1.3.1.1. Accidents	1.3.1.3.1.1.1. Personnel Vigilance	6. Pathway to be marked on road
				7. Vehicular routes to be defined and followed.
				8. Concave mirrors to be placed at turnings.

Node: 1. General

Section: 1.3. Project implementation issues

Sub hazards: 1.3.2. Competency

Guide Word	Causes	Consequences	Safeguards	Recommendations
1.3.2.1. Level of indigenous training	1.3.2.1.1. Lack of Training	1.3.2.1.1.1. Unsafe activities	1.3.2.1.1.1.1. Proper training is imparted at regular interval of time	



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ANNEXURE - III (ATTENDANCE SHEET)



Doc Title	Attendance Sheet			
Doc No.	JSPL/HAZOP/004/F-03			
Subject	HAZID Study	Client	Artson/CCMR	
Date	14/08/2018	Time	10:43 Am	

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REFERENCES:



1. P & ID(s) studied on site before and during the session.
2. Plot Plan- GMR
3. Guidelines on tools & techniques for hazard identification & risk management -ISO 17776:2001

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