Attachment 2
HAZOP Worksheet

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 1000/6000 AREA

Node description： Gas Station and NG Distribution

Drawing no： 1000-PID-001/002

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： X-1901 1/2, X-1001, D-1001

Design purpose： To stabilize pressure, account flow and remove liquid from nature gas resourse,54.1~62 barG,40 degree C.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
1001.1	High flow	1.Upstream natural gas resource suddenly pressure surge or rupture in downstream.	Temperature less than 380 degree C, reaction of sulphur hydrogenation fail and the downstream catalyst become deactivated and cause carbonic acid dew point corrosion in S-2001.	1.USV-1915/1925/1935. 2.TIA-2155/2154 low temperature alarm. 3.Same as high pressure(1001.10).	3	2	1	N	1.Add FI-1915/1925 high flow alarm. 2.PCV-1916/1926 regulation loop manual valve add LOCK OPEN on P&ID. 3.USV-1915/1925 should be trunnion ball valve and for HH flow shut off.
1001.2	low/no flow	1.non actual hazard identify.						N	
1001.3	incorrect flow direction	[1] 1.Human error cause some manual valve abnormally open.	Loss of feed and environment pollution.		2	4	2	N	Add CSC for vent to atmosphere (gas station).

1001.3	incorrect flow direction	[2] 1.Abnormally open D-1001 bottom line.	High pressure gas blow off to TK-5003 damage the D-1001 bottom line, cause release and fire.	1.LSALL-1004 activate USV-1001. 2.D-1001 bottom line 8-type blind plate.	4	3	3	Y	Take note at D-1001 bottom: open gate valve fully and then slowly open 1" globe valve for draining the liquid and closing do reverse and make sure the drain line is fully closed after the drain.
1001.4	reverse flow	1.non actual hazard identify						N	
1001.5	part of flow/composition	1.non actual hazard identify						N	
1001.6	as well as flow/impurity	1.non actual hazard identify						N	
1001.7	other than flow/incorrect substance	1.non actual hazard identify						N	
1001.8	high concentration	1.Nitrogen content of feed increase to 7%.	Increase the pressure of the synthesis loop.	Synthesis loop purge gas control valve FV-3169 .	2	5	3	N	Check the capacity of synthesis loop purge gas control valve FV-3169 (for Nitrogen content of feed increase to 7%).
1001.9	low concentration	1.non actual hazard identify						N	
1001.10	high pressure	1.High pressure upstream or PCV-1916/1926 or operator fault or HV-1003 close or fire.	High flow and pressure in downstream cause rupture and fire and environment pollution.	1.Same as high flow(1001.1). 2.PSV-1911/1921. 3.USV-1915/1925/1935.	4	2	2	N	
1001.11	low pressure	1.non actual hazard identify						N	
1001.12	vacuum	1.non actual hazard identify						N	

1001.13	high temperature	1.non actual hazard identify						N	
1001.14	low temperature	1.non actual hazard identify						N	
1001.15	high level	1.No removing oily water from D-1001 due to slug or operator error.	Reduce the temperature and failure hydrogenator reaction and damage catalyst of R-2003 and down stream reactors and malfunction of fuel system and burners .	1.LSAHH-1004(2oo3). 2.TIC-2220 low temperature alarm. 3.Cleaning the pipeline of natural gas by using pig before every start-up.	4	3	3	Y	D-1001 equipped with 2oo3 high level protection and shut off the ball valve same as 1001.18 recommendation.
1001.16	low/no level	1.non actual hazard identify						N	
1001.17	rupture/leak	1.Same as incorrect flow direction(1001.3).	Overpressure and fire and environment pollution.	1.PSV. 2.Gas detection system. 3.Fire fighting system.	3	4	3	N	Same as 1001.18 recommendation.
1001.18	other	1.External fire.	Lead to more severe fire and impact other area.	1.Gas detection system. 2.Fire fighting system.	4	4	4	N	1.Add 14" fire safe pneumatic ball valve(USV according to API 2218) and 2" bypass valve (LC) for isolation before gas station package. 2.Cancel out HV-1003. 3.Move PG-1002, PI-1002, TG-1002, TI-1001, FI-1006 and manual block valves to the BL, but keep one manual block valve and blind plate for isolating gas station and D-1001.

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project
Company name： Middle East Kimiaye Pars Company
Project no：
Process name： 1000/6000 AREA
Node description： Desulphurisation
Drawing no： 2000-PID-006/007; 1000-PID-003

Establish dt：2016/8/10
Plant site：
Risk matrix： 8X7(TCC)

Pipe / equipment no： E-2006, E-2004, R-1001, R-1002 1, R-1002 2
Design purpose： Remove sulphur,48.3~48.8 barG,380 degree C

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
1002.1	High flow	1.Upstream high pressure due to failure of PCV-1916/1926. 2.Operator fault to open USV-1935 downstream globe valve . 3.Downstream valve PV-1045 fail open. 4.Low pressure in downstream node. 5.Instrument air failure cause USV-2482 open.	1.Same as high flow(1001.1). 2.E-2006 outlet temperature decrease cause hydrogenation reaction uncompleted, then catalyst of R-2003/H-2001 deactivated.	1.TIA-1034/1035 low temperature alarm. 2.TICA-2220 low temperature alarm. 3.AIA-1045 high sulphur alarm.	3	3	2	N	1.Soft ware limitation for changing set point value not more than 5%, must be consider. 2.AIA-1045 high sulphur alarm and proper SOP is considered in operating and personnel training is also be considered.
1002.2	low/no flow	1.manual valve close accidentally.	Plant shut down.	PICA-1045 high pressure alarm.	2	5	3	N	1.Manual valve add LOCK OPEN on P&ID (1000-PID-003). 2.Consider a L.C. for the bypass of FV-2150 to prevent H2 backflow.
1002.3	incorrect flow	1.non actual hazard identify						N	

1002.4	reverse flow	1.non actual hazard identify						N	
1002.5	part of flow/composition	1.FT/FIC/FV-2150 fail closed. 2.PT/PIC/PV-2608 fail closed. 3.Same as high concentration 1001.8.	1.Deactivate the catalyst of R-2003/H-2001. 2.Same as high concentration 1001.8.	1.FICA-2150 low flow alarm. 2.PIA-2150 low pressure alarm. 3.Same as high concentration 1001.8.	3	2	1	N	Same as high concentration 1001.8.
1002.6	as well as flow/impurity	1.non actual hazard identify						N	
1002.7	other than flow/incorrect substance	1.non actual hazard identify						N	
1002.8	high conecntration (organic sulphur)	1.High sulphur content from Damavand company.	Deactivate catalyst of R-2003/H-2001.	AIA-1045 high sulphur alarm and proper SOP is considerate in operating and personnel training is also considered.	3	2	1	N	
1002.9	low concentration (H2)	1.Same as part of flow/composition(1002.5)	Same as part of flow/composition(1002.5)	Same as part of flow/composition(1002.5)				N	
1002.10	high pressure	1.R-1002-2 exit manual valve close accidentally. 2.Upstream high pressure due to failure of PCV-1916/1926. 3.Operator fault to open USV-1935. 4.Blockage of catalyst in R-1001/1002 1/1002 2. 5.External fire.	1.Overpressure and fire and environment pollution. 2.H2 flow from FV-2150 to natural gas line stopped, hence desulfurization stopped.	1.PV-1045 open and vent to flare. 2.PSV-1031/1038/1043@55 barG. 3.PIC-2608 hydrogen pressure increase.	4	2	2	N	

1002.11	low pressure	[1] 1.PT/PIC/PV-1045 fail open. 2.PT/PIC/PV-1006 fail closed.	H-2001 overtemperature and damage to furnace tubes and the coil of convention area .Refer to node 2002.	1.PIA-1001 low pressure alarm. 2.PICA-1006 low pressure alarm. 3.PICA-1045 low pressure alarm. 4.TI-2148/2149 high temperature alarm. 5.TICA-2220 high temperature alarm.				N	
1002.11	low pressure	[2] 1.In winter with increasing the N.G consumption in Iranioin city pressure of N.G will reduce slowly.	non actual hazard identify		2	4	2	N	
1002.12	vacuum	1.non actual hazard identify						N	
1002.13	high temperature	1.Same as low flow 1002.2. 2.Low flow on E-2001/2002.	Same as low flow 1002.2.	Same as low flow 1002.2.				N	
1002.14	low temperature	1.Same as high flow 1002.1.	Same as high flow 1002.1.	Same as high flow 1002.1.				N	
1002.15	high reaction	1.No possible.						N	
1002.16	low reaction	1.Same as low temperature1002.14.	Deactivate the catalyst of R-2003/H-2001.	1.AIA-1045 total sulphur high alarm. 2.AP-1036 sampling and analysis the total sulphur and H2S,TIA-1034/1035 detect the temperature change. 3.AP-1039/1040/1044/1046&AIA-1045 sampling and analysis total sulphur and H2S.	3	2	1	N	

1002.17	non reaction	1.Same as high flow(1001.1). 2.Hydrogen can't be added.	Catalyst deactivated.	1.AIA-1045 sulphur analysis and high alarm. 2.FICA-2150 low flow alarm.	3	3	2	N	
1002.18	side reaction	1.non actual hazard identify						N	
1002.19	wrong/incorrect reaction	1.non actual hazard identify						N	
1002.20	heat exchange tubes rupture/leak	1.Coils of E-2004/2006 rupture/leak.	NG into convection area and fire and increase the temperature of flue gas.	1.AP-2160. 2.Low alarm of PICA-1045 is a safeguard just for rupture case.	3	3	2	N	Add TIA-2229/2154/2155 high temperature alarm.
1002.21	rupture/leak	1.Flange/Gasket or pipe fitting leak.	Fire.	1.Gas detection system. 2.Fire fighting system.	3	4	3	N	
1002.22	other	1.External fire.	Shut down the plant and damage equipments.	1.PSV-1031/1038/1043. 2.Gas and fire detect system. 3.Fire proofing is considered.	3	2	1	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 1000/6000 AREA

Node description： NG Saturating

Drawing no： 6000-PID-003/002, 001, 004; 7000-PID-015

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： E-6001, T-6001 1/2, X-6001A/B, D-6001, X-6002A/B, E-6004, P-6001A/B, P-2002A/B, E-6002, D-6002, P-7003A/B, E-6003, TK-7002, P-7004A/B

Design purpose： NG Saturating by using MPS and condensate, 42.3~47.3 barG,262~365 degree C

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
1003.1	High flow(process gas)	1.FST/FIC/FV-6070 fail open. 2.FV-6070 bypass valve abnormally open. 3.PV-2481 & USV-2482 abnormally open.	H-2001 furnace tubes coking and then overtemperature.	FFSAL-2064 low S/C ratio activate IS-1 and shut off process gas USV-2092/2093(1oo2) and fuel gas USV-2541/2542(1oo2),group voting(2oo2).	3	4	3	Y	
1003.2	High flow(MPS)	1.PT/PIC/PV-6025 fail open. 2.PV-6025 bypass valve abnormally open	S/C ratio increase, no hazard.					N	
1003.2	High flow(MPS)	1.PT/PIC/PV-6025 fail open. 2.PV-6025 bypass valve abnormally open	D-6001 level decrease and then high pressure gas blow off to D-6002 and vent to atmosphere maybe cause vapor cloud explosion.	1.LICA-6051 low level alarm. 2.LSAL-6051(2oo3) activate IS-31 to trip P-6001A/B and shut off USV-6082 and FV-6086(1oo2). 3.D-6002 top vent line to atmosphere.	4	3	3	Y	

1003.3	High flow(condensate)	1.LT/LIC/LV-2441 fail open. 2.LT/LIC/LV-2474 fail open. 3.LT/LIC/LV-2403 fail open. 4.FT/FIC/FV-6031 fail open. 5.Decreasing of BFW consumption for other users.	1.Same as low/no flow(MPS) 1003.5 item 2. 2.Same as high level (T-6001 tube side)1003.22.	1.Same as low/no flow(MPS) 1003.5 item 2. 2.Same as high level (T-6001 tube side)1003.22.				N	
1003.4	low/no flow(process gas)	1.FST/FIC/FV-6070 fail, open position too small. 2.Upstream process gas low pressure. 3.Bypass LV-6051 open. 4.Tubes leakage/rupture in E-6001. 5.High pressure difference in T-6001 1/2. 6.Downstream FV-2061 closed.	1.Overheating of reformer tubes, reduced tube life, possible rupture. 2.Potential overheating of waste heat section coils. 3.Lossing product.	1.Low NG feed flow alarm FAL-2061. 2.FSAL-6070 low flow interlock. 3.High temperature alarm TAH-2305. 4.High temperature trip TSAH-2305 Operator action. 5.Flue gas temp. alarms TAH-2295 & TAH-2297 .	4	3	3	Y	

1003.5	low/no flow(MPS)	1.PT/PIC/PV-6025 fail closed. 2.Abnormal condition in methanol synthesis loop. 3.PV-3042 fail closed. 4.PV-7031C/D fail open.	1.High level in D-6001. 2.Low liquid level in T-6001 1/2 shell side. 3.Malfunction of E-6004 and wash water outlet temperature decreased. 4.H-2001 furnace tubes coking and then overtemperature.	1.PV-3042 fail lock close. 2.PICA-3042 low pressure alarm. 3.PV-7031A/B add in operation to compensate MPS. 4.LSAL-6022 1/2 low level interlock. 5.LSAH-6051 high level interlock. 6.LAHH-6083 HH level interlock. 7.LV-6082 and FV-6082 open. 8.FFIA-2069 S/C ratio low alarm and FV-2072 open. 9.FFSAL-2064 low S/C ratio activate IS-1 and shut off process gas USV-2092/2093(1oo2) and fuel gas USV-2541/2542(1oo2),group voting(2oo2).	3	4	3	N	PIC-6025 add low pressure alarm.

1003.6	low/no flow(condensate)	1.LT/LIC/LV-2441 fail closed. 2.LT/LIC/LV-2474 fail closed. 3.LT/LIC/LV-2403 fail closed. 4.FT/FIC/FV-6031 fail closed.	1.Same as high flow(MPS)1003.2 item 2. 2.T-6001 1/2 low level and PRG escape to D-6002 and vent to atmosphere maybe cause vapor cloud explosion. 3.T-6001 1/2 saturation of process gas will not be complete, it only be partly before complete.	1.Same as high flow(MPS)1003.2 item 2. 2.LIA-6033 1/2 ,LIA-6034 1/2 low level alarm. 3.USV-6081 will be closed by IS-31 before entering process gas into overflow line tank. 4.Based on Topsoe, the blowdown nozzle is located under the lowest hole on the saturator tube so it is mechanically impossible to have NG in blowdown line.	4	5	5	Y	Add LL level interlock by using LT-6034 1/2 signal to shut off FV-6081 and USV-6081, SIF should be meet SIL 2.
1003.7	incorrect flow direction	1.Same as high flow(MPS) 1003.2 item2 and low/no flow(condensate)1003.6.	Same as high flow(MPS) 1003.2 item2 and low/no flow(condensate)1003.6.	Same as high flow(MPS) 1003.2 item2 and low/no flow(condensate)1003.6.				N	
1003.8	reverse flow	1.Same as heat exchange tubes rupture/leak(T-6001) 1003.30.	Same as heat exchange tubes rupture/leak(T-6001) 1003.30.	Same as heat exchange tubes rupture/leak(T-6001) 1003.30.				N	
1003.9	part of flow/composition	1.Same as low/no flow(condensate) 1003.6.	Same as low/no flow(condensate) 1003.6.	Same as low/no flow(condensate) 1003.6.				N	
1003.10	as well as flow/impurity	1.Same as part of flow/composition 1002.5 and low reaction 1002.16.	Same as part of flow/composition 1002.5 and low reaction 1002.16.	Same as part of flow/composition 1002.5 and low reaction 1002.16.				N	
1003.11	other than flow/incorrect substance	1.non actual hazard identify						N	

1003.12	high concentration (Na+, other impurity)	1.FT/FIC/FV-6059 1/2 fail closed. 2.Impurity in solid NaOH deliver to X-5003.	1.Na+ and any other impurities are brought to R-2003/H-2001 and potentially damage catalyst. 2.High concentration of Na+ and other impurities build up in circulating water and need for high blowdown rate.	1.FIA-6059 low flow alarm. 2.Check the temperature change of R-2003, TICA-2253, TIA-2268, TIA-2154~2265. 3.AP-2266 hydrocarbon analysis. 4.FT/FIC/FV-6086 shall be open to increase blowdown rate and decrease concentration of impurities.	4	3	3	Y	Add a note in operation manual : operator to check the temperature change of R-2003, TICA-2253, TIA-2268, TIA-2154~2265 and detect deactivation of catalyst.
1003.13	low concentration	1.Inert gas(N2) increase in NG and lead to low concentration of CH4.	Increase the purge gas from methanol synthesis loop and decrease the production.	1.Increase purge gas to fuel gas. 2.AI-1001A/B/C show NG composition.	2	3	1	N	
1003.14	high pressure(E-6001/D-6001/T-6001)	1.FST/FIC/FV-2061 fail, open position too small or closed. 2.Condensate high flow.	Same as high flow(process gas)1003.1.	1.PSV-6053@55 barG. 2.PICA-2073 high pressure alarm.	4	3	3	Y	
1003.15	low pressure(E-6001/D-6001/T-6001)	[1] 1.FST/FIC/FV-2061 fully open. 2.USV-2094 abnormally open. 3.PV-2481,USV-2482 abnormally open.	Same as high flow(process gas) 1003.1.	Same as high flow(process gas) 1003.1.				N	
1003.15	low pressure(E-6001/D-6001/T-6001)	[2] 1.PV-1045 abnormally open.	Same as low/no flow(process gas) 1003.4.	Same as low/no flow(process gas) 1003.4.				N	

1003.16	vacuum	1.PT/PIC/PV-6025 abnormally closed and MPS condense in T-6001 1/2 shell side.						N	Design pressure of T-6001 1/2 steam side should have to be considered for full anti-vacuum design due to PT/PIC/PV-6025 abnormally closed and MPS condense in T-6001 1/2 shell side.
1003.17	high temperature(process gas)	1.Same as low/no flow(process gas)1003.4. 2.TV-2220 failure closed. 3.E-6001 tube leak/rupture. 4.LV-6051 opening.	Same as low/no flow(process gas)1003.4.	Same as low/no flow(process gas)1003.4.				N	
1003.18	high temperature(E-6004)	1.Not possible.						N	
1003.19	low temperature	1.Same as high flow(process gas)1003.1and low/no flow(MPS) 1003.5.	Same as high flow(process gas)1003.1and low/no flow(MPS) 1003.5.	Same as high flow(process gas)1003.1and low/no flow(MPS) 1003.5.				N	
1003.20	high level(D-6001)	[1] 1.Same as high flow (condensate)1003.3	Same as high flow (condensate)1003.3	Same as high flow (condensate)1003.3				N	

1003.20	high level(D-6001)	[2] 1.PT/PIC/PV-6025 fail closed. 2.Abnormal condition in methanol synthesis loop. 3.PV-3042 fail closed. 4.PV-7031C/D fail open.	1.D-6001 level increase and then bring Na+ to R-2003/H-2001 and potentially damage catalyst. 2.D-6001 internal tray damage.	1.LICA-6051 high level alarm. 2.LSY-6051(2oo3) activate open FV-6081/6086. 3.LSAH-6051(2oo3) activate IS-1 and shut off process gas USV-2092/2093(1oo2) and fuel gas USV-2541/2542(1oo2) and USV-2547, USV-2548 (1oo2). 4.Check the temperature change of R-2003, TICA-2253, TIA-2268, TIA-2154~2265. 5.AP-2266 hydrocarbon analysis.	4	2	2	Y	Add a note in operation manual : operator to check the temperature change of R-2003, TICA-2253, TIA-2268, TIA-2154~2265 and detect deactivation of catalyst.
1003.21	high level(T-6001 shell side)	1.LV-6021A/B fail closed.	Same as low flow (MPS)1003.5.	1.Same as low flow (MPS)1003.5. 2.LICA-6021 high level alarm.				N	
1003.22	high level(T-6001 tube side)	1.Same as high flow (condensate)1003.3.	1.Process gas can not flow into tubes of T-6001 smoothly and pressure of process gas increase, due to liquid blockage. 2.D-6001 level increase. 3.Flow rate of boiler blowdown increase and D-6002 level increase. 4.MPS consumption increase.	1.LIA-6033 1/2 high level alarm. 2.FV-6081/6086 open. 3.LICA-6051 high level alarm. 4.FV-6082 / LV-6082 open. 5.LICA-6082 high level alarm.	2	5	3	N	

1003.23	high level(D-6002)	1.non actual hazard identify						N	
1003.24	high level(TK-7002)	1.LT/LIC/LV-6082 abnormally open. 2.P-7004A/B failure. 3.High level in T-6001 1/2 tube side top head and D-6001.	Waste process condensate release to the ditch.	1.LIA-7101 high level alarm. 2.LAHH-7102 activate I-39 to shut off LV-6082. 3.Overflow design.	1	1	1	N	
1003.25	low/no level(D-6001)	1.Same as low/no flow (condensate)1003.6. 2.Same as high flow (MPS)1003.2.	Same as low/no flow (condensate)1003.6.	Same as low/no flow (condensate)1003.6.				N	
1003.26	low/no level(T-6001 shell side)	[1] 1.Same as low flow (MPS)1003.5 item 2.	Same as low flow (MPS)1003.5 item 2.	Same as low flow (MPS)1003.5 item 2.				N	
1003.26	low/no level(T-6001 shell side)	[2] 1.PT/PIC/PV-6025 fully closed. 2.LT/LIC/LV-6021A/B fail open.	1.P-6002A/B cavitation and damage. 2.Steam drum D-3003 low level and methanol reactor overtemperature and damage.	1.LSAL-6022 1/2 activate IS-30 to trip P-6002A/B. 2.D-3003 LL level trip LSAL-3042 activate IS-3.	4	3	3	Y	
1003.27	low/no level(T-6001 tube side)	1.Same as low/no flow (condensate)1003.6.	Same as low/no flow (condensate)1003.6.	Same as low/no flow (condensate)1003.6.				N	
1003.28	low/no level(D-6002)	1.FV-6081, USV-6081,FV-6086,USV-6082 abnormally closed.	P-7003A/B cavitation and damage.	1.LICA-6082 low level alarm. 2.LALL-6083 LL level activate I-37 to trip P-7003A/B.	1	3	1	N	

1003.29	low/no level(TK-7002)	1.LT/LIC/LV-6082 abnormally closed. 2.P-7004A/B abnormally started. 3.P-7003A/B failure.	P-7004A/B cavitation and damage.	1.LIA-7101 low level alarm. 2.LALL-7102 activate I-38 to trip P-7004A/B.	2	3	1	N	
1003.30	heat exchange tubes rupture/leak(T-6001)	1.Heat exchange tubes rupture.	Process gas leak to steam system cause overpressure and maybe cause fire and /or explosion.	1.PSV-6027@45.0 barG. 2.PV-6025 close. 3.LICA-6021 low level alarm. 4.LSAL-6022 1/LSAL-6022 2 LL activate IS-30 to close P-6002 A/B and LV-6021B. 5.FIA-2065 low flow alarm.	4	3	3	Y	
1003.31	heat exchange tubes rupture/leak(E-6001)	1.Same as high temperature(process gas)1003.17.	Same as high temperature(process gas)1003.17.	Same as high temperature(process gas)1003.17.				N	
1003.32	heat exchange tubes rupture/leak(E-6004)	1.Heat exchange tubes rupture/leak(E-6004)	1.Injection of process condensate into MPS system. 2.Same as heat exchange tubes rupture/leak(T-6001) 1003.30.	1.PSV-6027@45.0 barG. 2.PV-6025 close. 3.FIA-6059 low flow alarm.	4	3	3	N	PIC-6025 add high pressure alarm.
1003.33	rupture/leak	1.Same as rupture/leak 1002.21.	Same as rupture/leak 1002.21.	Same as rupture/leak 1002.21.				N	
1003.34	other	1.Same as other 1002.22.	Same as other 1002.22.	Same as other 1002.22.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 2000# AREA

Node description： Pre-refomer Feed and Pre-refomer

Drawing no： 2000-PID-003/004/007/008

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： E-2002, R-2003

Design purpose： Saturated Natural Gas to Steaming Mixture. 262 Degree C, 42.3 barG HP Steam to Steaming Mixture. 343 Degree C, 41.4 barG. Pre-heating to 496 Degree C then feed into Pre-reformer. operation temperature 441~496 degree C, operation pressure 37.7~38.4 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
2001.1	High flow(process gas)	1.FT/FIC/FV-2061 abnormally open. 2.Upstream high pressure. 3.Downstream low pressure.	1.Low S/C ratio and damage catalyst R-2003/H-2001. 2.E-2002 low temperature in outlet stream hence malfunction of R-2003.	1.FFSAL-2064 low S/C ratio activate IS-1 and shut off process gas USV-2092/2093(1oo2) and fuel gas USV-2541/2542(1oo2) and USV-2547, USV-2548(1oo2). 2.TICA-2232 low temperature alarm. 3.TICA-2253 low temperature alarm. 4.FV-2072 steam flow increase. 5.FFAL-2069 low S/C ratio alarm.	3	4	3	N	

2001.2	High flow(HPS)	1.FT/FIC/FV-2072 fail open. 2.FV-2072 bypass valve abnormally open due to operator error.	1.Low temperature in outlet stream E-2002. 2.High steam comsumption which effect steam balance of the plant.	1.PIA-2077 high pressure alarm. 2.TICA-2232 low temperature alarm. 3.TICA-2253 low temperature alarm.	2	4	2	N	
2001.3	low/no flow(process gas)	1.Same as no/low flow(process gas)1003.4. 2.FST/FIC/FV-2061 fail closed. 3.PT/PICA/PV-2073 fail open. 4.USV-2094 fail open. 5.USV-2092/2093 fail closed. 6.E-2002 tubes rupture or failure.	1.Overheating of H-2001 reformer tubes, reduce tube life. 2.E-2002,R-2003 overtemperature and damage the coil of E-2002 and reduce the life of R-2003 maybe process gas vent to atmosphere cause fire and explosion. 3.Lossing product.	1.TICA-2253 high temperature alarm. 2.TIA-2226 high temperature alarm. 3.FSAL-2062 total sat.steam low flow trip. 4.TST-2305A/B/C(2oo3) high temperature alarm activate IS-01. 5.TST-2221A/B/C(2003)high temperature activate IS-01. 6.FV-2531 1/2 and FV-2532A decrease the flow of fuel gas.	4	4	4	Y	

2001.4	low/no flow(HPS)	1.FST/FIC/FV-2072 fail closed. 2.Steam supply failure. 3.Hand valve HV-2098 abnormally close due to operator error.	1.Coking R-2003 catalyst and reformer catalyst damage, reduce the life of the reformer. 2.Lossing product during catalyst replacing period. 3.Coils of E-2002 high temperature and even damage.	1.FFAL-2069 low S/C ratio alarm. 2.PDAH-2252 high d/p alarm. 3.FAL-2069 low flow alarm. 4.FSAL-2062 low flow activate IS-01. 5.FFSAL-2064 low S/C ratio activate IS-01. 6.FSAL-2072 low flow alarm. 7.PIA-2077 low pressure alarm. 8.TICA-2253 low temperature alarm. 9.TALL-2232 low temperature interlock.	4	4	4	Y	

2001.5	incorrect flow direction	1.Steam system pressure decrease suddenly. 2.HPS line pressure increase suddenly. 3.Process gas low pressure. 4.Human error and opening of isolate valve on Nitrogen from BL(on 2000-PID-004). 5.Human error and opening of isolate valve on Nitrogen from C-2001 line. 6.Human error and opening of isolate valve on Hydrogen (for start-up) line. 7.Condensate low pressure. 8.BFW low pressure. 9.Human error and opening of isolate valve on Nitrogen from BL(on 2000-PID-008).	1.Process gas go into steam line system. 2.Steam go to methanol line(for the start-up). 3.Process gas to Nitrogen from BL and distribution in the plant overally. 4.Process gas to Nitrogen from C-2001. 5.Process gas to Hydrogen from BL.	1.Mutiple check valves. 2.8-type blind plate in Nitrogen lines. 3.USV-2071 isolation design. 4.Double block valve in Nitrogen lines.	3	4	3	N	
2001.6	reverse flow	1.Flange rupture or gasket blow out. 2.Sudden decrease of upstream pressure.	1.Same as low pressure 1003.15.(just for cause 2). 2.Lossing product. 3.Damage E-2002 tubes. 4.R-2003 catalyst attrition and destruction and demage. 5.Same as low/no flow(process gas) 2001.3.	1.Check valve on process gas line. 2.PDIA-2252 shows reverse pressure difference. 3.Same as low/no flow(process gas) 2001.3.	3	3	2	N	
2001.7	part of flow/composition	1.Not possible.						N	

2001.8	as well as flow/impurity(sulphure)	1.Same as high conecntration(organic sulphur) 1002.8.	Same as high conecntration(organic sulphur) 1002.8.	Same as high conecntration(organic sulphur) 1002.8.				N	
2001.9	as well as flow/impurity(Hydrocarbon)	1.Natural gas from BL contain high hydrocarbon long time.	1.Coking on the catalyst of R-2003. 2.Lower life time of R-2003 catalyst.	1.AP-2266,AP-2267 hydrocarbon anaylisis. 2.TIA-2268 temperture alarm.	3	4	3	N	
2001.10	as well as flow/impurity(Na+)	1.Same as high concentration(Na+)1003.12.	Same as high concentration(Na+)1003.12.	1.Same as high concentration(Na+)1003.12.				N	
2001.11	as well as flow/impurity of HPS(SiO2)	1.Damaged demister pad. 2. Maloperation of BFW system and apperance of SiO2, O2, CO2. 3.Some ions into HPS system and increasing steam conductivity.	Deactivating the catalyst.	1.AIA-2379 online conductivity high alarm. 2.AP-7100 manual AP for BFW quality. 3.AP-2380 manual AP for steam quality.	2	4	2	N	
2001.12	other than flow/incorrect substance	1.Not possible.						N	
2001.13	high water concentration(process	1.Same as high flow(HPS) 2001.2	Same as high flow(HPS) 2001.2	Same as high flow(HPS) 2001.2				N	
2001.14	low water concentration(process	1.Same as low/no flow(HPS) 2001.4.	Same as low/no flow(HPS) 2001.4.	Same as low/no flow(HPS) 2001.4.				N	

2001.15	high pressure(process gas)	1.Upstream high presasure. 2.Blockage of valves in downstream. 3.External fire. 4.HPS high pressure.	1.HPS cannot be injected into process gas. 2.Same as S/C ratio low. 3.Leakage of PV-2073. 4.Leakage of USV-2094.	1.Same as S/C ratio low. 2.Leakage level of PV-2073 and USV-2094 are V. 3.PICA-2073 high pressure alarm and control.	3	3	2	N	
2001.16	high pressure(HPS)	1.HPS system failure. 2.X-7011A/B,X-7010,X-7012A/B fail open. 3.PV-2363 fail open. 4.FT-3001 failure.(Ask from steam turbine vendor)	1.More steam consumption, and reverse effect on the plant steam consumption. 2.Same as high flow(HPS)2001.2. 3.Effect of PV-2363 fully opening is negligible.	1.PIA-2077 high pressure alarm. 2.PIAC-7004 high pressure alarm and PV-7004 control vavle.	2	4	2	N	FT-3001 failure(cause high pressure or not)(Ask from steam turbine vendor).
2001.17	low pressure(process gas)	1.PV-2073 abnormally open. 2.Upstream low pressure same as low/no flow(process gas)1003.4. 3.USV-2094 abnormally open. 4.Flange or gasket failure.	1.Overheating of H-2001 reformer tubes, reduce tube life. 2.E-2002,R-2003 overtemperature and damage the coil of E-2002 and reduce the life of R-2003 maybe process gas vent to atmosphere cause fire and explosion. 3.Extrernal fire and environmental pollution. 4.Increase S/C ratio due to excessive HPS injection.	1.TICA-2253 high temperature alarm. 2.TIA-2226 high temperature alarm. 3.TST-2305A/B/C(2oo3) high temperature alarm activate IS-01. 4.TST-2221A/B/C(2003)high temperature activate IS-01.	4	3	3	Y	

2001.18	low pressure(HPS)	1.HPS system failure. 2.FV-2072 fail closed. 3.Same as low/no flow(HPS) 2001.4 4.HV-2097 abnormally open due to operator error. 5.TV-7025A/B fail open. 6.TV-7026/7027/7004/7003/7002 fail open. 7.Human error in opening isolating valve of HPS from Damavand.	1.Coking R-2003 catalyst and reformer catalyst damage, reduce the life of the reformer. 2.Lossing product during catalyst replacing period. 3.Coils of E-2002 high temperature and even damage.	1.FFAL-2069 low S/C ratio alarm. 2.PDAH-2252 high d/p alarm due to coking of catalyst. 3.FAL-2069 low flow alarm. 4.FSAL-2062 low flow activate IS-01. 5.FFSAL-2064 low S/C ratio activate IS-01. 6.FSAL-2072 low flow alarm. 7.PIA-2077 low pressure alarm. 8.TICA-2253 low temperature alarm. 9.TALL-2232 low temperature interlock. 10.8-type blind plate in order to prevent human error in opening isolating valve of HPS from Damavand. 11.TIAC-7026/7027/7004/7003/7002 low temperature alarm. 12.PIAC-7004/7028 low pressure alarm.	4	4	4	N	
2001.19	vacuum	1.Not possible.						N	
2001.20	high temperature(process gas)	1.Same as low/no flow (process gas)2001.3 and low pressure(process gas)2001.17.	Same as low/no flow (process gas)2001.3 and low pressure2001.17.	Same as low/no flow (process gas)2001.3 and low pressure2001.17.				N	

2001.21	low temperature(process gas)	1.FV-2233 1/2 fail open. 2.Low temperature of flue gas. 3.Leakage of false air dampers to atmosphere. 4.Malfunction of combustion system including burners.	1.Reduce the coil life of E-2002. 2.Malfunction and incomplete reaction inside R-2003. 3.Outlet temperature of NG to primary reformer decrease.	1.TICA-2232 low temperature alarm and trip I-17. 2.PSAL-2224 flue gas low pressure alarm and trip IS-1. 3.AP-2266/2267. 4.TICA-2253 low temperature alarm.	2	4	2	N	
2001.22	high reaction	1.non actual hazard identify						N	
2001.23	low reaction	1.Catalyst of R-2003 inactivated. 2.High concentration of heavy hydrocarbon in upsteam. 3.Low temperature of inlet stream. 4.Inverse effect of low pressure on reaction and catalyst performance inside R-2003. 5.Low concentration of water in the inlet stream.	1.Reduce the catalyst and tube life of H-2001. 2.Higher temperature in outlet of reactor R-2003.	1.AP-2266/2267 hydrocarbon analysis. 2.TIA-2268 temperature alarm. 3.Same as low water concentration(process gas)2001.14. 4.TI-2254 to TI-2265 temperature indicators inside R-2003. 5.Based on Topsoe, low pressure has not any inverse effect on reaction and catalyst performance inside the R-2003.	3	4	3	N	
2001.24	non reaction	1.Same as low reaction 2001.23.	Same as low reaction 2001.23.	Same as low reaction 2001.23.				N	

2001.25	heat exchange pipe rupture/leak	1.Manufacturing deficiency or aging of E-2002.	NG into convection area and fire and increase the temperature of flue gas.	1.AP-2160 composition analysis. 2.PSAH-2224 pressure high alarm and trip IS-01. 3.TI-2228/2229/2154/2155 temperature indicator. 4.Routing check and maintenance.	4	2	2	Y	
2001.26	low flow/no(P-5012 A/B discharge)	1.P-5012 A/B outlet manual valve abnormally closed. 2.Suction blocked due to manual off valve.	1.P-5012 A/B and pipe overpressure and damage.(in the case of cause 1) 2.P-5012 A/B overheat and damage.(in the case of cause 2) 3.Methanol leak and maybe cause fire.(in the case of cause 1)	1.PSV-5405/5409 @52.0 barG. 2.Design temperature of Pump can stand against the produced overtemperature.	2	4	2	N	
2001.27	high flow(P-5012 discharge)	1.Human error in starting both pumps at the same time. 2.Wrong manipulation of stroke.	High hydrogen concentration during the start up.	1.FIC-5407 flow indicator. 2.SOP for operator shall not change the pump stroke during operation.	3	3	2	N	
2001.28	rupture/leak	1.Flange/gasket or pipe fitting leak.	Fire and environmental pollution.	1.Gas detection system. 2.Fire fighting system.	3	4	3	N	
2001.29	other	1.Same as other 1002.22.	Same as other 1002.22.	Same as other 1002.22.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 2000# AREA

Node description： Primary Reformer

Drawing no： 2000-PID-007/009/017/005/006

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： E-2001, H-2001, X-2003, F-2002, FT-2002, E-2007, F-2001, FT-2001, S-2001

Design purpose： Sturated NG react to CO,CO2,H2,...reformed gas.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
2002.1	High flow(air)	1.To be confirmed by ITT.						N	To be confirmed by ITT(about high flow of air).
2002.2	High flow(process gas)	1.Upstream high flow. 2.Upstream high pressure. 3.Downstream low pressure.	1.E-2001 low temperature in outlet stream hence malfunction of H-2001. 2.Increasing CH4 content in the outlet of catalyst tubes. 3.Increasing the purge gas flow. 4.Decrease the methanol production. 5.More steam consumption of turbine FT-3001. 6.More combustion air consumption and more steam consumption of turbine FT-2002. 7.More steam consumption of flue gas fan turbine FT-2001.	1.TI-2234 temperature indicator. 2.Sample point AP-2306 in the outlet of H-2001. 3.TI-2303/2304/2305 temperature indicator.	2	4	2	N	Add FIC-2061 high flow alarm.

2002.3	High flow(fuel gas)	1.FT/FIC/FV-2531 1/2 fail open. 2.FT/FIC/FV-2536A fail open. 3.FT/FIC/FV-3169 fail open. 4.PT/PIC/PV-1011 fail open.	1.Same as high temperature(flue gas)2002.23. 2.Flame failure to cause explosion. (To be checked with ITT)	1.PIA-2540 high pressure alarm. 2.PST-2554A/B/C(2oo3) high pressure alarm and activate IS-01. 3.TST-2305A/B/C(2oo3) high temperature alarm activate IS-01. 4.TST-2221A/B/C(2oo3)high temperature activate IS-01. 5.TIA-2303,TIA-2304 high temperature alarm.	5	3	4	Y	Flame failure to cause explosion (H-2001 fuel gas high flow). (To be checked with ITT)
2002.4	low/no flow(air)	1.F-2002 combustion Air Blower failure. 2.F-2001 flue gas ID fan failure. 3.Operator error to close manual valve.	Air deficiency , low temperature afterburning ,flame out ,leakage of flammable gas, the system shut down possible explosion.	1.PICA-2163 low pressure alarm . 2.AIA-2223 1,AIA-2224 oxygen concentration low alarm. 3.F-2002 blower failure activate IS-11 to auto-start MF-2002. 4.PSAL-2163(2oo3) low pressure activate IS-01. 5.F-2001 blower failure activate IS-12 to auto-start MF-2001.	4	3	3	Y	
2002.5	low/no flow(process gas)	1.Same as low/no flow(process gas) 2001.3. 2.High d/p in catalyst tubes. 3.Catalyst tubes rupture. 4.Failure or rupture in E-2001 coils.	Same as low/no flow(process gas)2001.3.	Same as low/no flow(process gas)2001.3.				N	

2002.6	no/low flow(fuel gas)	1.FST/FIC/FV-2531 1/2 fail closed. 2.USV-2541,USV-2542 abnormally close. 3.PV-2536B fail open. 4.Upstream no flow of purge gas. 5.FV-2536A fail closed. 6.USV-2543,USV-2545 abnormally open. 7.Operator error to close the block valve of fuel gas line or valves before burners. 8.Burner failure.	1.Unstable flame or flame out, leakage of flammable gas maybe cause explosion. 2.Low temperature of process gas, methane slip in the outlet of H-2001 increased, hence led to high pressure of methanol synthesis loop and then loss product.	1.PIA-2540 low pressure alarm. 2.FICA-2536 low flow alarm. 3.PST-2556A/B/C(2oo3) low alarm and trip IS-01.	4	3	3	Y	
2002.7	incorrect flow direction(fuel gas)	[1] 1.Purge gas supply failure. 2.PV-1001 failure, high pressure of fuel gas .	The high pressure fuel gas(50 barG)go to purge gas system(7 barG) and possibly to cause low pressure system leaking or rupture and cause fire or explosion.	1.PIC-2554 control fuel gas line pressure. 2.PIAH-2540 high pressure alarm. 3.PSV-1013/1014 @7 barG. 4.Check valve on purge gas line.	4	3	3	Y	
2002.7	incorrect flow direction(fuel gas)	[2] 1.Purge gas supply failure. 2.PV-1001 failure, high pressure of fuel gas .	The high pressure fuel gas(50 barG)go to Nitrogen system(10.5 barG) and possibly to cause contaminate Nitrogen system and increase the chance of fire and explosion.	1.PIC-2554 control fuel gas line pressure. 2.PIAH-2540 high pressure alarm. 3.PSV-1013/1014 @7 barG. 4.Check valve on nitrogen line. 5.Normally operation the nitrogen line block valve closed.	5	3	4	Y	SOP should add that normally operation the nitrogen line block valve closed. (for H-2001).

2002.8	reverse direction(air)	1.Not possible.						N	
2002.9	reverse direction(fuel gas)	1.Not possible.						N	
2002.10	reverse direction(reformed gas)	1.No flow of reformed gas. 2.Low pressure of reformed gas.	Explosion in cold collector and R-2004.	1.FFSAH-2008 low O/C ratio trip IS-2. 2.PDIA-2283 high d/p alarm. 3.TIA-2326/2327/2328 high temperature alarm. 4.TSAH-2325/2334/2333 high temperature trip IS-2.	5	2	3	Y	Select PDT-2283 to show minus value too (reverse polarity).
2002.11	part of flow/composition(process gas)	1.Abnormal operation of upstream led to a.High sulphur content .(same as high concentration(organic sulphur)1002.8) b.Insufficient water content.)(same as low/no flow(HPS) 2001.4) c.High heavy hydrocarbon content.(same as as well as flow/impurity(Hydrocarbon) 2001.9) 2.Low/no/side reaction in H-2001 which maybe cause of low temperature inside the furnace.	1.Same as high concentration(organic sulphur)1002.8 2.Same as low/no flow(HPS) 2001.4 3.Same as as well as flow/impurity(Hydrocarbon) 2001.9 4.Loss of product due to low syngas production. 5.Increasing purge gas flow rate.	1.Same as high concentration(organic sulphur)1002.8. 2.Same as low/no flow(HPS) 2001.4. 3.Same as as well as flow/impurity(Hydrocarbon) 2001.9. 4.AIA-2479 CH4 high concentration alarm. 5.AP-2480/2306 sample point.	2	3	1	N	

2002.12	part of flow/composition(fuel gas)	1.Abnormal operation of upstream led to a.High sulphur content .(same as high concentration(organic sulphur)1002.8) b.Insufficient water content.)(same as low/no flow(HPS) 2001.4) c.High heavy hydrocarbon content.(same as as well as flow/impurity(Hydrocarbon) 2001.9) 2.Change of air humidity. 3.Burner failure and smoke in stack.	1.Low temperature of furnace and incomplete reaction inside catalyst. 2.Low temperature of flue gas and insufficient heat flow downstream coils. 3.Smoke and air pollution in stack outlet.	1.AP-2160/2222 sample point for flue gas. 2.TIA-2155 flue gas low temperature alarm. 3.TI-2203/2204/2295/2297 furnace temperature indicator. 4.TI-2203/2204 process gas temperature indicator.	2	4	2	N	
2002.13	as well as flow/impurity (air)	1.Air intake filter broken.	1.Air with dust into F-2002 and damage it. 2.Damage to burners.		2	2	1	N	Add SOP for planned inspection for air intake filter of F-2002.
2002.14	as well as flow/impurity (fuel gas)	1.No removing oily water from D-1001 due to slug or operator error.	Over-firing lead to overheating of reformer tubes, then reduce tube life or damage.	1.LSAHH-1004(2oo3) activate IS-01. 2.Cleaning the pipeline of natural gas by using pig before every start-up. 3.TST-2305A/B/C(2oo3) high temperature alarm activate IS-01. 4.TST-2221A/B/C(2003)high temperature activate IS-01.	4	3	3	N	

2002.15	other than flow/incorrect substance	1.Not possible.						N	
2002.16	high concentration (HPS)	1.Same as High flow(HPS) 2001.2.	Same as High flow(HPS) 2001.2.	Same as High flow(HPS) 2001.2.				N	
2002.17	low concentration (HPS)	1.Same as low water concentration(process gas) 2001.14.	Same as low water concentration(process gas) 2001.14.	Same as low water concentration(process gas) 2001.14.				N	
2002.18	high pressure(H-2001 chamber)	1.F-2001 flue gas fan system failure. 2.PT/PIC-2163/FY/FT/FIC/FHIC-2111 control loop failure. 3.SC-2119 control loop failure. 4.Fuel gas failure. 5.Same as High flow(air)2002.1 & High flow(fuel gas) 2002.3.	Back fire causes personnel hazard.	1.PASH-2224(2oo3) high pressure alarm and trip IS-01. 2.FT-2001 failure auto-start spare motor MF-2001. 3.PAHH-2224 high pressure trip I-15 open the damper on the top of H-2001.	4	3	3	Y	

2002.19	high pressure(process gas)	1.Upstream high pressure. 2.Catalyst coking of H-2001.	1.Decreasing reaction rate and high concentration of CH4 in outlet stream. 2.High pressure in downstream. 3.Rupture of catalyst tube.	1.PT-2282 high pressure alarm. 2.PDIA-2283 high d/p alarm. 3.PV-2073. 4.PICA-2073 high pressure alarm. 5.PI-2307 pressure indicator. 6.PSAH-2224(2oo3) high pressure trip IS-1. 7.AIA-2223 2 high combustibles concentration alarm. 8.PSV-2354~2360 @29 barG.	4	3	3	Y	
2002.20	low pressure(H-2001 chamber)	1.Same as vacuum 2002.22.	Same as vacuum 2002.22.	Same as vacuum 2002.22.				N	
2002.21	low pressure(process gas)	1.Low pressure of upstream. 2.High d/p of catalyst. 3.Rupture/leak in E-2001. 4.Rupture/leak in catalyst tube.	1.Higher reaction rate in catalyst tube, increasing CH4 conversion and probability of hot spot on catalyst tube and damage and rupture catalyst tube. 2.Damage to refractory inside the cold collector.	1.PDIA-2283 high d/p alarm. 2.TIA-2303/2304 high temperature alarm. 3.TSAH-2305(2oo3) high temperature trip IS-1. 4.AP-2306/2480 sample point for CH4 concentration. 5.AIA-2479 online analyzer for CH4 concentration. 6.TIAH-2234 high temperature alarm.	4	3	3	Y	

2002.22	vacuum	1.ID fan F-2001 makes high vacuum of H-2001.	Destroy the refractory of furnace wall.	1.PICA-2224 low pressure alarm. 2.PSAL-2224(2oo3) low pressure trip.	3	4	3	Y	
2002.23	high temperature(flue gas)	1.TT/TIC-2221A/B/FT/FY-2531/FY-2536 4/QY-2535 3/FV-2536A/FV-2531 1/2 malfunction to cause high flow of fuel gas. 2.FT/FIC/FV-3169 fail open. 3.PT/PIC/PV-1011 fail open.	1.Over-firing and overheating of reformer tubes, flame impingement on tubes then reduced tube life or damage. 2.Overtemperature of flue gas and damage the all coils in convection section. 3.Overtemperature of flue gas and damage to convection casing and its refractory. 4.Overheating of ID fan impeller and stack then reduced life or damage.	1.TST-2305A/B/C(2oo3) high temperature alarm activate IS-01. 2.TST-2221A/B/C(2oo3)high temperature activate IS-01. 3.TIA-2303,TIA-2304 high temperature alarm.	5	3	4	Y	
2002.24	high temperature(E-2001)	1.Same as low/no flow (process gas)2001.3. 2.Same as high temperature(flue gas)2002.23.	1.Overheating of H-2001 reformer tubes, reduced tube life. 2.E-2001,overtemperature and damage the coil of E-2001 maybe process gas vent to atmosphere cause fire and explosion and lead CH4 decompose to hot spot on coils.	1.TIA-2234 high temperature alarm. 2.TIA-2226 high temperature alarm. 3.TST-2305A/B/C(2oo3) high temperature alarm activate IS-01. 4.TST-2221A/B/C(2003)high temperature activate IS-01.	4	3	3	Y	

2002.25	high temperature(H-2001 catalyst tube)	1.Process reformer gas low flow. 2.Fuel gas to reformer high flow. 3.S/C ratio low. 4.Same as high temperature(flue gas)2002.23. 5.Same as change of composition NG toward more CH4.	Overheating of reformer tubes, reduced tube life.	1.TST-2221A/B/C(2003)high temperature activate IS-01. 2.TST-2305A/B/C(2oo3) high temperature alarm activate IS-01. 3.TIA-2226 high temperature alarm. 4.TIA-2295,TIA-2297 high temperature alarm. 5.TIA-2303,TIA-2304 high temperature alarm.	4	3	3	N	
2002.26	low temperature(process gas)	1.Same as low/no flow(fuel gas) 2002.6. 2.Failure of E-2001. 3.Burner failure. 4.Same as no/low flow(air) 2002.4. 5.Same as part of flow/composition(fuel gas)2002.12.	1.Low/no reaction inside catalyst tube. 2.Loss of product due to low syngas production. 3.Increasing purge gas flow rate.	1.TI-2303/2304/2305/2234 temperature indicator. 2.AP-2306/2480. 3.AIA-2479 high CH4 concentration alarm.	3	3	2	N	
2002.27	high reaction	1.High temperature inside the furnace. 2.Same as part of flow/composition(process gas)2002.11(high water concentration)2001.13. 3.Same as low pressure (process gas)2002.21.	1.Higher reaction rate in catalyst tube, increasing CH4 conversion and probability of hot spot on catalyst tube and damage and rupture catalyst tube. 2.Coking deactivating and damage catalyst. 3.Damage to refractory inside the cold collector.	1.TIA-2303/2304 high temperature alarm. 2.TSAH-2305(2oo3) high temperature trip IS-1. 3.AP-2306/2480 sample point for CH4 concentration. 4.AIA-2479 online analyzer for CH4 concentration.	4	3	3	Y	

2002.28	low reaction	1.Catalyst of H-2001 deactivated. 2.Low temperature inside furnace due to burner, fuel gas or combustion air failure. 3.Same as high pressure(process gas)2002.19. 4.Same as low temperature(process gas)2002.26.	1.Overheating of reformer tubes, reduced tube life. 2.Loss of product due to low syngas production. 3.Increasing purge gas flow rate.	1.TST-2221A/B/C(2oo3)high temperature activate IS-01. 2.TST-2305A/B/C(2oo3) high temperature alarm activate IS-01. 3.TIA-2226 high temperature alarm. 4.TIA-2295, TIA-2297 high temperature alarm. 5.TIA-2303, TIA-2304 high temperature alarm.	4	3	3	Y	
2002.29	non reaction	1.Same as low reaction 2002.28.	Same as low reaction 2002.28.	Same as low reaction 2002.28.				N	
2002.30	heat exchange pipe leak/rupture	[1] 1.Coils of E-2001 rupture/leak.	1.NG into convection area and fire increase the temperature of flue gas. 2.Loss production.	1.AP-2160 composition analysis. 2.PSAH-2224(2oo3) pressure high alarm and trip IS-01. 3.TIA-2234 high temperature alarm.	3	3	2	N	Add TIA-2229/2154/2155 high temperature alarm.
2002.30	heat exchange pipe	[2] 1.Coils of E-2007 rupture/leak.	Same as low/no flow(air)2002.4.	Same as low/no flow(air)2002.4.	4	2	2	N	
2002.31	leak/rupture	1.Flange/gasket or pipe fitting leak.	Fire.	1.Gas detection system. 2.Fire fighting system.	3	4	3	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 2000# AREA

Node description： Process Oxygen

Drawing no： 2000-PID-001/002

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： X-2001A/B, E-2008, D-2011

Design purpose： To provide process O2 and heat up by HP steam for secondary reforming.operation temperature 236 degree C, operation pressure 34 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
2003.1	High flow(O2)	1.FT/FIC/FV-2007/2009 fail open. 2.Oxygen resource supply high pressure.	1.Secondary reformer R-2004 overheating maybe damage the refractory. 2.O2 concentration go to explosion range and cause explosion.	1.FFASH-2008(2oo3) O/C ratio high alarm and trip IS-02. 2.PI-2001 O2 pressure indicator. 3.TSAH-2325(2oo3)high temperature alarm and trip IS-02. 4.TSAH-2334(2oo3)high temperature alarm and trip IS-02. 5.TSAH-2333(2oo3)high temperature alarm and trip IS-02. 6.TIA-2326/2327/2328 high temperature alarm. 7.TIA-2330/2331/2332 high temperature alarm.	5	2	3	Y	

2003.2	low/no flow(O2)	1.Oxygen resource supply failure. 2.FT/FIC/FV-2007/2009 fail closed. 3.HV-2003,HV-2004 manual valve abnormally closed due to operator error. 4.USV-2010,USV-2045,USV-2048 abnormally closed. 5.X-2001A/B filter blocked.	1.Low exit temperature, losing production capacity, plant shut down. 2.R-2004 flame out cause the process gas back to O2 line and make explosion.	1.FICA-2007 low flow alarm. 2.FSAL-2007(2oo3) low flow trip IS-02. 3.PDIA-2004 high d/p alarm. 4.AIA-2479 CH4 high alarm. 5. Double check valve on O2 line.	3	3	2	Y	
2003.3	incorrect flow direction	1.HPS lose pressure suddenly.	Possible damage the HPS line.	1.PIA-2035 low pressure alarm. 2.FSAL-2040 low flow alarm and trip IS-02. 3.PDSAL-2036(2oo3) low trip IS-21. 4.Check valve in HPS line.	2	3	1	N	
2003.4	reverse flow direction(O2)	1.Same as low/no flow(O2) 2003.2.	Same as low/no flow(O2) 2003.2.	Same as low/no flow(O2) 2003.2.				N	

2003.5	part of flow/composition	1.FST/FIC/FV-2040 fail closed. 2.HP resource supply failure. 3.USV-2038,USV-2039 abnormally closed. 4.USV-2041, HV-2031 abnormally open. 5.X-2002A/B filter blocked. 6.Manual valve closed due to operator error.	Increased risk of ignition in O2 stainless steel piping to R-2004.In case of ignition, fire and potential explosion.	1.PDSAL-2036 d/p alarm and trip IS-21. 2.FAL-2040 low flow alarm and trip IS-02. 3.TSAH-2325(2oo3)high temperature alarm and trip IS-02. 4.TSAH-2334(2oo3)high temperature alarm and trip IS-02. 5.TSAH-2333(2oo3)high temperature alarm and trip IS-02. 6.TIA-2326/2327/2328 high temperature alarm. 7.TIA-2330/2331/2332 high temperature alarm.	5	2	3	Y	

2003.6	as well as flow/impurity	1.Dust or rust in upstream of Oxygen. 2.Failure of filter X-2002A/B.	Ignition of the Oxygen pipe line, maybe cause fire.	X-2001A/B filter.	3	5	4	N	1.Before the start-up all the O2 pipe must be chemical clean according to procedure(to be approved by owner). 2.During the design step all the sharp edge must be avoided. 3.Proper design, material, procedure considered and qualified vendor shall supply the filter according to O2 service standard/practice.
2003.7	other than flow/substance	1.Not possible.						N	
2003.8	high concentration (HPS)	1.Same as low/no flow(O2) 2003.2. 2.FST/FIC/FV-2040 fail	Same as low/no flow(O2) 2003.2.	Same as low/no flow(O2) 2003.2.				N	
2003.9	low concentration (HPS)	1.Same as part of composition 2003.5	Same as part of composition 2003.5	Same as part of composition 2003.5				N	

2003.10	high pressure(D-2011)	1.LT/LICA/LV-2016 fail closed. 2.Manual valves closed due to operator error. 3.PT/PIC/PV-2015 fail open. 4.Same as low/no flow(O2)2003.2. 5.HPS system failure.	1.Possible damage D-2011 and rupture/leak cause potential personnel hazard. 2.Same as low/no flow(O2)2003.2.	1.PSV-2019@52.0bar G. 2.LICA-2016 high level alarm. 3.Same as low/no flow(O2)2003.2.	3	2	1	Y	
2003.11	low pressure(D-2011)	1.PT/PIC/PV-2015 fail closed. 2.HPS system failure.	Vacuum in D-2011.	1.Design pressure of D-2011 is FV/52 barG. 2.PICA-2015 low pressure alarm.	3	3	2	N	
2003.12	vacuum	1.Same as low pressure(D-2011)2003.11.	Same as low pressure(D-2011)2003.11.	Same as low pressure(D-2011)2003.11.				N	

2003.13	high temperature(O2)	1.PT/PIC/PV-2015 fail open. 2.FT/FIC/FV-2007/2009, open position too small. 3.HV-2003/2004 open position too small. 4.High temperature of oxygen resource. 5.High temperature of HPS. 6.FT/FIC/FV-2040 failure open.	Secondary reformer R-2004 overheating maybe cause rupture and explosion.	1.PSAH-2001 high alarm and trip IS-23. 2.TSAH-2329(2oo3)high temperature alarm and trip IS-02. 3.TSAH-2325(2oo3)high temperature alarm and trip IS-02. 4.TSAH-2334(2oo3)high temperature alarm and trip IS-02. 5.TSAH-2333(2oo3)high temperature alarm and trip IS-02. 6.TIA-2326/2327/2328 high temperature alarm. 7.TIA-2330/2331/2332 high temperature alarm. 8.HPS upstream TST/TICA/TSAH-7071 high temperature alam and trip IS-2.	4	3	3	Y	
2003.14	low temperature	1.PT/PICA/PV-2015 fail closed. 2.LT/LICA/LV-2016 fail closed. 3.High flow of oxygen. 4.HPS resource supply failure.	Steam condensation, Secondary reformer burner or target tile damage.	1.TSAL-2047(2oo3) low temperature trip IS-02. 2.TIA-2047 low temperature alarm. 3.Eletrical tracing of line to 250 degree C.	3	4	3	Y	

2003.15	high level(D-2011)	1.Same as high pressure (D-2011)2003.10.	1.Same as high pressure (D-2011)2003.10. 2.Low temperature of O2 outlet of E-2008 due to filling of exchanger of condensate, same as low temperature(O2) .	1.LICA-2016 high level alarm. 2.Same as low/no flow(O2)2003.2. 3.TIA-2047 low temperature alarm. 4.TSAL-2047(2oo3) low temperature trip IS-2.	3	4	3	Y	
2003.16	low level(D-2011)	1.LT/LICA/LV-2016 fail open. 2.PT/PIC/PV-2015 fail closed.	HPS go into D-7001 and damage the deaerator and water hammer in pipe and high consumption HPS.	1.PSV-7095/7096/7097@3.5barG. 2.LICA-2016 low level alarm.	3	3	2	Y	
2003.17	heat exchange pipe rupture/leak	1.E-2008 heat exchange pipe rupture/leak.	HPS leak to the oxygen line, increase the temperature of oxygen and low O2 concentration. no safety concern.	Select the qualified and reputable vendor.				N	
2003.18	rupture/leak	1.Flange/gasket or pipe fitting leak.	Leak or rupture of oxygen maybe cause fire and damage the oxygen line.	1.Fire fighting system. 2.PI-2001 O2 pressure indicator. 3.Flame detector system(2000-FD-01).	3	4	3	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project
Company name： Middle East Kimiaye Pars Company
Project no：
Process name： 2000# AREA
Node description： Secondary Reformer
Drawing no： 2000-PID-002/010

Establish dt：2016/8/10
Plant site：
Risk matrix： 8X7(TCC)

Pipe / equipment no： X-2002A/B, SI-2001, R-2004
Design purpose： To complete reforming reaction.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
2004.1	High flow(HPS)	1.Same as high concentration(HPS) 2003.8.	Same as high concentration(HPS) 2003.8.	Same as high concentration(HPS) 2003.8.				N	
2004.2	High flow(reformer gas)	1.Upstream process gas high flow.	Loss of production, but no safety concern.	AIA-2479 high CH4 concentration alarm.				N	
2004.3	low/no flow(HPS)	1.Same as part of flow/composition 2003.5.	Same as part of flow/composition 2003.5.	Same as part of flow/composition 2003.5.				N	

2004.4	low/no flow(reformed gas)	1.Upstream reformed gas low/no flow.	Secondary reformer overheating and high temperature to cause rupture and explosion.	1.FFASH-2008(2oo3) O/C ratio high alarm and trip IS-02. 2.TSAH-2325(2oo3)high temperature alarm and trip IS-02. 3.TSAH-2334(2oo3)high temperature alarm and trip IS-02. 4.TSAH-2333(2oo3)high temperature alarm and trip IS-02. 5.TIA-2326/2327/2328 high temperature alarm. 6.TIA-2330/2331/2332 high temperature alarm. 7.FFIA-2020 O/C ratio high alarm.	4	3	3	Y	
2004.5	incorrect flow direction	1.Same as reverse direction(reformed gas)2002.10.	Same as reverse direction(reformed gas)2002.10.	Same as reverse direction(reformed gas)2002.10.				N	
2004.6	reverse flow direction	1.Same as low/no flow(O2)2003.2.	Same as low/no flow(O2)2003.2.	Same as low/no flow(O2)2003.2.				N	
2004.7	part of flow/composition	1.Same as part of flow/composition 2003.5.	Same as part of flow/composition 2003.5.	Same as part of flow/composition 2003.5.				N	
2004.8	as well as flow/impurit	1.Not possible.						N	
2004.9	other than flow/substance	1.Not possible.						N	

2004.10	high concentration(O2)	1.Same as high flow(O2) 2003.1.	Same as high flow(O2) 2003.1.	Same as high flow(O2) 2003.1.				N	
2004.11	low concentration(O2)	1.Same as low/no flow(O2) 2003.2.	Same as low/no flow(O2) 2003.2.	Same as low/no flow(O2) 2003.2.				N	
2004.12	high d/p pressure(R-2004)	1.R-2004 catalyst blocked. 2.Crushing of the catalyst.	High pressure in upstream.	PDIA-2323/2283 high d/p alarm.	2	3	1	N	O2 burner vendor should check the length of the flame and prevent catalyst top surface damage.
2004.13	high pressure(R-2004)	1.Downstream manual valve abnormally closed. 2.Compressor shut down. 3.E-2020 1/2 and E-2021 1/2/3 one tube failure. 4.External fire.	R-2004 overpressure and damage. Leak and rupture cause fire or explosion.	1.PSV-1015@60 barG. 2.PSV-1008/1009@55 barG. 3.PDIA-2324 high pressure alarm. 4.TIA-2325,TIAC-2344 low temperature alarm. 5.PIA-2282 high pressure alarm. 6.PDIA-2283 high d/p alarm. 7.PSV-2354~2360 @29 barG. 8.PV-2481/ USV-2482 open and vent to flare.	4	4	4	Y	Manual valve of synthesis gas compressor inlet should be LO.
2004.14	low pressure	1.Same as low/no flow (reformer gas)2004.4. 2.Same as low/no flow(HPS)2004.3. 3.Same as low/no flow(O2)2003.2. 4.Low pressure of upstream.	1.Same as low/no flow (reformer gas)2004.4. 2.Same as low/no flow(HPS)2004.3. 3.Same as low/no flow(O2)2003.2.	PI-2324/2322 pressure indicator.	2	4	2	N	

2004.15	vacuum	1.Not possible.						N	
2004.16	high temperature	1.Same as high concentration(O2) 2004.10. 2.Same as high flow(O2)2003.1. 3.High temperature of upstream. 4.Low/no reaction.	1.Secondary reformer R-2004 overheating maybe damage the refractory. 2.O2 concentration go to explosion range and cause explosion. 3.Damage to downstream.	Same as high concentration(O2) 2004.10.				N	
2004.17	low temperature	[1] 1.Same as low/no flow(O2) 2003.2. 2.Low temperature of upstream.	Same as low/no flow(O2) 2003.2.	Same as low/no flow(O2) 2003.2.	3	3	2	N	
2004.17	low temperature	[2] 1.Same as high flow(reformer gas)2004.2. 2.Low temperature of upstream.	Same as high flow(reformer gas)2004.2	Same as high flow(reformer gas)2004.2				N	
2004.18	high reaction	1.Same as high flow(O2) 2003.1.	Same as high flow(O2) 2003.1.	Same as high flow(O2) 2003.1.				N	
2004.19	low reaction	1.Low temperature of R-2004. 2.R-2004 catalyst inactivated. 3.Low/no flow (O2) 2003.2.	Low exit temperature, lost production capacity. 2.Low temperature of HHPS and change of steam balance.	1.TIA-2324/2325 low temperature alarm. 2.AIA-2479 high CH4 concentration alarm.	3	3	2	N	
2004.20	no reaction	1.Same as low reaction 2004.19.	Same as low reaction 2004.19.	Same as low reaction 2004.19.	3	3	2	N	

2004.21	rupture/leak	1.Flange/gasket or pipe fitting leak. 2.Damage and failure of refractory inside secondary reformer, transfer line.	Fire and explosion.	1.Gas detection system. 2.Fire fighting system. 3.Flame detector(2000-FD-01).	5	2	3	N	
2004.22	other	1.Same as other 1002.22.	Same as other 1002.22.	Same as other 1002.22.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 2000# AREA

Node description： Waste Heat Boiler and HHP Steam Drum

Drawing no： 2000-PID-011/012/014/013

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： E-2020 1/2, E-2021 1/2, SI-2004, E-2021 3, D-2001, SI-2002, E-2022 1/2/3(tube side)

Design purpose： Remove heat of reforming reaction and generate HHPS.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
2005.1	High flow(BFW)	1.LT/LIC/LV-2372 fail open. 2.FT/FIC/FV-2417 fail open. 3.High pressure of BFW from header. 4.Low pressure D-2001. 5.High flow of continuous blow down.	1.Steam system water hammer and maybe damage the line due to excessive condensate. 2.Liquid carry over to super heater consequently liquid to turbine and damage.	1.LIA-2373 high level alarm. 2.LICA-2372 high level alarm. 3.TICA-2360 low temperature alarm. 4.Traps in steam header.	4	3	3	Y	Add LSAH-2372(2oo3) high level trip IS-03, SIF should be meet SIL 2.
2005.2	high flow(HHPS)	[1] 1.High flow of reformed gas. 2.High temperature of reformed gas.	1.Low level in steam drum. 2.High flow of BFW. 3.Low temperature of BFW.	1.LSAL-2372 low level trip IS-1. 2.LIA-2373/2372 low level alarm. 3.LICA/LV-2372.	4	2	2	Y	
2005.2	high flow(HHPS)	[2] 1.High flow of reformed gas. 2.High temperature of reformed gas.	High pressure due to the more steam in steam drum.	1.PICA/PV-2363. 2.PSV-2376~2380 @112 barG.	4	3	3	Y	

2005.3	High flow(RFG)	1.High flow of upstream.	Producing more steam(HHPS) and decreasing level of steam drum and lower liquid of E-2020 1/2 and damage exchanger.	1.FI-2372 steam flow indicator. 2.PICA-2361 high pressure alarm. 3.LSAL-2372 low level trip IS-1. 4.LIA-2373/2372 low level alarm. 5.LICA/LV-2372.	4	2	2	Y	
2005.4	low/no flow(BFW)	1.LT/LIC/LV-2372 fail closed. 2.FT/FIC/FV-2417 fail closed. 3.BFW Pump P-7001A/B/C failure. 4.High flow of reformed gas.	Low level in D-2001.Overheating of waste heat boiler E-2020 1/2,E-2021 1/2/3 and maybe cause rupture and fire and explosion.	1.LSAL-2372(2oo3) low level trip IS-01. 2.LIA-2373 low level alarm. 3.LICA-2372 low level alarm. 4.P-7001C spare pump auto-start.	4	3	3	Y	
2005.5	low/no flow(HHPS)	[1] 1.PT/PIC/PV-2363 fail closed. 2.Manual valve abnormally closed by human error.	1.Decrease the steam system flow. 2.D-2001 drum overpressure and cause D-2001 damage and rupture.	1.PT/PIC/PV-2361 pressure high open. 2.PSV-2376@112.0 barG,PSV-2377/2378/2379/2380@115.2.0 barG,4 operate 1 spare.	4	3	3	Y	
2005.5	low/no flow(HHPS)	[2] 1.PT/PIC/PV-2363 fail closed. 2.Manual valve abnormally closed by human error.	Overheating of steam superheater E-2021 1/2/3 and waste heat boiler E-2020 1/2 and maybe cause rupture.	TSAH-2335/2336/2355/2356(2oo3 each) high temperature trip IS-1.	4	3	3	Y	

2005.6	low/no flow(RFG)	1.Same as low/no flow (process gas)2001.3. 2.Incorrect position of damper out of waste heat boiler. 3.Human error and closing manual valve in suction on C-3001.	1.Decrease the saturated HHPS, and then methanol unit shut down in the worst case. 2.Refermed gas temperature decrease and condense prematurely in E-2022 1 and cause carbonic acid corrosion. 3.Low/no production due to low/no syngas.	1.Same as low/no flow (process gas)2001.3. 2.PICA-3007 low pressure alarm. 3.TICA-2360 low temperature alarm. 4.Normal operation condition is 50 degree C above dew point.	2	4	2	N	
2005.7	incorrect flow direction(BFW)	1.6"manual valve and HV-2371 abnormally open due to operator error. 2.Rupture the tube in E-2022. 3.Incorrect flow in BFW into phosphate line.	1.Low level in D-2001.Overheating of waste heat boiler E-2020 and maybe cause rupture. 2.Losing phosphate solution and changing its concentrations. 3.Water in reformed gas.	1.LSAL-2372(2oo3)low level trip IS-01. 2.LIA-2373 low level alarm. 3.LICA-2372 low level alarm. 4.Check valve on phosphate line.	4	3	3	N	
2005.8	reserve direction(phosphate solution)	1.Not possible (check valves and reciprocating pumps P-7051A/B).						N	
2005.9	part of flow/composition(BFW dosing)	1.X-7001 phosphate dosing unit fail.	1.Solid deposit in D-2001. 2.Corrosion and damage D-2001(without phosphate dosing for very long time).	1.AP-2383 sample point. 2.AIA-2382 high pH alarm. 3.AIA-2384 high conductivity alarm.	2	2	1	N	
2005.10	other than flow/incorrect substance	1.Not possible.						N	

2005.11	high concentration(RFG)	1.Upstream concentration changed.	no safety concern.	1.AIA-2479 high CH4 concentration alarm. 2.AP-2480 sample point.				N	
2005.12	low concentration(RFG)	1.Upstream concentration changed.	no safety concern.	1.AIA-2479 high CH4 concentration alarm. 2.AP-2480 sample point.				N	
2005.13	high pressure(RFG)	.1.Manual valve abnormally closed due to operator error in inlet of C-3001/3002. 2.High pressure of upstream. 3.Compressor C-3001 shut down.	RFG line system overpressure and leakage and cause fire or explosion.	1.PSV-2354/2355/2356/2357/2358/2359/2360@29 barG, 6 operate 1 spare. 2.PV-2481 open and vent to flare. 3.USV-2482 open and vent to flare.	4	3	3	Y	
2005.14	high pressure(D-2001)	1.Same as low/no flow(HHPS)2005.5 item1.	Same as low/no flow(HHPS)2005.5 item1.	Same as low/no flow(HHPS)2005.5 item1.				Y	
2005.15	low pressure(RFG)	1.PV-2481,USV-2482 abnormally open. 2.Upstream RFG low pressure, same as low/no flow(RFG)2005.6. 3.Flange/gaskets leakage.	Same as low/no flow(RFG)2005.6.	Same as low/no flow(RFG)2005.6.				N	

2005.16	low pressure(D-2001)	1.PV-2361 abnormally open. 2.Manual valve abnormally open at the top of D-2001.	1.Shut down C-3001 and C-3002 and R-3001 due to low pressure HHPS and no production. 2.Decrease the saturated HHPS, and then methanol unit shut down in the worst case. 3.Steam system water hammer and maybe damage the line. 4.Steam condensate maybe consequently enter to turbine and damage. 5.Change in steam balance of unit.	1.PICA-2363 low pressure alarm. 2.PIA-2372 low pressure alarm. 3.PV-2363 close. 4.TICA-2360 low temperature alarm. 5.C-3001 and C-3002 turbine protection system by vendor GE.	3	3	2	N	
2005.17	vacuum	1.Decreasing the temperature of D-2001 during shut down period.	Damage D-2001.	Fully anti-vacuum design.	4	4	4	N	
2005.18	high temperature (D-2001)	1.Same as low/no flow(HHPS) 2005.5 item 2.	Same as low/no flow(HHPS) 2005.5 item 2.	Same as low/no flow(HHPS) 2005.5 item 2.				N	
2005.19	low temperature (D-2001)	1.Same as low/no flow(RFG)2005.6 & low pressure(D-2001) 2005.16.	Same as low/no flow(RFG)2005.6 & low pressure(D-2001) 2005.16.	Same as low/no flow(RFG)2005.6 & low pressure(D-2001) 2005.16.				N	
2005.20	high level(D-2001)	1.Same as high flow(BFW)2005.1.	Same as high flow(BFW)2005.1.	Same as high flow(BFW)2005.1.				N	
2005.21	low level(D-	1.Same as low/no flow(BFW)2005.4.	Same as low/no flow(BFW)2005.4.	Same as low/no flow(BFW)2005.4.				N	

2005.22	heat exchange pipe rupture/leak	1.Same as heat exchange pipe rupture/leak 2003.17.	Same as heat exchange pipe rupture/leak 2003.17.	Same as heat exchange pipe rupture/leak 2003.17.				N	
2005.23	rupture/leak	1.Same as exchanger rupture/leak 2005.22. 2.Flange/gasket or pipe fitting leak.	1.Fire and explosion. 2.CO toxic release.	1.Fire and gas detection system. 2.Fire fighting system.	4	2	2	N	
2005.24	other	1.Same as other 1002.22.	Same as other 1002.22.	Same as other 1002.22.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 2000# AREA

Node description： RFG Cool down and Separation

Drawing no： 2000-PID-014/015/016

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： E-2022 1/2/3(shell side), D-2002, P-2001A/B, E-5023(tube side), D-2003, E-5024 1/2(tube side), D-2004, P-2002A/B, E-2025, AE-2026, E-2027, D-2005, P-2003A/B

Design purpose： RFG cool down to 48 degree C and separate liquid .

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
2006.1	High flow(RFG)	1.Upstream high flow. 2.PV-2481/USV-2482 fail open.	1.Increase the temperature of RFG in the outlet of E-2022 1/2/3. 2.Low liquid level D-2002/2003/2004/2005. 3.High temperature in suction of C-3001 and cause compressor trip due to high discharge temperature. 4.HH water content in the suction compressor led to trip due to HH level in suction drum.	1.LICA-2403/2419/2441/2474 level control and low level alarm. 2.TIA-2476 high temperature alarm. 3.Suction drum high level alarm and trip. 4.Compressor outlet temperature HH trip.	3	4	3	N	
2006.2	High flow(condensate)	[1] 1.LT/LIC/LV-2403 fail open. 2.LV-2403 by pass valve abnormally open due to operator error. 3.low temperature of RFG.	D-2002 level decrease and P-2001A/B cavitation and damage in the worst case.	1.LICA-2403 low level alarm. 2.LSAL-2404 activate IS-33 to trip P-2001A/B and shut off LV-2403.	2	4	2	N	

2006.2	High flow(condensate)	[2] 1.LT/LIC/LV-2441 fail open. 2.LV-2441 by pass valve abnormally open due to operator error. 3.Low temperature of RFG.	D-2004 level decrease and P-2002A/B cavitation and damage in the worst case.	1.LICA-2401 low level alarm. 2.LSAL-2402 activate IS-34 to trip P-2002A/B and shut off LV-2441.	2	4	2	N	
2006.2	High flow(condensate)	[3] 1.LT/LIC/LV-2474 fail open. 2.LV-2474 by pass valve abnormally open due to operator error. 3.Low temperature of RFG.	D-2005 level decrease and P-2003A/B cavitation and damage in the worst case.	1.LICA-2474 low level alarm. 2.LSAL-2474(2oo3) activate IS-35 to trip P-2003A/B and shut off LV-2474.	2	4	2	N	
2006.3	High flow(DMW)	1.High pressure of upstream.	Low temperature of RFG in E-2025 outlet.	1.TI-2444 temperature indicator. 2.TT/TICA-2457 DMW temperature control loop.	2	4	2	N	
2006.4	High flow(CW)	1.High flow of upstream.	High consumption of cool water.	TIA-2476 indicator.	1	3	1	N	
2006.5	low/no flow(RFG)	1.Same as upstream low/no flow(RFG)2005.6.	1.Low temperature of BFW. 2.Low heat duty to distillation unit and inverse effect on product quality or quantity. 3.Low temperature of DMW in E-2025 outlet hence lower deaerator efficiency in removing O2.	1.PICA-3007 low pressure alarm. 2.TI-2402/2444/2472/2476 indicator.	2	4	2	N	
2006.6	low/no flow(condensate)	[1] 1.LT/LIC/LV-2403 fail closed. 2.P-2001 A/B failure.	High level of D-2002.	LICA-2403 high level alarm.	2	4	2	N	

2006.6	low/no flow(condensate)	[2] 1.LT/LIC/LV-2442 fail closed. 2.P-2002 A/B failure.	High level of D-2004.	LICA-2441 high level alarm.	2	4	2	N	
2006.6	low/no flow(condensate)	[3] 1.LT/LIC/LV-2474 fail closed. 2.P-2003 A/B failure.	RFG carry over and liquid enter in to 3000 area cause the C-3001/3002 damage.	1.LICA-2474 high level alarm. 2.LSAH-2474(2oo3) activate IS-40 to trip C-3001/3002. 3.P-2003A/B auto-start spare pump.	4	3	3	Y	
2006.7	low/no flow(DMW)	1.P-7002 A/B failure. 2.LST/LICA-7091 cascade control FIC/FV-7091 fail closed.	1.DMW system outlet temperature increase. 2.D-7001 low level lead BFW losing and damage D-2001/D-3003. 3.High temperature of reformed gas in outlet E-2025 and possibility damage to downstream equipment especially compressor.	1.PSV-2458@14.0bar G. 2.TICA-2457 high temperature alarm. 3.FIC-7091 low flow alarm. 4.LSAL-7091(2oo3) activate IS-70 to trip P-7001 A/B/C. 5.LICA-7091 low level alarm. 6.P-7002 A/B auto-start spare pump.	4	2	2	Y	
2006.8	low/no flow(CW)	1.Cooling water resource supply failure. 2.Manual valve of E-2027 tube side inlet/outlet abnormally close due to operator error. 3.Fouling E-2027 tubes.	1.RFG overtemperature and reduce the capacity of C-3001/3002. 2.Low liquid level in D-2005.	1.TIA-2476 high temperature alarm. 2.LICA-2474 control level and low alarm. 3.LSAL-2474(2oo3) trip IS-35. 4.E-0501 monitoring exchanger in cooling unit to show amount of fouling inside different exchanger.	2	4	2	N	

2006.9	incorrect flow direction	1.Low liquid level in D-2002/2003/2004/2005 lead to reformed gas into condensate line (Same as High flow(condensate) 2006.2). 2.Leakage E-2025/2026/2027 exchanger tube. 3.Human error to open the block valves on H2 line and N2 line.	1.Intering RFG into DMW stream to deaerator. 2.Intering RFG into CWR stream to cooling tower and safety problems.	1.8-type blind plate on N2 line during normal operation. 2.H2 and N2 line normally closed. 3.LICA-2403/2441/2474 control and low level alarm. 4.LSAL-2474(2oo3) trip IS-35. 5.Gas detector in cooling tower(T-0501)	3	4	3	N	
2006.10	reverse flow(RFG)	1.Not possible.						N	
2006.11	part of flow/composition	1.Change composition from upstream. 2.Leakage of E-2025 lead to entering high pressure into DMW.	1.High liquid level in D-2005. 2.Changing inlet gas into C-3001 and hence decreasing efficiency.	1.LICA-2474 control level and high level alarm. 2.LSAH-2474(2oo3) high level trip IS-40. 3.AIA-2479 high CH4 concentration alarm. 4.AP-2480 sample point.	2	4	2	N	
2006.12	as well as flow/impurit	1.Not possible.						N	
2006.13	other than flow/incorrect substance	1.Not possible.						N	
2006.14	high pressure(RFG)	1.Same as high pressure(RFG)2005.13.	Same as high pressure(RFG)2005.13.	Same as high pressure(RFG)2005.13.				N	
2006.15	low pressure(RFG)	1.Same as low pressure(RFG)2005.15.	Same as low pressure(RFG)2005.15.	Same as low pressure(RFG)2005.15.				N	

2006.16	vacuum	1.Not possible.						N	
2006.17	high temperature(RFG)	[1] 1.AE-2026 malfunction.	RFG overtemperature and reduce the capacity of C-3001/3002.	TIA-2476 high temperature alarm.	2	4	2	N	
2006.17	high temperature(RFG)	[2] 1.TT/TIC/TV-5277 fail open. 2.TT/TIC/TV-5064 fail open.	1.T-5003 temperature and pressure decrease, loss of production rate and quality. Refer to 5000 area. 2.T-5001 temperature and pressure decrease, loss of production rate and quality. Refer to 5000 area.					N	
2006.18	high temperature(DMW)	1.TT/TIC/TV-2457 fail closed. 2.High temperature of RFG.	Increase the temperature of DMW if temperature over the boiling point at deaerator pressure, DMW will flash and make vibration.	TICA-2457 high temperature alarm(set point 100 degree C).	2	4	2	N	
2006.19	low temperature(RFG)	[1] 1.FT/FIC/FV-2417 fail open. 2.Low temperature of upstream.	Reformed gas temperature decrease and condense prematurely in E-2022 1 and cause carbonic acid corrosion and water hammer and damage piping.	1.PICA-3007 low pressure alarm. 2.Normal operation condition is 50 degree C above dew point.	2	4	2	N	
2006.19	low temperature(RFG)	[2] 1.TT/TIC/TV-5277 fail closed. 2.TT/TIC/TV-5064 fail closed.	1.T-5003 temperature and pressure decrease. Refer to 5000 area. 2.T-5001 temperature and pressure decrease. Refer to 5000 area.					N	

2006.20	low temperature(DMW)	1.TT/TIC/TV-2457 fail open.	1.High consumption of LPS. 2.High temperature of RFG.	1.TIAH-2476 high RFG temperature alarm. 2.TI-2444 temperature indicator.	2	4	2	N	
2006.21	high level(D-2002/2003/2004/2005)	1.Same as low/no flow(condensate)2006.6.	Same as low/no flow(condensate)2006.6.	Same as low/no flow(condensate)2006.6.				N	
2006.22	low level(D-2002/2003/2004/2005)	1.Same as high flow(condensate)2006.2.	Same as high flow(condensate)2006.2.	Same as high flow(condensate)2006.2.				N	
2006.23	heat exchange pipe rupture/leak	1.Manufacturing deficiency or aging of E-2022 1/2/3, E-2025, E-2027 heat exchange tubes.	1.BFW leak to the RFG line, increase the pressure of RFG system line cause overpressure and RFG leakage. 2.Intering RFG into DMW stream to deaerator. 3.Intering RFG into CWR stream to cooling tower, and fire. 4.Leakage AE-2026 into air and cause fire ans explosion.	1.PV-2481 open and vent to the flare. 2.USV-2482 open and vent to the flare. 3.PSV-2354/2355/2356/2357/2358/2359/2360,6 operate 1 spare. 4.Gas detector in cooling tower(T-0501). 5.Vent of D-7001 into safe location.	2	4	2	N	
2006.24	rupture/leak	1.Flange/gasket or pipe fitting leak.	1.Fire and explosion. 2.CO toxic release.	1.Fire and gas detection system. 2.Fire fighting system.	4	2	2	N	
2006.25	other	1.Same as other 1002.22.	Same as other 1002.22.	Same as other 1002.22.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Methanol synthesis

Node description： Synthesis Gas Compressing

Drawing no： 3000-PID-001

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： C-3001/C-3002, FT-3003 1/2

Design purpose： Synthesis Gas Compressing,24.0~80.0 barG.48~74 degree C.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
3001.1	High flow(Synthesis gas)	1.Refer to node 2005,2006.	1.C-3001/3002 outlet pressure decrease. 2.R-3001 1/2/3 low reaction and cause production decreasing, inert gas increasing. 3.C-3001/3002 overspeed and mechanical failure. 4.Incomplete separation of liquid droplet of synthesis gas cause problems in suction of compressor.	1.C-3001/3002 overspeed trip. 2.FIA-2476 high flow alarm.	4	3	3	Y	1.C-3001/3002 overspeed trip, SIF should be meet SIL 1.(Check with GE) 2.Ask from compressor vendor for the proper safeguard about liquid droplet in compressor.

3001.2	High flow(Recycle gas)	1.Upstream synthesis gas high flow. 2.FT/FIC/FV-3169 fail closed. 3.High speed on synthesis turbine. 4.Overspeed of turbine. 5.Failure of damper(controlling flow of recycle gas).	1.C-3001/3002 circulator inlet pressure decrease, outlet pressure decrease.(Check by GE) 2.R-3001 1/2/3 low reaction and cause production increasing slightly, inert gas increasing. 3.C-3001/3002 overspeed and mechanical failure. 4.Incomplete separation of liquid droplet of synthesis gas cause problems in suction of compressor. 5.Higher pressure drop across the catalyst bed led to damage to catalyst support.	1.C-3001/3002 overspeed trip. 2.FIA-2476 high flow alarm. 3.FIA-3167 high flow alarm. 4.PDIA-3112/3115/3117 high d/p alarm.	4	4	4	N	1.Ask from compressor vendor for the proper safeguard about liquid droplet in compressor. 2.C-3001/3002 circulator inlet pressure decrease, outlet pressure decrease(for recycle gas high flow).(Check by GE)
3001.3	low/no flow(Synthesis gas)	1.Manual valve abnormally closed due to operator error in inlet of C-3001/3002. 2.C-3001 synthesis gas inlet SDV valve abnormally closed. 3.Low/no flow of upstream. 4.Human error to open HV-3011. 5.Failure compressor or turbine.	C-3001/3002 surge and mechanical damage.	1.FIC-500 anti-surge control to open FCV-500.(Refer to GE P&IDs) 2.High vibration trip.	4	3	3	Y	1.High vibration trip, SIF should be meet SIL 1. (Check with GE) 2.Ask from compressor vendor for the proper safeguard about liquid droplet in compressor. 3.Ask and confirm from GE about SIL level.

3001.4	low/no flow(Recycle gas)	1.Upstream synthesis gas low flow. 2.FT/FIC/FV-3169 fail open. 3.C-3002 recycle gas inlet SDV valve abnormally closed. 4.PT/PIC/PV-3166 fail open. 5.Failure of compressor or turbine or damper.	C-3001/3002 surge and mechanical damage.	1.FIC-503 anti-surge control to open FCV-503.(Refer to GE P&IDs) 2.FI-3167 flow indicator.	4	3	3	N	High vibration trip, SIF should be meet SIL 1. (Check with GE)
3001.5	incorrect flow direction	1.Operator mistake in opening HV-3011 or its bypass.	1.Same as low/no flow(synthesis gas) 3001.3 2.Environmental pollution.	1.FIC-500 anti-surge control to open FCV-500.(Refer to GE P&IDs) 2.High vibration trip. 3.PICA-3007 low pressure alarm.	4	3	3	N	
3001.6	reverse flow	1.Surge in compressor.	Damage of compressor.	Anti-surge control.	4	4	4	N	
3001.7	part of flow/composition	1.Same as upstream part of flow/composition.	Changing the molecular weight of synthesis gas and more consumption energy.	AI-3001/3002/3003 CO/CO2/H2 analyzer.	3	4	3	N	
3001.8	as well as flow/impurit	1.Refer to 1000/2000 area.						N	
3001.9	high concentration(synthesis gas)	1.High concentration(synthesis gas) in upstream.	Changing the molecular weight of synthesis gas and more consumption energy.	AI-3001/3002/3003 CO/CO2/H2 analyzer.	3	4	3	N	Check by GE for effect of (cause, consequence, safeguard) changing the molecular weight of synthesis gas.
3001.10	low concentration(synthesis gas)	1.Upstream R-2004 abnormal conversion.	Affect methanol reaction.	AI-3001/3002/3003 CO/CO2/H2 analyzer.				N	Check by GE for effect of (cause, consequence, safeguard) changing the molecular weight of synthesis gas.

3001.11	high pressure	1.C-3001/3002 discharge SDV abnormally closed. 2.High pressure in upstream.	Overpressure and flammable release.	1.PSV-502.(Refer to GE P&IDs) 2.High vibration trip. 3.High temperature trip. 4.Anti-surge control.	4	3	3	Y	
3001.12	low pressure	1.HV-3011 fail open. 2.PV-3166 fail open. 3.FV-3169 fail open. 4.Low pressure in upstream.	Same as low/no flow(Synthesis gas) 3001.3.	Same as low/no flow(Synthesis gas) 3001.3.				N	
3001.13	vacuum	1.Not possible.						N	
3001.14	high temperature	1.Upstream RFG high temperature. 2.C-3001/2 intercooler CW failure. 3.High temperature of D-3001 outlet recycle gas. 4.High pressure in downstream synthesis gas compressor. 5.Low pressure in upstream synthesis gas compressor.	C-3001/3002 overtemperature and mechanical damage.	1.TIA-2476 high temperature alarm. 2.TIA-3164 high temperature alarm. 3.TIA-3113/3116/3118 high temperature alarm. 4.C-3001/3002 package high temperature alarm and trip.	4	3	3	Y	C-3001/3002 package high temperature alarm and trip, SIF should be meet SIL 1. (Check with GE)
3001.15	low temperature	1.Low temperature of upstream. 2.High pressure of compressor suction.	No safety and operation hazard concern.					N	
3001.16	rupture/leak	1.Flange/gasket or pipe fitting leak.	1.Fire and explosion. 2.CO toxic release.	1.Fire and gas detection system. 2.Fire fighting system.	4	2	2	N	
3001.17	other	1.Refer to compressor C-3001/3002 package node.						N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Methanol synthesis

Node description： Methanol Reaction

Drawing no： 3000-PID-003/004

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： R-3001 1/2/3, J-3002 1/2/3,E-3001 1/2/3

Design purpose： RFG react to methanol.inlet temperature 74.0 , outlet temperature246 degree C.operation pressure 77.3~77.8 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
3002.1	High flow(process gas)	1.High flow from compressor discharge.	1.Increased pressure drop and damage catalyst/support. 2.Increased conversion in R-3001 1/2/3 lead to higher MPS production.	1.PDIA-3112/3115/3117 high d/p alarm. 2.FI-3168 total flow indicator. 3.Compressor capacity control system. (Check by GE)	3	2	1	N	1.Ask from GE about cause, consequence and safeguard(for process gas high flow). 2.Compressor capacity control system. (Check by GE)
3002.2	low/no flow(process gas)	1.Low flow from compressor.	1.Reduced R-3001 1/2/3 conversion and temperature decrease. 2.Low/no steam production. 3.Low MeOH production. 4.Consumption of HPS in start-up ejectors. 5.Development of hot spot in reactor tubes.	1.Compressor capacity control system. 2.Proper SOP is considered to start J-3002 1/2/3 when inlet temperature of R-3001 1/2/3 failed to 200 degree C and lower.	3	3	2	N	

3002.3	Mal-distributed flow	1.Uneven pressure drop, restricted flow from reactor R-3001 1/2/3 due to uneven catalyst loading. 2.Unsymmetrically in piping system.	Loss of production.	1.Symmetrical piping 2.R-3001 1/2/3 catalyst loading SOP. 3.PDIA-3112/3115/3117 high d/p alarm. 4.PI-3071/3075/3079 pressure indicator.	3	3	2	N	
3002.4	incorrect flow	1.Not possible.						N	
3002.5	reverse flow	1.Same as reverse flow 3001.6.	Damage to R-3001 1/2/3 catalyst.	Same as reverse flow 3001.6.	3	3	2	N	
3002.6	part of flow/composition	1.Refer to 1000/2000 area.						N	
3002.7	as well as flow/impurity	1.Same as upstream part of flow/composition.	1.Increasing the pressure of synthesis reactor. 2.Increasing the pressure of purge gas to fuel gas system. 3.Loss of production.	1.AI-2479 high CH4 concentration alarm. 2.PIC/PV-3166 high pressure alarm. 3.FV-3169. 4.FIA-3167 high flow alarm.	3	4	3	N	
3002.8	high concentratio	1.Same as high concentration (synthesis gas) 3001.9.	Same as high concentration (synthesis gas) 3001.9.	Same as high concentration (synthesis gas) 3001.9.				N	
3002.9	low concentratio	1.Same as low concentration (synthesis gas) 3001.10.	Same as low concentration (synthesis gas) 3001.10.	Same as low concentration (synthesis gas) 3001.10.				N	
3002.10	high pressure	1.Same as high concentration (synthesis gas) 3001.9. 2.Same as low concentration (synthesis gas) 3001.10.	1.Same as high concentration (synthesis gas) 3001.9. 2.Same as low concentration (synthesis gas) 3001.10.	1.Same as high concentration (synthesis gas) 3001.9. 2.Same as low concentration (synthesis gas) 3001.10.				N	

3002.11	low pressure	1.Lower discharge pressure from compressor 2.High purge rate by failure of FIC/FV-3169 3.Vent open, PIC-3166B/PV-3166 4.Inadvertently open HV-3166 5.FT/FIC/FV-3171 open position too big.	Reduced the production.	1.PIC-3166 A low alarm at HP separator outlet. 2.Comressor control system.	3	3	2	N	
3002.12	vacuum	1.Not possible.						N	
3002.13	high temperature	1.Insufficient cooling for catalyst tubes in R-3001 1/2/3 due to: a.LT/LIC/LV-6021A fail closed or P-6002A/B failure; b.LST/LIC-3042 cascade control FT/FIC/FV-3041 fail closed. Cause a and b simultaneously happen. 2.PV-3042 fail closed lead to high pressure and temperature of steam drum. 3.High temperature in upstream. 4.Low heat removed rate due to scaling on the outer surface of tubes(caused by low BFW quality) and led to high temperature difference.	1.Long term operation at higher temperature will reduce catalyst life time. 2.Reaction runaway in the worst case, exceeding design temperature of reactor R-3001 and downstream equipment. 3.Affect the life time of D-3003. 4.Higher temperature of recycle compressor suction lead to compressor lower efficiency.	1.TIA-3073/3077/3081 high alarm (reactor outlet). 2.PICA-3042 high pressure alarm. 3.LICA-3042 low level alarm. 4.LICA-3043 low level alarm. 5.TIA-3045 high temperature alarm. 6.LSAL-3042(2oo3) low level activate to trip compressor and open PV-2481(1oo2). 7.FV-3041 fully open for water low supply case. 8.Dosing phosphate. 9.Intermittent blowdown from reactors to D-7004.	4	2	2	Y	

3002.14	low temperature	1.Upstream low flow. 2.Upstream low temperature. 3.PV-3042 fail open. 4.Deactivated catalyst hence low reaction rate.	1.R-3001 1/2/3 less reaction, less production rate. 2.Increased wax formation.	1.TIA-3081/3077/3073 (reactor outlet) low temperature alarm. 2.PICA-3042 low pressure alarm.	3	3	2	N	
3002.15	high reaction	1.Same as high temperature 3002.13.	Same as high temperature 3002.13.	Same as high temperature 3002.13.				N	
3002.16	low reaction	1.Same as low temperature 3002.14.	Same as low temperature 3002.14.	Same as low temperature 3002.14.				N	
3002.17	non reaction	1.non actual hazard identify.						N	
3002.18	side reaction	1.Same as high temperature 3002.13 and low temperature 3002.14.	1.Low temperature lead to more wax formation. 2.High temperature lead to more TMA, ethanol, higher alcohols formation.	Same as high temperature 3002.13 and low temperature 3002.14.				N	
3002.19	heat exchange pipe rupture/leak	[1] 1.Manufacturing deficiency or aging of E-3001 1/2/3 heat exchange tubes.	no safety concern.					N	

3002.19	heat exchange pipe rupture/leak	[2] 2.Manufacturing deficiency or aging of R-3001 1/2/3 heat exchange tubes.	Process gas leak into steam system.	1.Check of inerts in MP steam by way of AP 3049,and MeOH in MP blowdown by way of AP 3054. 2.PICA-7034 high pressure alarm in MPS header. 3.PV-7034 open. 4.TIA-7031 high temperature alarm. 5.PSV-7036/7037@45.0barG,1 operator 1 spare. 6.AIA-3053/3055.	3	2	1	N	
3002.20	rupture/leak	1.Flange/gasket or pipe fitting leak.	1.Fire and explosion. 2.CO toxic release.	1.Fire and gas detection system. 2.Fire fighting system	4	2	2	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project
Company name： Middle East Kimiaye Pars Company
Project no：
Process name： Methanol synthesis
Node description： MP Steam Drum
Drawing no： 3000-PID-002

Establish dt：2016/8/10
Plant site：
Risk matrix： 8X7(TCC)
Pipe / equipment no： D-3003, SI-3002
Design purpose： To generate MPS from heat of methanol synthesis reaction .

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
3003.1	High flow(BFW/Condensate)	1.LT/LIC/LV-6021A fail open. 2.FT/FIC/FV-3041 fail open. 3.FV-3041 bypass valve abnormally open due to operator error.	1.High level in D-3003. 2.Liquid carry over to MP steam header.	1.LICA-3042 high level alarm. 2.LICA-3043 high level alarm.	2	4	2	N	
3003.2	High flow(Phosphate)	1.Failure of X-7001.	1.Increased chemical consumption. 2.Increased continuous blowdown.	1.Overconsumption to be seen by operator. 2.Regular analysis of BFW.	2	2	1	N	
3003.3	High flow(intermittent blowdown)	1.HV-3087/3090/3093 spring fail lead to permanent opening of the valve partly.	Waste BFW.		2	2	1	N	Add a proper SOP to operating manual to check leakage from HV-3087/3090/3093.
3003.4	High flow(continuous blowdown)	1.HV-3054 abnormally full open due to operator error. 2.High flow rate of phosphate lead to high concentration and necessity of more blowdown.	Waste BFW.	1.LICA-7251 level indicator. 2.LICA-3042/3043 low level alarm.	2	2	1	N	

3003.5	low/no flow(BFW/Condensate)	1.Low/no flow of condensate from unit 6000 by any reason.	Low liquid level D-3003.	1.LICA-3042 low level alarm. 2.LIA-3043 low level alarm. 3.FV-3041 open.	3	3	2	N	
3003.6	low/no flow(phosphate)	1.Low/no flow of X-7001 failure.	Increased scale formation.	Regular analysis of BFW.	3	2	1	N	AP-3054 for checking concentration of phosphate and proper SOP in operating manual.
3003.7	low/no flow(continuous blowdown)	1.HV-3054 abnormally closed due to operator error. 2.USV-3052 fail closed.	Build up of impurities and affect the quality of MPS and boiler water.	1.Regular analysis of BW. 2.AIA-3055 high alarm (conductivity).	3	2	1	N	AP-3054 for checking concentration of phosphate and proper SOP in operating manual.
3003.8	incorrect flow	1.Not possible.						N	
3003.9	reverse flow	1.P-7052A/B failure.	Back flow of BFW	Two check valves. (before injection point and pump discharge)	2	3	1	N	
3003.10	part of flow/composition	1.Same as low/no flow(phosphate)3003.6. 2.Impurity in BFW.	Same as low/no flow(phosphate)3003.6.	Same as low/no flow(phosphate)3003.6.	3	2	1	N	
3003.11	as well as flow/impurit	1.Impurity in chemicals.	Impurity in BFW.	AP-3054.	3	2	1	N	
3003.12	high concentratio	1.Same as part of flow/composition 3003.10.	Same as part of flow/composition 3003.10.	Same as part of flow/composition 3003.10.				N	
3003.13	low concentratio	1.Same as low/no flow (phosphate)3003.6.	Same as low/no flow (phosphate)3003.6.	Same as low/no flow (phosphate)3003.6.				N	

3003.14	high pressure(D-3003)	[1] 1.PST/PIC/PV-3042 fail closed. 2.D-3003 top manual valves abnormally closed due to operator error.	1.Increasing pressure in the boiler. 2.Potentially exceeding design pressure. 3.Increasing temperature in the reactor and boilers.	1.PICA-3042 high alarm. 2.PSV-3047/3048/3057,2 operate 1 spare.	3	3	2	N	
3003.14	high pressure(D-3003)	[2] 1.Tube rupture in R-3001.	Process gas leak into steam system, potential exceeding design pressure.	Same as heat exchange pipe rupture/leak 3002.19 item 2.	3	2	1	N	
3003.15	low pressure(D-3003)	1.Opening of MP steam header vent valve PV-7034. 2.D-3003 top manual vent valve abormally open. 3.PV-3042 fail open. 4.Low reaction rate in R-3001 1/2/3.	1.Decreasing pressure. 2.Increased evaporation. 3.Loss of steam. 4.Reaction temperature decrease, same as low temperature 3002.14.	1.PICA-3042 low alarm (maintaining pressure in D-3003). 2.Same as low temperature 3002.14.	3	3	2	N	
3003.16	vacuum	1.Blockage of inlet and outlet of steam drum while cooling it.	Damage D-3003.	Design pressure of D-3003 is FV/45 barG.	3	2	1	N	
3003.17	high temperature	1.Same as high pressure(D-3003) 3003.14.	Same as high pressure(D-3003) 3003.14.	Same as high pressure(D-3003) 3003.14.				N	
3003.18	low temperature	1.Same as low pressure(D-3003) 3003.15.	Same as low pressure(D-3003) 3003.15.	Same as low pressure(D-3003) 3003.15.				N	
3003.19	high level	1.Same as high flow(BFW/Condensate)3003.1.	Same as high flow(BFW/Condensate)3003.1.	Same as high flow(BFW/Condensate)3003.1.				N	
3003.20	low/no level	1.Same as low/no flow(BFW/Condensate)3003.5.	1.Same as low/no flow(BFW/Condensate)3003.5. 2.Damage the reactor and catalyst.	Same as low/no flow(BFW/Condensate)3003.5.	3	3	2	N	
3003.21	rupture/leak	1.Flange/gasket or pipe fitting leak.	Injury to the personnel.		3	3	2	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Methanol synthesis

Node description： HP Separation

Drawing no： 3000-PID-005/006

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： AE-3002 1/2/3, E-3003 1/2/3, D-3001

Design purpose： Separate unreacted synthesis gas to purge gas into fuel gas header and recycle gas go back to C-3002 suction. Operation temperature 125~48 Degree C.Operation pressure 77.3~32 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
3004.1	High flow	1.High flow in upstream. 2.PV-3166 fail open cause high flow(vent line tie-in upstream).	1.Less cooling of AE-3002 and E-3003. 2.Liquid entrainment in D-3001 (liquid carry over to compressor causing compressor damage). 3.Loss of production in case of opening PV-3166.	1.Compressor recycle gas inlet FIA-3167 high alarm. 2.D-3001 equipped with demister. 3.PIC-3166A low pressure alarm.	3	3	2	Y	
3004.2	low/no flow	1.Low/no flow of upstream. 2.LV-3161A/B fail closed. 3.PV-3166 fail open cause low/no flow(vent line tie-in downstream). 4.Dampers of recycle gas in compressor closed.	1.Temperature decrease. 2.Loss of production.	1.TIA-3081/3077/3073 (reactor outlet) low temperature alarm. 2.LSAH-3161(2oo3) high level alarm and trip IS-3. 3.LICA-3161 high level alarm.	3	3	2	N	

3004.3	Mal-distribution flow	1.Restricted flow from AE-3002 1/2/3, E-3002 1/2/3 due to uneven arrangement. 2.Unsymmetric design of piping system.	1.Temperature increasing in one pass heat exchangers. 2.Loss of production.	1.Symmetrical piping. 2.TIA-3142/3145/3148 high temperature alarm. 3.TIA-3144/3147/3150 high temperature alarm.	3	3	2	N	
3004.4	incorrect flow	1.Not possible.						N	
3004.5	reverse flow	1.Not possible.						N	
3004.6	as well as flow/impurit	1.Same as impurity in compressor inlet.	Same as impurity in compressor inlet.	Same as impurity in compressor inlet.				N	
3004.7	high concentration	1.Changing composition in upstream.	Loss of production.	1.AI-3001/3002/3003 CO/CO2/H2 analyzer. 2.PV-3166 open and vent inert gas to flare. 3.FV-3169 open and vent inert gas to fuel gas header. 4.FV-3171 open and vent inert gas to fuel gas header.	3	3	2	N	
3004.8	low concentration	1.Same as low concentration 3002.9.	Same as low concentration 3002.9.	Same as low concentration 3002.9.				N	
3004.9	high pressure	1.High pressure in upstream. 2.Insufficient conversion in R-3001. 3.Blockages downstream. 4.External fire. 5.Pressure buildup in synthesis loop due to high inert material concentration.	1.Overpressure and release and loss of production. 2.Leakage cause fire and explosion and toxic release.	1.PICA-3166A high alarm at HP separator outlet, controlling the purge rate. 2.PV-3166 open and vent to flare. 3.PSV-3163@99.0 barG. 4.HV-3166 manually open.	4	3	3	Y	

3004.10	low pressure	1.Low pressure of upstream. 2.HV-3166 abnormally open by human error. 3.PV-3166 fail open.	Loss of production.	1.PIC-3166 low pressure alarm. 2.Low pressure alarm in compressor.(Check by GE)	3	3	2	N	Low pressure alarm in compressor.(Check by GE)
3004.11	vacuum	1.Not possible.						N	
3004.12	high temperature	1.Loss of CW in E-3003 1/2/3. 2.High gas flow. 3.Wax deposit in E-3003 1/2/3. 4.AE-3002 1/2/3 motor failure.	1.Recycle gas temperature increase and damage C-3002 in worst case. 2.Loss of production.	1.TIA-3142/3145/3148, high alarm, outlet air cooler AE-3002 1/2/3. 2.TIA-3144/3147/3150, high alarm outlet E-3003 1/2/3. 3.TIA-3164, high alarm outlet HP separator D-3001. 4.Wax will melt at high temperature and flow away from E-3003 1/2/3. 5.C-3002 high temperature trip.	4	3	3	N	
3004.13	low temperature	1.1.Upstream low temperature. 2.Low air temperature . 3.Low CWS temperature.	No operation and safety hazard.					N	
3004.14	high level	1.LST/LIC/LV-3161A/B fail closed. 2.USV-3172 abnormally closed. 3.Blockage of LV-3161A/B due to wax deposition.	D-3001 level increase then liquid carry over to C-3002 and damage.	1.LICA-3161 high level alarm. 2.LSAH-3161(2oo3) activate IS-03 to trip 3000 area. 3.C-3001/3002 high vibration trip.	4	3	3	Y	

3004.15	low/no level	1.LST/LIC/LV-3161A/B fail open.	High pressure process gas blow off to D-3002, cause D-3002 overpressure and release.	1.LICA-3161 low level alarm. 2.LSAL-3161(2oo3) activate IS-42 to shut off USV-3172. 3.FO-3191 restrict orifice. 4.PICA-3194 high pressure alarm. 5.PV-3194 open. 6.PSV-3196/3197/3206 ,2 operate 1 spare.	4	1	1	Y	
3004.16	heat exchange pipe rupture/leak	1.Manufacturing deficiency or aging of E-3003 1/2/3 and AE-3002 1/2/3 heat exchange tubes.	1.Process gas leak to CW system and cause CW system overpressure and release, danger of fire and explosion in cooling towers. 2.Process gas leak to atmosphere lead to fire and explosion and toxic release.	1.PSV-3143/3146/3149@7.5 barG. 2.Gas detection. (TCC specify tag name) 3.AP-0501 in cooling water inlet line. 4.The drain nozzle of E-3003 1/2/3 outlet line is also used as the sampling point.	4	3	3	Y	1.Selection of cooling tower electrical equipment from explosion proof type. 2.Gas detection. (TCC specify tag name)
3004.17	rupture/leak	1.Same as rupture and leak 3001.16.	Same as rupture and leak 3001.16.	Same as rupture and leak 3001.16.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Methanol synthesis

Node description： LP Separation

Drawing no： 3000-PID-007

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： D-3002

Design purpose： Separate purge gas from raw methanol product .Operation temperature 47 Degree C, operation pressure 32~2 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
3005.1	High flow	1.Same as low/no level 3004.15.	Same as low/no level 3004.15.	1.Same as low/no level 3004.15. 2.LICA-3192 high level alarm. 3.LSAH-3192 high level activate IS-42.	3	3	2	N	
3005.2	low/no flow	1.LV-3161A/B fail closed.	Low liquid level in D-3002 and flow of gas to outlet line.	1.LICA-3192 low level alarm. 2.LSAL-3192 low level activate IS-43.	3	3	2	N	
3005.3	incorrect flow direction	1.High high liquid level in D-3002.	Liquid carry over into purge line.	1.LICA-3192 high level alarm. 2.LSAH-3192 high leve activate IS-42.	3	3	2	N	
3005.4	reverse flow	1.Not possible.						N	

3005.5	high pressure	1.High pressure from upstream. 2.External fire. 3.LV-3192 fail closed.	1.Same as low/no level 3004.15. 2.Higher concentration of gases in liquid.	1.FO-3191 restrict orifice. 2.PICA-3194 high pressure alarm. 3.PV-3194 open. 4.PSV-3196/3197/3206 ,2 operate 1 spare.	3	3	2	N	
3005.6	low pressure	1.Low pressure of upstream. 2.LV-3192 fail open.	No safety concern.	1.PICA-3194 low pressure alarm. 2.PV-3194 close.	2	3	1	N	
3005.7	vacuum	1.Not possible						N	
3005.8	high temperature	1.High temperature of upstream. 2.External fire.	Overpressure, damage to D-3002 and release.	1.PSV-3196/3197/3206 ,2 operate 1 spare. 2.TI-3198 temperature indicator.	4	3	3	N	Gas detector is necessary in D-3002 area.
3005.9	low temperature	1.Low temperature of upstream.	No safety and operation hazard.					N	
3005.10	high level	1.LST/LIC/LV-3192 fail closed. 2.Manual valve from D-3002 to TK-5001 abnormally closed due to operator error. 3.High flow of upstream.	D-3002 level increase, then cause vapor space of D-3002 reduce and PV-3194 open lead liquid go into purge gas line, and damage burner and target tile of H-2001.	1.LICA-3192 high level alarm. 2.PICA-3194 high pressure alarm. 3.LSAH-3192 (2oo3)activate IS-42 to shut off USV-3172 and LV-3161A/B.	3	3	2	Y	
3005.11	low/no level	1.Low/no flow of upstream. 2.LST/LIC/LV-3192 fail open.	Gas flow into liquid outlet line.	1.LICA-3192 low level alarm. 2.LSAL-3192 low level activate IS-43.	3	3	2	N	
3005.12	rupture/leak	1.Flange/gasket or pipe fitting leak.	Fire and explosion.	1.Fire and gas detection system. 2.Fire fighting system.	4	2	2	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 4000 AREA

Node description： Methanol Tank

Drawing no： 4000-PID-001/002

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： TK-4001 1, TK-4001 2, P-4001A/B, D-4001, P-4002

Design purpose： Methanol storage. Operation temperature 48 Degree C, pressure -0.003~0.020 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
4001.1	High flow(TK-4001 1/2)	1.High flow in upstream.	Same as high level(TK-4001 1/2) 4001.15.	Same as high level(TK-4001 1/2) 4001.15.				N	
4001.2	High flow(D-	1.Drain liquid rate into D-4001 is too high.	Same as high level(D-4001) 4001.16.	Same as high level(D-4001) 4001.16.				N	
4001.3	low/no flow(TK-4001 1/2)	1.Low/no flow of inlet liquid from upstream. 2.Blockage of manual valve in the inlet of TK-4001 1/2.	Same as low/no level(TK-4001 1/2)4001.18.	FT/FICQ-4024 flow indicator.	4	3	3	N	1.Add an Automatic Recirculating Valve (ARV) in the discharge of each pump, instead of check valve. 2.Change FV-4022 control valve and bypass to remote control (HIC valve).

4001.4	low/no flow(D-4001)	1.Low/no flow of inlet liquid from upstream. 2.Blockage of manual valve in the inlet of D-4001.	1.Equipment vacuum and failure/rupture, methanol leak to environment 2.Damage to P-4001A/B due to low NPSHa.	1.Fill the sump with sand and cover top surface of pit with concrete. 2.LIAS-4030 low level alarm and low low level trip P-4002.	3	3	2	N	
4001.5	incorrect flow direction	[1] 1.TK-4001 1/2 feed manual valve incorrectly closed/open due to operator error during loading operation. 2.Methanol product pump to TK-5001 due to opertor error and opening the valve on the line 12"-PMP-40-115-B24-N.	1.TK-4001 1/2 high level cause internal floating roof seal damage and methanol overflow. 2.Same as high level(TK-4001 1/2) and low/no level(TK-4001 1/2) 4001.16/18. 3.Mixing of raw methanol and final product.	1.LIA-4009/4010 high level alarm. 2.LSAH-4007/4008 activate I-90/93 to shut off UV-4013/4015. 3.Check valve on the route from P-4001A/B to TK-5001.	4	3	3	Y	
4001.5	incorrect flow direction	[2] 1.TK-4001 1/2 feed manual valve incorrectly closed/open due to operator error during unloading operation.	P-4001 A/B cavitation and damage.	1.LIA-4009/4010 low level alarm. 2.LSAL-4007/4008 activate I-91/92 and IS-90 to shut off USV-4014/4016 and trip P-4001 A/B. 3.Check valve in the discharge of P-4001A/B.	3	4	3	N	
4001.6	reverse flow	1.Not possible.						N	
4001.7	concentration	1.Same as high concentration 5005.5.	Same as high concentration 5005.5.	Same as high concentration 5005.5.				N	

4001.8	as well as flow/impurity	1.Less of NaOH solution dosing in upstream cause TMA residual stay in T-5001 bottom in condition of low pH. 2.Resin saturation with TMA.	Affect product quality.	1.AP-5019 sampling and analysis for raw methanol composition at TK-5001 outlet line. 2.A status signal of failure of dosing unit indicated in central control room. 3.AP-5382 sampling and analysis for refined methanol composition at X-5001A/B outlet line.	3	3	2	N	
4001.9	other than flow/incorrect substance	1.Not possible.						N	
4001.10	high pressure	1.PCV-4025/4027 abnormally open. 2.External fire. 3.High temperature of product.	1.Overpressure, methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.TK-4001 1/2 rupture and failure.	1.BV-4001/4002/4003(TK-4001 1),BV-4004/4005/4006(TK-4001 2) breather valve.(fire retardant) 2.ERM-4008/4009. 3.Gas detector.(TCC specify tag number) 4.Thermoresistive heat detector.(TCC specify tag number) 5.Fire-fighting foam system. 6.CCTV on site. 7.Dike wall around both tanks.	4	3	3	N	1.Delete isolating valve on pressure feedback impulse line of PCV-4025/4027. 2.Change PSV-4001/4002 inlet manual valve from L.C. to L.O. 3.Add PI-4005/4006 high pressure alarm. 4.Gas detector.(TCC specify tag number) 5.Thermoresistive heat detector.(TCC specify tag number)

4001.11	low pressure(TK-4001 1/2)	1.PCV-4025/4027 fail closed lead nitrogen sealing failure during extremes of external low temperature . 2.Methanol liquid level decrease too fast. 3.Environment temperature decrease suddenly such as rain.	1.Pressure in TK-4001 1/2 may be reach to vacuum, failure and rupture of the tank and equipment, methanol leakage, fire, toxic release and environment pollution. 2.Caviation in P-4001A/B due to low NPSHa.	1.BV-4001/4002/4003(TK-4001 1),BV-4004/4005/4006(TK-4001 2) breather valve. 2.Nitrogen seal valve PCV-4025/4027.	4	3	3	N	Add PI-4005/4006 low pressure alarm.
4001.12	low pressure(D-4001)	1.Outlet rate is too high. 2.PCV-4026 fail closed.	Equipment vacuum and failure/rupture, methanol leak to environment.	1.Breather valve BV-4007. 2.Fill the sump with sand and cover top surface of pit with concrete.	3	3	2	N	PCV-4026 shall be equipped with a PG to show pressure inside D-4001 and distance between this PCV and top surface of ground of installation position of D-4001 shall be less than 1.5 meter, otherwise an individual PG shall be dedicated to D-4001.
4001.13	vacuum	1.Same as low pressure(TK-4001 1/2) 4001.11 and low pressure(D-4001) 4001.12.	Same as low pressure(TK-4001 1/2) 4001.11 and low pressure(D-4001) 4001.12.	Same as low pressure(TK-4001 1/2) 4001.11 and low pressure(D-4001) 4001.12.				N	

4001.14	high temperature	1.External fire. 2.High temperature in upstream.	1.Same as high pressure 4001.10. 2.Damage P-4001A/B due to low NPSHa. 3.More vapor pressure of MeOH cause more leakage of methanol vapor to N2 side of tank and produce pollution in the environment.	1.Same as high pressure 4001.10. 2.TIA-4001A~F/4002A~F high temperature alarm. 3.Thermoresistive heat detector. (TCC specify tag number)	4	3	3	N	Thermoresistive heat detector. (TCC specify tag number)
4001.15	low temperature	1.Environment temperature decrease suddenly such as rain. 2.Low temperature in upstream.	Same as low pressure(TK-4001 1/2) 4001.11 and low pressure(D-4001) 4001.12.	1.Same as low pressure(TK-4001 1/2) 4001.11 and low pressure(D-4001) 4001.12. 2.TIA-4001A~F/4002A~F temperature indicator.	4	3	3	N	
4001.16	high level(TK-4001 1/2)	1.P-4001 A/B accidently stop working. 2.UV-4014/4016 fail closed. 3.Inlet or outlet manual valve of P-4001A/B abnormally closed due to operator error. 4.Blockage of strainers in suction of P-4001A/B.	1.Methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.Overflow and incorrect flow direction of MeOH to lines installed on the roof. 3.TK-4001 1/2 high level casue internal floating roof seal damage.	1.LIA-4009/4010 high liquid level alarm. 2.LSAH-4007 activate I-90 to close UV-4013. 3.LSAH-4008 activate I-93 to close UV-4015. 4.Dike wall around both tanks. 5.Gas detector. (TCC specify tag number) 6.CCTV on site.	4	3	3	N	Gas detector. (TCC specify tag number)

4001.17	high level(D-4001)	1.Drain liquid rate into D-4001 is too high. 2.P-4002 outlet manual valve abnormally closed due to operator error. 3.P-4002 failure.	1.Closed drain drum will flood and methanol leak into environment. 2.Filling up instrument hock up lines (BV,LT,PCV) with methanol.	1.LIAS-4030 high level alarm and high high level will start P-4002 automatically. 2.A status signal of the P-4002 unit is indicated in the central control room. 3.The sump is filled up with sand.	3	3	2	N	
4001.18	low/no level(TK-4001 1/2)	1.Low/no flow of inlet liquid from upstream. 2.High flow of outlet stream. 3.Blockage of manual valve in the inlet of TK-4001 1/2.	Damage to P-4001A/B due to low NPSHa.	1.LIA-4009/4010 high level alarm. 2.LSAH-4007/4008 activate I-90/93 to shut off UV-4013/4015.	4	3	3	N	
4001.19	low/no level(D-4001)	1.Rupture of D-4001 or leakage. 2.Low/no flow of inlet liquid from upstream. 3.High flow of outlet stream. 4.Blockage of manual valve in the inlet of D-4001.	1.Equipment vacuum and failure/rupture, methanol leak to environment 2.Damage to P-4001A/B due to low NPSHa.	1.Breather valve BV-4007. 2.Fill the sump with sand and cover top surface of pit with concrete. 3.LIAS-4030 low level alarm and low low level trip P-4002.	3	3	2	N	PCV-4026 shall be equipped with a PG to show pressure inside D-4001 and distance between this PCV and top surface of ground of installation position of D-4001 shall be less than 1.5 meter, otherwise an individual PG shall be dedicated to D-4001.
4001.20	rupture/leak	1.Flange/gaskets leakage. 2.Pipe or equipment stress due to equipment settle or pipe vibration. 3.Leakage due to overflow of D-4001.	Methanol leak and fire explosion, injury personnel and environmental pollution.	1.Gas detector.(TCC specify tag number) 2.Fire-fighting Foam system. 3.CCTV on site.	3	3	2	N	Gas detector. (TCC specify tag number)

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 5000# AREA

Node description： Raw Methanol Buffer Tank.

Drawing no： 5000-PID-001,5000-PID-020

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： TK-5001,T-5005,P-5004A/B

Design purpose： Raw methanol product storage.47 Degree C,1 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
5001.1	High flow	1.High flow of upstream.	1.High pressure of TK-5001, rupture of the tank. 2.High liquid level in TK-5001.	1.PIA-5004 high pressure alarm. 2.PVRV-5007 @-0.003/0.015 barG. 3.PSV-5006 @0.02barG. 4.LIA-5001 high level alarm. 5.N2 sealing above floating roof through PCV-5009.	3	2	1	N	
5001.2	low/no flow	1.P-5001 A/B accidently stop working. 2.FT/FIC/FV-5041 fail closed. 3.Inlet or outlet cut-off manual valve of P-5001A/B abnormally closed due to operator error. 4.Blockage of strainers in suction of P-5001A/B.	1.Overpressure, methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.Low/no flow to T-5001.	1.P-5001 A/B auto-start. 2.LIA-5001 high liquid level alarm. 3.LSAH-5002 activate IS-44 to close LV-3192 and FV-5020.	4	3	3	Y	

5001.3	incorrect flow direction	1.High pressure in upstream.	Raw MeOH go to MeOH from BL, drain from pumps, MeOH from X-5001, MeOH from E-5008, MeOH to X-5001A/B, MeOH from E-5012, MeOH to X-5001A/B, NaOH from X-5003, off-spec MeOH from pumps, MeOH from P-5008A/B/C and min. flow of P-5001A/B stream.	1.Check valves to protect reverse flow. 2.High pressure of pump outlet in comparison with TK-5001 inlet.	3	3	2	N	
5001.4	reverse flow	1.Not possible.						N	
5001.5	part of flow/composition	1.P-5070 A/B NaOH solution dosing pump failure. 2.X-5003 outlet cut-off valve abnormal closed by people wrong operation . 3.DMW system has problem or the DMW inlet line cut-off valve is abnormal closed. 4.Changing composition in upstream. 5.Failure of mixer motor of TK-5050.	1.Raw methanol is acidic, and downstream equipments and pipes may be corroded. 2.Affect product quality.	1.AP-5019 sampling and analysis for raw methanol composition at TK-5001 outlet line. 2.A status signal of failure of dosing unit indicated in central control room.	3	4	3	N	
5001.6	as well as flow/impurity	1.Impurity in solid NaOH feed to X-5003. 2.Impurity in upstream.	Affect process condensate quality, no operation and safety hazard in this node.					N	Solid NaOH have to be supplied from high quality and low impurity type.

5001.7	other than flow/incorrect substance	1.Human error in feeding the TK-5050 by wrong material.	1.Corrosion in downstream equipment. 2.Loss of high quality product and in worst case loss of product.	Proper SOP shall be added to operation manual.	4	3	3	N	Proper SOP shall be added to operation manual (for TK-5050).
5001.8	high concentration(NaOH)	1.Failure in X-5003 dosing system.	High NaOH concentration in condensate delivered to saturation unit lead to more blowdown.	AP-5019 sampling point to analyze Na+ concentration.	2	3	1	N	
5001.9	low concentration(NaOH)	1.Same as part of flow/composition 5001.5.	Same as part of flow/composition 5001.5.	Same as part of flow/composition 5001.5.				N	
5001.10	high pressure	1.High level lead high pressure in case of : a.P-5001 A/B accidently stop working. b.FT/FIC/FV-5041 fail closed. c.Inlet or outlet cut-off manual valve of pump abnormally closed due to operator error. 2.PCV-5009 abnormally open. 3.External fire. 4.High flow of upstream.	1.Overpressure, methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.TK-5001 rupture and failure.	1.P-5001 A/B auto-start. 2.PIA-5004 high pressure alarm. 3.PVRV-5007 breathing valve. 4.PSV-5006@0.020 barG. 5.Gas detector.(TCC specify tag number) 6.Thermoresistive heat detector.(TCC specify tag number) 7.Fire-fighting Foam system. 8.CCTV on site.	4	3	3	Y	1.Gas detector. (TCC specify tag number) 2.Thermoresistive heat detector. (TCC specify tag number)

5001.11	low pressure	1.Raw methanol liquid level decrease too fast. 2.Environment temperature decrease suddenly such as rain.	1.Pressure in TK-5001 may be reach to vacuum, failure and rupture of the tank and equipment, methanol leakage, fire, toxic release and environment pollution. 2.Caviation in P-5001A/B due to low NPSHa.	1.Nitrogen seal valve PCV-5009. 2.PVRV-5007 breathing valve. 3.PIA-5004 low pressure alarm .	4	2	2	N	
5001.12	vacuum	1.Same as low pressure 5001.11.	Same as low pressure 5001.11.	Same as low pressure 5001.11.				N	
5001.13	high temperature	1.Upstream methanol high temperature.	1.Overpressure, methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.Caviation and damage P-5001A/B due to low NPSHa.	1.PIA-5004 high pressure alarm. 2.PVRV-5007 breathing valve. 3.PSV-5006@0.020 barG. 4.Gas detector. (TCC specify tag number) 5.Thermoresistive heat detector. (TCC specify tag number) 6.Fire-fighting Foam system. 7.CCTV on site.	4	3	3	N	1.Gas detector. (TCC specify tag number) 2.Thermoresistive heat detector. (TCC specify tag number)
5001.14	low temperature	1.Since effect of low temperature in decreasing pressure is marginal, so this deviation has not safety or operation hazard.						N	

5001.15	high level	1.P-5001 A/B accidently stop working. 2.FT/FIC/FV-5041 fail closed. 3.Inlet or outlet cut-off manual valve of P-5001A/B abnormally closed due to operator error. 4.Blockage of strainers in suction of P-5001A/B.	1.Overpressure, methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.Low/no flow to T-5001. 3.Overflow and incorrect flow direction of MeOH to lines installed on the roof.	1.P-5001 A/B auto-start. 2.LIA-5001 high liquid level alarm. 3.LSAH-5002 activate IS-44 to close LV-3192 and FV-5020.	4	3	3	N	
5001.16	low/no level	1.Low/no flow of inlet liquid from upstream. 2.High flow of outlet stream. 3.Blockage of manual valve in the inlet of TK-5001.	1.Vacuum in TK-5001, failure and rupture of tank, methanol leakage, fire, explosion, toxic release. 2.Low/no flow to T-5001. 3.Damage to P-5001A/B due to low NPSHa.	1.LIA-5001 low liquid level alarm. 2.LSAL-5002 activate IS-53 to trip P-5001A/B. 3.PCV-5009 to inject N2 and break the vacuum. 4.PVRV-5007.	4	2	2	N	
5001.17	rupture/leak	1.Same as rupture/leak 4001.20.	Same as rupture/leak 4001.20.	Same as rupture/leak 4001.20.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 5000# AREA

Node description： Stabilizer Column

Drawing no： 5000-PID-002/003/004/005

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： T-5001,E-5024 1/2(shell side), E-5001,D-5009,P-5011A/B,E-7003 1,AE-5004,D-5001,P-5003A/B,E-5010,P-5002A/B

Design purpose： To separate inert and methanol/water. Overhead temperature 78 Degree C, pressure 0.7 barG. Bottom temperature 88 Degree C, pressure 1 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
5002.1	High flow(inlet)	1.FV-5041 fail open. 2.FV-5041 bypass abnormally open.	Same as high level(T-5001)5002.13.	1.Same as high level(T-5001)5002.13. 2.FIC-5041 flow indicator.				N	
5002.2	High flow(outlet)	1.Same as low/no level (T-5001)5002.15.	Same as low/no level (T-5001)5002.15.	Same as low/no level (T-5001)5002.15.				N	
5002.3	High flow(reflux)	1.Same as low/no level (D-5001)5002.16.	Same as low/no level (D-5001)5002.16.	Same as low/no level (D-5001)5002.16.				N	
5002.4	low/no flow(inlet)	1.Low/no flow in upstream. 2.FT/FIC/FV-5041 fail closed. 3.Inlet or outlet manual valve of control valve abnormally closed due to operator error.	1.T-5001 liquid level decrease, the tower may evaporated to dryness. 2.Shutdown of distillation unit and loss of production.	1.P-5001 A/B auto-start. 2.LICA-5041 low liquid level alarm. 3.LSAL-5042 activate IS-54 to trip P-5002 A/B. 4.FIC-5041 flow indicator.	3	3	2	N	

5002.5	low/no flow(outlet)	1.P-5002A/B failure. 2.FT/FIC/FV-5161 fail closed. 3.Human error in closeing block valve upstream and downstream of P-5002A/B. 4.P-5002A/B strainers blockage.	Same as high level(T-5001)5002.13.	Same as high level(T-5001)5002.13.				N	
5002.6	low/no flow(reflux)	1.FT/FIC/FV-5093 fail closed. 2.P-5003 A/B failure. 3.Low/no heating inside reboilers E-5024 1/2.	1.Same as high level(D-5001) 5002.14. 2.Insufficient separation due to low recycle inside the tower.	Same as high level(D-5001) 5002.14.				N	
5002.7	as well as flow/impurity	1.Impurity in upstream. 2.Failure of E-5010 tubes.	1.Same as part of flow 5001.5. 2.Impurity in process condensate from distillation to saturation unit.	1.Same as part of flow 5001.5. 2.AP-5044/5052/5053/5055/5056/5057/5098 sampling point.	4	3	3	N	
5002.8	high pressure	1.PT/PIC/PV-5091B fail closed. 2.AE-5004 accidently stop working. 3.TT/TIC/TV-5064 abnormally close during low capacity loading. 4.PV-5069 abnormally open.	1.T-5001 will overpressure. 2.Pocess gas/liquid leaked to environment causing pollution or fire and injury to personnel. 3.Incomplete separation of dissolved gases.(no operation hazard since they will be separated in storage tank)	1.PICA-5091 high pressure alarm. 2.PIA-5047 high pressure alarm. 3.PV-5109 open and vent to the flare. 4.PSV-5058/5059/5060/5061,3 operate 1 spare.	3	3	2	Y	

5002.9	low pressure	1.FT/FIC/FV-5093 fail open, high reflux rate to T-5001. 2.PV-5091B,PV-5109 abnormally open. 3.TV-5064 fail open. 4.Ambient low temperature, lead to low temperature AE-5004 outlet and CWS to E-5010.	Light end separation efficiency increase, no safety and operation hazard(before vacuum).	FICA-5093 high flow alarm.				N	
5002.10	vacuum	1.Same as low pressure 5002.9.	Damage to exchanger, accumulator, and column.	Design pressure of T-5001, E-5024 1/2, E-5001, E-5010, D-5001, AE-5004 is FV/3.5 barG.	3	2	1	N	
5002.11	high temperature	1.Same as high pressure 5002.8.	Same as high pressure 5002.8.(high temperature help better separation of dissolved gases)	Same as high pressure 5002.8.				N	
5002.12	low temperature	1.Same as low pressure 5002.9.	Same as low pressure 5002.9.(low temperature cause a bit lower separation of dissolved gases)	Same as low pressure 5002.9.				N	

5002.13	high level(T-5001)	1.FV-5041 fail open. 2.FV-5041 bypass abnormally open. 3.P-5002A/B stop working accidently. 4.FT/FIC/FV-5161 fail closed. 5.High reflux (FT/FIC/FV-5093 fail open, human error in opening bypass of FV-5093, human error in starting both P-5003A/B at same time)	1.T-5001 liquid level increase, the tower may flood, damage column tray. 2.Loss of production.	1.LICA-5041 high liquid level alarm. 2.LIA-5042 high liquid level alarm. 3.P-5002 A/B auto-start. 4.Enough volume in the bottom of T-5001 to collect all of liquid inside E-5024 1/2, E-5001, and all trays inside T-5001 even in HH/LL after shutdown (D-5001 shall be kept full of liquid).	3	3	2	N	
5002.14	high level(D-5001)	1.P-5003A/B failure. 2.Blockage of strainers of P-5003A/B. 3.FT/FIC/FV-5093 failed closed.	1.Liquid carry over to coolers and fuel system. 2.Loss of production due to shutdown.	1.LICA-5093 high level alarm. 2.LIA-5094 high level alarm. 3.P-5003 A/B auto-start.	2	4	2	N	
5002.15	low/no level(T-5001)	1.FV-5041 stocked at an closed position. 2.FT/FIC/FV-5161 fail open. 3.FV-5161 bypass valve abnormally open.	P-5002 A/B cavitation.	1.LICA-5041 has low level alarm. 2.LICA-5042 activate IS-54 to trip P-5002A/B.	2	3	1	N	
5002.16	low/no level(D-5001)	1.FT/FIC/FV-5093 fail open. 2.FV-5093 bypass manual valve abnormally open due to operator error. 3.TV-5064 fail open. 4.AE-5004 failure.	1.P-5003 A/B cavitation and damage. 2.Poor separation of dissolved gases.	1.LICA-5093 low level alarm. 2.LSAL-5094 activate IS-56 to trip P-5003 A/B.	3	3	2	N	

5002.17	heat exchange pipe rupture/leak(E-5024 1/2)	1.Exchanger tube rupture/leak due to manufacturing deficiency, aging or corrosion. 2.Human error in opening manual valve for drain E-5024 1/2, lead to low liquid level inside exchangers.	Process gas(25.3 bar) leak into T-5001 and go into fuel gas system.	1.PIA-5047 high pressure alarm for big leakage. 2.AP-5052/5053/5055/5056/5057 sampling point to analysis H2.	3	3	2	N	Add sampling point at E-5024 1/2 shell side outlet.
5002.18	heat exchange pipe rupture/leak(E-5010)	1.Exchange tube rupture/leak due to manufacturing deficiency, aging or corrosion.	1.CW leak to process side, no safety concern. 2.Pollution of condensate with chemical in the cooling water.	AP-5052/5053(from liquid inside the tower over the feed injection point).	2	2	1	N	
5002.19	heat exchange pipe rupture/leak(E-5001)	1.Exchanger tube rupture/leak due to manufacturing deficiency, aging or corrosion. 2.Human error in opening manual valve for drain E-5001, lead to low liquid level inside exchangers.	LPS leak to process side ,no safety concern.	Design temperature of E-5001 tube side is 340 degree C.	2	2	1	N	
5002.20	rupture/leak	1.Flange/gaskets leakage. 2.Pipe or equipment stress due to equipment settle or pipe vibration.	Methanol leak and fire.	1.Metal hose. 2.Gas detector. (TCC specify tag number) 3.Thermoresistive heat detector. (TCC specify tag number) 4.CCTV on site.	4	2	2	N	1.Gas detector. (TCC specify tag number) 2.Thermoresistive heat detector. (TCC specify tag number)

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 5000# AREA

Node description： LP Methanol Column

Drawing no： 5000-PID-006/007/008/009; 5000-PID-006/007/008/009

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： T-5002, E-5002 1/2/3/4(shell side), AE-5005, D-5002, P-5004A/B, E-5008, P-5005A/B

Design purpose： To separate methanol and methanol/water. Overhead temperature 67 Degree C, pressure 0.1 barG. Bottom temperature 86 Degree C, pressure 0.7 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
5003.1	High flow(inlet)	1.FV-5161 fail open. 2.FV-5161 bypass abnormally open. 3.High flow in upstream.	1.Same as high level (T-5002)5003.13. 2.Decrease product quality.	Same as high level (T-5002)5003.13.				N	
5003.2	High flow(outlet)	1.Same as low/no level (T-5002)5003.15.	Same as low/no level (T-5002)5003.15.	Same as low/no level (T-5002)5003.15.				N	
5003.3	High flow(reflux)	1.Same as low/no level(D-5002)5003.16.	Same as low/no level(D-5002)5003.16.	Same as low/no level(D-5002)5003.16.				N	
5003.4	low/no flow(inlet)	1.FV-5161 fail closed.	Same as low/no level (T-5002)5003.15.	Same as low/no level (T-5002)5003.15.				N	
5003.5	low/no flow(outlet)	1.Same as high level(T-5002)5003.13.	Same as high level(T-5002)5003.13.	Same as high level(T-5002)5003.13.				N	
5003.6	low/no flow(reflux)	1.FT/FIC/FV-5203 fail closed. 2.P-5004 A/B failure.	Same as high pressure 5003.8.	Same as high pressure 5003.8.				N	
5003.7	as well as flow/impurit	1.Same as as well as flow/impurity 5001.6.	Same as as well as flow/impurity 5001.6.	Same as as well as flow/impurity 5001.6.				N	

5003.8	high pressure	1.FT/FIC/FV-5203 fail closed. 2.P-5004 A/B failure. 3.AE-5005 failure. 4.Overheating of reboilers.	1.Equipments overpressure, process gas/liquid leaked to environment causing pollution, toxic release, injury personnel, fire, explosion. 2.Loss of production (without changing quality).	1.PICA-5207 high pressure alarm. 2.PSAH-5207 activate IS-04 to close USV-5302 and trip part of 5000 area. 3.PST/PIC/PV-5207A/B pressure control. 4.PSV-5179/5180@3.5 barG,1 operate 1 spare. 5.P-5004A/B auto-start. 6.TI-5177/5184/5208 and temperature indicators on the T-5002.	3	3	2	Y	
5003.9	low pressure	1.FT/FIC/FV-5203 fail open. 2.PV-5207A fail closed. 3.Low heating in reboilers(E-5002 1/2/3/4).	T-5002 may go under vacuum, damage to column and equipment.	1.FICA-5203 high flow alarm. 2.Design pressure of T-5002 and D-5002 are fully vacuum. 3.PICA-5207 low pressure alarm.	3	2	1	N	
5003.10	vacuum	1.Same as low pressure 5003.9.	Same as low pressure 5003.9.	Same as low pressure 5003.9.				N	
5003.11	high temperature	1.Same as high pressure 5003.8.	Same as high pressure 5003.8.	Same as high pressure 5003.8.				N	
5003.12	low temperature	1.Same as low pressure 5003.9.	Same as low pressure 5003.9.	Same as low pressure 5003.9.				N	

5003.13	high level(T-5002)	1.FV-5161 stocked at an open position. 2.FV-5161 bypass abnormally open. 3.P-5005A/B stop working accidently. 4.FT/FIC/FV-5239 fail closed. 5.High liquid inlet from upstream. 6.Human error in closing upstream and downstream manual valve of P-5005A/B. 7.P-5005A/B strainers blockage.	1.T-5002 liquid level increase, the tower may flood, damage column tray. 2.Shutdown of distillation unit and loss of production.	1.LICA-5161 high liquid level alarm. 2.LIA-5162 high liquid level alarm. 3.P-5005 A/B auto-start.	3	3	2	N	
5003.14	high level(D-5002)	1.P-5004A/B failure. 2.FT/FIC/FV-5203 or FT/FIC/FV-5337 failed closed. 3.Overheating in reboilers(E-5002 1/2/3/4).	1.D-5002 high pressure. 2.Liquid carry over back to inlet line and outlet line maybe cause blockage of inlet, lead T-5002 overpressure, process gas/liquid leaked to environment causing pollution, injury personnel, fire and explosion. 3.T-5002 distillation failure. 4.Loss of production due to shutdown.	1.LICA-5203 high level alarm. 2.LIA-5204 high level alarm. 3.P-5005 A/B auto-start. 4.FICA-5203 low flow alarm. 5.PSAH-5207 activate IS-04 to trip part of 5000 area. 6.PSV-5179/5180@3.5 barG,1 operate 1 spare.	3	3	2	Y	
5003.15	low/no level(T-5002)	1.FV-5161 fail closed. 2.FT/FIC/FV-5239 fail open. 3.FV-5239 bypass valve abnormally open.	P-5005A/B cavitation.	1.LICA-5161 has low level alarm. 2.LSAL-5162 activate IS-57 to trip P-5005 A/B.	3	3	2	N	

5003.16	low/no level (D-5002)	1.FT/FIC/FV-5203 fail open. 2.FV-5203 bypass manual valve abnormally open due to operator error. 3.FT/FIC/FV-5337 fail open. 4.FV-5337 bypass manual valve abnormally open due to operator error. 5.Lower heating in reboilers(E-5002 1/2/3/4).	1.P-5004 A/B cavitation and damage. 2.Low production rate and product quality.	1.LICA-5203 low level alarm. 2.LSAL-5204 activate IS-58 to trip P-5004 A/B. 3.PT/PIC-5207 / PV-5207A to control the pressure.	3	3	2	N	
5003.17	heat exchange pipe rupture/leak(E-5002 1/2/3/4)	1.Exchange tube rupture/leak due to manufacturing deficiency, aging or corrosion.	Methanol (2.7 barG) leak into T-5002, no safety concern.					N	Proper design, material, procedure considered and qualified vendor shall supply the exchanger (for E-5002 1/2/3/4).
5003.18	plate heat exchange failure(E-5008)	1.Exchange failure due to manufacturing deficiency, aging or corrosion.	Methanol leak into CW system cause CW pollution and high pressure, lead to algae growth.	1.E-5008 outlet sampling point(for small leak). 2.PSV-5220@7.5 barG(for the worst case). 3.AP-0501 to analysis MeOH content. 4.NaClO injection into cooling water. 5.Use of bypass of PSV-5220 as sample point.	3	3	2	N	
5003.19	rupture/leak	1.Same as rupture/leak 5002.20.	1.Same as rupture/leak 5002.20. 2.MeOH leakage to atmosphere lead to injury to personnel in long time.	Same as rupture/leak 5002.20.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 5000# AREA

Node description： MP Methanol Column

Drawing no： 5000-PID-010/011/012/013

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： T-5003, E-5023(shell side), E-5003 1/2, E-7003 2, E-5002 1/2/3/4(tube side), D-5003, P-5006A/B, E-5012, P-5007A/B, AE-5006, E-5007, P-5010A/B

Design purpose： To separate water and methanol. Overhead temperature 102 Degree C, pressure 2.7 barG. Bottom temperature 149 Degree C, pressure 3.6 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
5004.1	High flow(inlet)	1.FV-5239 fail open. 2.FV-5239 bypass abnormally open.	Same as high level (T-5003)5004.13.	Same as high level (T-5003)5004.13.				N	
5004.2	High flow(bottom product)	1.FT/FIC/FV-5367 fail open. 2.FV-5367 bypass valve abnormally open. 3.Fail open of FV-5020.	Same as low/no level (T-5003)5004.15.	Same as low/no level (T-5003)5004.15.				N	

5004.3	High flow(reflux)	1.FT/FIC/FV-5321 fail open. 2.FV-5321 bypass manual valve abnormally open due to operator error. 3.FT/FIC/FV-5336 fail open. 4.FV-5336 bypass manual valve abnormally open due to operator error. 5.Lower heating in reboilers(E-5023, E-5003 1/2).	Same as low/no level(D-5003)5004.16.	Same as low/no level(D-5003)5004.16.				N	
5004.4	low/no flow(inlet)	1.FV-5239 fail closed.	Same as low/no level (T-5003)5004.15.	Same as low/no level (T-5003)5004.15.				N	
5004.5	low/no flow(bottom product)	1.Same as high level(T-5003)5004.13.	Same as high level(T-5003)5004.13.	Same as high level(T-5003)5004.13.				N	
5004.6	low/no flow(reflux)	1.FT/FIC/FV-5321 fail closed.	Same as high pressure 5004.8.	Same as high pressure 5004.8.				N	
5004.7	as well as flow/impurity	1.Impurity in solid NaOH feed to X-5003. 2.Impurity in upstream.	1.Affect process condensate quality. 2.Bad quality of product if impurity can be appeared in final product.					N	Supply pure chemical from qualified vendor and check the quality in each purchase (for solid NaOH).

5004.8	high pressure	1.FT/FIC/FV-5321 fail closed. 2.P-5006 A/B failure. 3.E-5002 1/2/3/4 tube side partial condensed. 4.Overheating of reboilers.	1.Equipments overpressure, process gas/liquid leaked to environment causing pollution, toxic relerse, injury personnel, fire, explosion. 2.Loss of production. 3.Change the composition of distillate product and bottom product.(in case of no reflux)	1.PIA-5260 high pressure alarm. 2.TIA-5280 high temperature alarm. 3.Multiple temperature high alarm on T-5003. 4.PSV-5250/5251/5261,2 operate 1 spare. 5.P-5006A/B auto-start. 6.HV-5338 operated by operator checking PIA-5252 in high pressure case.	4	3	3	N	
5004.9	low pressure	1.Low heating in reboilers(E-5023,E-5003 1/2). 2.FT/FIC/FV-5321 fail open. 3.HV-5338 fail open. 4.TV-5277 fail open. 5.USV-5302 fail closed.	1.Distilation process disturbed and economic loss will appear. 2.T-5003 may go under vacuum, damage to column and equipment.	1.FICA-5321 high flow alarm. 2.Design pressure of T-5003 and D-5003 are fully vacuum. 3.PICA-5252 low pressure alarm. 4.TICA-5277 high temperature alarm. 5.FICA-5301 flow indicator. 6.Multiple temperature low alarm on T-5003.	3	2	1	N	
5004.10	vacuum	1.Same as low pressure 5004.9.	Same as low pressure 5004.9.	Same as low pressure 5004.9.				N	
5004.11	high temperature	1.Same as high pressure 5004.8.	Same as high pressure 5004.8.	Same as high pressure 5004.8.				N	
5004.12	low temperature	1.Same as low pressure 5003.9.	Same as low pressure 5003.9.	Same as low pressure 5003.9.				N	

5004.13	high level(T-5003)	1.FV-5239 fail open. 2.FV-5239 bypass abnormally open. 3.P-5010 A/B stop working accidently. 4.P-5007 A/B stop working accidently. 5.FT/FIC/FV-5367 fail closed. 6.High liquid inlet from upstream. 7.Human error in closing upstream and downstream manual valve of P-5010A/B. 8.P-5010A/B strainers blockage.	1.T-5003 liquid level increase, the tower may flood, damage column tray. 2.Shutdown of distillation unit and loss of production.	1.LICA-5270 high liquid level alarm. 2.LIA-5271 high liquid level alarm. 3.P-5007 A/B auto-start.	3	2	1	N	
5004.14	high level(D-5003)	1.P-5006 A/B failure. 2.FT/FIC/FV-5321 or FT/FIC/FV-5336 failed closed. 3.Overheating in reboilers(E-5023,E-5003 1/2).	1.D-5003 high pressure. 2.Liquid carry over to flare. 3.Accumulator may get flood and loss of methanol production condensate due to accumulation in pipes. 4.T-5003 distillation failure. 5.Loss of production due to shutdown.	1.LICA-5321 high level alarm. 2.P-5006 A/B auto-start. 3.FICA-5321,FICA-5336 low flow alarm. 4.PSV-5250/5260/5261,2 operate 1 spare.	2	4	2	Y	
5004.15	low/no level(T-5003)	1.FV-5239 fail closed. 2.FT/FIC/FV-5367 fail open. 3.FV-5367 bypass valve abnormally open.	1.P-5010 A/B cavitation. 2.P-5007 A/B cavitation.	1.LICA-5270 has low level alarm. 2.LSAL-5271 activate IS-59 to trip P-5007 A/B and P-5010 A/B.	3	3	2	N	

5004.16	low/no level (D-5003)	1.FT/FIC/FV-5321 fail open. 2.FV-5321 bypass manual valve abnormally open due to operator error. 3.FT/FIC/FV-5336 fail open. 4.FV-5336 bypass manual valve abnormally open due to operator error. 5.Lower heating in reboilers(E-5023, E-5003 1/2).	1.P-5006 A/B cavitation and damage. 2.Low production rate and product quality.	1.LICA-5321 low level alarm. 2.LSAL-5322 activate IS-60 to trip P-5006 A/B.	3	3	2	N	
5004.17	heat exchange pipe rupture/leak(E-5023)	1.Exchange tube rupture/leak due to manufacturing deficiency, aging or corrosion.	1.Process gas(25.3 bar) leak into T-5003 and shall go into the flare. 2.Loss of production due to non condensable gases in D-5003 lead to high pressure in this vessel.	1.PIA-5260 high pressure alarm for big leakage. 2.Probability of vent to flare via HV-5338.	3	3	2	N	Add sampling point at E-5023 shell side outlet.
5004.18	heat exchange pipe rupture/leak(E-5003 1/2)	1.Exchange tube rupture/leak due to manufacturing deficiency, aging or corrosion.	LPS (7.5 barG) leak into T-5003.	AP-5274				N	Choose a qualified and high quality vendor (for E-5003 1/2).
5004.19	heat exchange pipe rupture/leak(E-5012)	1.Exchange tube rupture/leak due to manufacturing deficiency, aging or corrosion.	Methanol leak into CW system cause CW pollution and high pressure, lead to algae growth.	1.E-5012 outlet sampling point.(for small leak). 2.PSV-5339@7.5 barG(for the worst case). 3.AP-0501 to analysis MeOH content. 4.Use of bypass of PSV-5339 as sample point.	2	3	1	N	
5004.20	rupture/leak	1.Same as rupture/leak 5002.20.	Same as rupture/leak 5002.20.	Same as rupture/leak 5002.20.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 5000# AREA

Node description： Product Polisher

Drawing no： 5000-PID-014

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： X-5001A/B

Design purpose： Remove TMA. Operation temperature 48 Degree C, pressure 3 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
5005.1	High flow	1.High from upstream.	Resin loss rate is more than expected and affect product quality, no safety concern.	1.X-5001 A/B outlet filter. 2.AP-5382.	2	3	1	N	
5005.2	low/no flow	1.No/low from upstream.	Production decreasing.	FICA-5336/5337 low flow alarm.	3	2	1	N	Position of AP-5382 should be change to X-5001A outlet and also a same analytic point to X-5001B shall be added.
5005.3	incorrect flow direction	1.Not possible.						N	

5005.4	high concentration(TMA)	1.Less of NaOH solution dosing in upstream cause TMA residual stay in T-5001 bottom in condition of low pH. 2.Resin saturation with TMA.	Affect product quality.	1.AP-5019 sampling and analysis for raw methanol composition at TK-5001 outlet line. 2.A status signal of failure of dosing unit indicated in central control room. 3.AP-5382 sampling and analysis for refined methanol composition at X-5001A/B outlet line.	3	3	2	N	
5005.5	high concentration	1.Change composition in upstream. 2.Failure of resin inside X-5001A/B.	Change composition in X-5001A/B outlet.	1.Sample point in upstream 2.AP-5382.	3	3	2	N	
5005.6	high pressure	[1] 1.X-5001 A/B outlet manual valve abnormally closed due to operator error. 2.Filter blocked. 3.Upstream high pressure.	1.X-5001 A/B pressure increase. 2.Affect methanol production	FICA-5336,FICA-5337 low flow alarm.	3	3	2	N	
5005.6	high pressure	[2] 1.External fire.	X-5001 A/B overpressure lead rupture and fire/explosion.	PSV-5384/5386@19 barG.	3	2	1	N	
5005.7	low pressure	1.Low pressure of upstream.	Same as low/no flow 5005.2.	1.PI-5387 pressure indicator. 2.FICA-5336/5337 low flow alarm.	3	2	1	N	
5005.8	vacuum	1.Not possible						N	
5005.9	high temperature	1.High temperature in upstream.	Affect TMA removal and impact product quality.	1.AP-5382. 2.TIA-5381 high temperature alarm.	2	4	2	N	

5005.10	low temperature	1.Low temperature in upstream.	no safety and operation concern					N	
5005.11	rupture/leak	1.Same as rupture/leak 5002.20.	Same as rupture/leak 5002.20.	Same as rupture/leak 5002.20.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： 5000# AREA

Node description： Methanol Product Buffer Tank

Drawing no： 5000-PID-015/016/017

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： TK-5002 1, P-5012A/B, TK-5002 2, P-5008A/B/C, TK-5003, P-5009A/B, E-5011

Design purpose： Methanol product storage(TK-5002 1/2),liquid off-stream storage(TK-5003).Operation temperature 48 Degree C, pressure -0.006~0.02 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
5006.1	high pressure(TK-5002 1/2)	1.Human error in closeing valve of gas vent line. 2.PCV-5395/5412 abnormally open. 3.External fire. 4.High temperature of product.	1.Overpressure, methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.TK-5002 1/2 rupture and failure.	1.PIA-5398/5415 high pressure alarm. 2.PVRV-5401/5418@-0.003/0.015 barG breathing valve. 3.PSV-5400/5417@0.020 barG. 4.Valve of gas vent line is LO. 5.Gas detector..(TCC specify tag number) 6.Thermoresistive heat detector.(TCC specify tag number) 7.Fire-fighting Foam system. 8.CCTV on site. 9.Dike wall around both tanks.	4	3	3	N	

5006.2	high pressure(TK-5003)	1.High temperature in liquid inlet toTK-5003 due to high temperature in upstream. 2.E-5011 cooling failure. 3.PCV-5445 abnormally open. 4.External fire.	1.Overpressure, higher alcohols and MeOH, other hydrocarbon leakage, failure and rupture of tank, fire, explosion, toxic release. 2.TK-5003 rupture and failure.	1.PIA-5448 high pressure alarm. 2.PVRV-5451@-0.003~0.015 barG breathing valve. 3.PSV-5450@0.020 barG. 4.Gas detector.(TCC specify tag number) 5.Thermoresistive heat detector.(TCC specify tag number) 6.Fire-fighting Foam system. 7.CCTV on site.	4	3	3	N	TCC study the relocating of TK-5003 to area 5003.
5006.3	low pressure(TK-5002 1/2)	1.Methanol liquid level decrease too fast. 2..Environment temperature decrease suddenly such as rain. 3.PCV-5395/5412z fail closed lead nitrogen sealing failure during extremes of external low temperature .	1.Pressure in TK-5002 1/2 may be reach to vacuum, failure and rupture of the tank and equipment, methanol leakage, fire, toxic release and environment pollution. 2.Caviation in P-5008A/B/C due to low NPSHa.	1.Nitrogen seal valve PCV-5395/5412. 2.PVRV-5401/5418 breathing valve. 3.PIA-5398/5415 low pressure alarm .	4	2	2	N	
5006.4	low pressure(TK-5003)	1.Liquid off-stream level decrease too fast. 2.Environment temperature decrease suddenly such as rain.	1.Pressure in TK-5003 may be reach to vacuum, failure and rupture of the tank and equipment, liquid off-stream leakage, fire, toxic release and environment pollution. 2.Caviation in P-5009A/B due to low NPSHa.	1.Nitrogen seal valve PCV-5445. 2.PVRV-5451 breathing valve. 3.PIA-5448 low pressure alarm .	4	2	2	N	
5006.5	vacuum(TK-5002 1/2)	1.Same as low pressure(TK-5002 1/2) 5006.3.	Same as low pressure(TK-5002 1/2) 5006.3.	Same as low pressure(TK-5002 1/2) 5006.3.				N	

5006.6	vacuum(TK-5003)	1.Same as low pressure(TK-5003) 5006.4.	Same as low pressure(TK-5003) 5006.4.	Same as low pressure(TK-5003) 5006.4.				N	
5006.7	high temperature(TK-5002 1/2)	1.Upstream methanol high temperature due to cooling failure(E-5008, E-5012).	1.Overpressure, methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.Caviation and damage P-5008A/B/C due to low NPSHa.	Same as high pressure(TK-5002 1/2)5006.1.	4	3	3	N	
5006.8	high temperature(TK-5003)	1.E-5011 cooling water failure.	1.Overpressure, liquid off-stream, failure and rupture of tank, fire, explosion, toxic release. 2.Caviation and damage P-5009A/B due to low NPSHa.	Same as high pressure(TK-5003)5006.2.	4	3	3	N	
5006.9	low temperature(TK-5002	1.no safety or operation hazard.	no safety or operation hazard.	no safety or operation hazard.				N	
5006.10	low temperature(TK-5003)	1.no safety or operation hazard.	no safety or operation hazard.	no safety or operation hazard.				N	

5006.11	high level(TK-5002 1/2)	1.P-5008 A/B/C accidently stop working. 2.USV-5422/5420 fail closed. 3.Inlet or outlet manual valve of P-5008A/B/C abnormally closed due to operator error. 4.Blockage of strainers in suction of P-5008A/B/C. 5.Manual valve from 4000 to 5000 abnormally open due to operator error.	1.Methanol leakage, failure and rupture of tank, fire, explosion, toxic release. 2.Overflow and incorrect flow direction of MeOH to lines installed on the roof.	1.LIA-5396/5413 high liquid level alarm. 2.LSAH-5397 activate IS-62 to close USV-5391. 3.LSAH-5414 activate IS-63 to close USV-5392. 4.Both TK-5002 1/2 high level activate I-50 to trip P-5004A/B, P-5006A/B.	4	3	3	Y	
5006.12	high level(TK-5003)	1.P-5009A/B accidently stop working. 2.Inlet or outlet manual valve of P-5009A/B abnormally closed due to operator error. 3.Blockage of strainers in suction of P-5009A/B.	1.Overpressure, liquid off-stream leakage , failure and rupture of tank, fire, explosion, toxic release. 2.Overflow and incorrect flow direction of liquid off-stream to lines installed on the roof.	1.LIA-5446 high liquid level alarm. 2.LSAH-5447 activate IS-51 to close FV-5441 and FV-5107.	4	3	3	Y	
5006.13	low/no level(TK-5002 1/2)	1.Low/no flow of inlet liquid from upstream. 2.High flow of outlet stream. 3.Blockage of manual valve in the inlet of TK-5002 1/2.	Damage to P-5008A/B/C due to low NPSHa.	1.LIA-5396/5413 low level alarm. 2.LSAL-5397 activate IS-64 to trip P-5008 A/B/C. 3.LSAL-5414 activate IS-65 to trip P-5008 A/B/C.	3	2	1	N	

5006.14	low/no level(TK-5003)	1.FT/FIC/FV-5441 fail closed. 2.FT/FIC/FV-5107 fail closed. 3.Blockage of manual valve in the inlet of TK-5003. 4.High flow of outlet stream.	Damage to P-5009A/B due to low NPSHa.	1.LIA-5446 low level alarm. 2.LALL-5447 activate I-52	3	2	1	N	
5006.15	high flow (P-5009 discharge)	1.P-5001 A/B accidently stop working. 2.FT/FIC/FV-5041 fail closed. 3.Inlet or outlet cut-off manual valve of P-5001A/B abnormally closed due to operator error. 4.Blockage of strainers in suction of P-5001A/B.	Low liquid level of TK-5003.	1.FFIA-6059 high flow alarm. 2.SOP for operator shall not change the pump stroke during operation.	2	3	1	N	
5006.16	low/no flow(P-5009 A/B discharge)	1.P-5009 A/B outlet manual valve abnormally closed. 2.Suction blocked due to manual off valve.	1.P-5009 A/B and pipe overpressure and damage.(in the case of cause 1) 2.Liquid off-stream leak and maybe cause fire.(in the case of cause 1) 3.P-5009 A/B overheat and damage.(in the case of cause 2)	1.PSV-5461/5462 @60.0 barG. 2.Design temperature of Pump can stand against the produced overtemperature.	2	4	2	N	

5006.17	incorrect flow direction	1.Incorrect tank loading from TK-4001/4002 to TK-5002 1/2 due to operator error. 2.Incorrect tank flow direction to TK-5002 1 instead of TK-5002 2 due to operator error. 3.Incorrect tank flow direction to TK-5002 2 instead of TK-5002 1 due to operator error. 4.Incorrect tank flow direction to 4000 unit and B.L. due to operator error.	1.Mixing good and bad quality product. 2.Level of tank abnormally increased TK-5002 1/2 ,same as high level(TK-5002 1/2)5006.11.	1.Same as high level(TK-5002 1/2)5006.11. 2.Proper SOP during operation.	3	2	1	N	
5006.18	rupture/leak	1.Same as rupture/leak 4001.20.	Same as rupture/leak 4001.20.	Same as rupture/leak 4001.20.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project
Company name： Middle East Kimiaye Pars Company
Project no：
Process name： 5000# AREA
Node description： Drain Drum
Drawing no： 5000-PID-019

Establish dt：2016/8/10
Plant site：
Risk matrix： 8X7(TCC)

Pipe / equipment no： D-5011, P-5013
Design purpose： Blowdown tank of 5000 area.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
5007.1	High flow	1.Too much drain liquid in distillation equipments.	Same as high level 5007.8.	Same as high level 5007.8.				N	
5007.2	low/no flow	1.non actual hazard identify						N	
5007.3	high pressure	1.PCV-5701 accidently full open. 2.PCV-5701 bypass manual valve abnormally open due to operator error.	Equipment overpressure and damage/rupture, methanol leakage.	Breather valve BV-5701.	2	3	1	N	
5007.4	low pressure	1.Outlet rate is too high. 2.PCV-5701 fail closed.	Equipment vacuum and failure/rupture, methanol leak to environment	1.Breather valve BV-5701. 2.Equipment design pressure can hold -0.003barg. 3.PCV-5701 accidently fail close. 4.Fill the sump with sand.	2	3	1	N	PCV-5701 shall be equipped with a PG to show pressure inside D-5011 and distance between this PCV and top surface of ground of installation position of D-5011 shall be less than 1.5 meter, otherwise an individual PG shall be dedicated to D-5011.

5007.5	vacuum	1.Same as low pressure 5007.4	Same as low pressure 5007.4	Same as low pressure 5007.4				N	
5007.6	high temperature	1.Not possible.						N	
5007.7	low temperature	1.Low temperature in upstream.	No safety and operation concern.					N	
5007.8	high level	1.Drain liquid rate is too high. 2.P-5013 outlet manual valve abnormally closed due to operator error. 3.P-5013 failure.	Closed drain drum will flood and methanol leak into environment.	1.LAHH-5701 will start P-5013 automatically. 2.A status signal of the P-5013 unit is indicated in the central control room. 3.Fill the sump with sand.	2	3	1	N	
5007.9	low/no level	1.Same as low pressure 5007.4.	1.Same as low pressure 5007.4. 2.Damage the pump due to low suction head.	Same as low pressure 5007.4.				N	
5007.10	rupture/leak	1.Flange or gaskets leakage.	1.Drum is underground, and methanol gas is heavier than air, thus the sump gas is rich of methanol. 2.Injury personnel.	Fill the sump with sand.	3	3	2	N	
5007.11	other	1.Rain may flood the sump	Equipment is submerged in the water	1.Fill the sump with sand. 2.Concrete at the top of sand.	3	3	2	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Stream system

Node description： HHP-HP Steam Control System

Drawing no： 7000-PID-006/007/010

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： X-7010, X-7011A/B, SI-7010, X-7012A/B, DS-7010A/B, DS-7011A/B

Design purpose： To provide HHPS, temperature 454 Degree C, pressure 98 barG, and letdown to HPS, temperature 345 Degree C, pressure 44 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
7001.1	High flow(HHPS)	1.Over consumption in FT-3001. 2.PT/PIC/PV-7002A/B/C fail open. 3.PT/PIC/PV-7025A/B fail open. 4.PT/PIC/PV-7004 fail open. 5.Vent fail open of FT-3001.	1.More steam export to FT-3001with lower pressure lead C-3001/3002 speed decrease and feed into R-3001 1/2/3 synthesis gas decrease, affect reaction and methanol production. 2.Shutdown of 3000 area. 3.Pressure of 2000 area increase and then PV-2481 open and vent to the flare.	1.PICA-2363 low pressure alarm at steam superheater E-2021 1/2 outlet.. 2.PIA-2372 low pressure alarm on steam drum D-2001.	3	4	3	N	

7001.2	high flow(HPS inside plant)	1.Fail open of extraction steam valve in FT-3001. 2.PT/PIC/PV-7002A/B/C fail open. 3.Over consumption of downstream.	1.Increasing pressure in HP header, maybe cause overpressure.(in case of cause1&2) 2.Maybe cause high/over temperature of process gas.(in case of cause1&2) 3.Lower pressure of HHPS header.(in case of cause1&2) 4.Decreasing pressure in HP header,less HP to downstream and maybe cause low S/C ratio.(in case of cause3)	1.PT/PIC/PV-7004 venting of excess steam.(in case of cause1&2) 2.PICA-7004 high pressure alarm.(in case of cause1&2) 3.PICA-7004 low pressure alarm.(in case of cause3) 4.FFSAL-2064 low S/C ratio activate IS-1 to shutdown the plant in case of low S/C ratio.	4	3	3	N	Ask GE for safeguard in compressor package. (in case of cause1)
7001.3	high flow(HPS export)	1.PT/PIC/PV-7025A/B fail open.	1.Increasing pressure in HP header, maybe cause overpressure. 2.Decreasing pressure in HHP header, less HHP to downstream and maybe cause compressor/turbine speed decreased, damage to compressor/turbine and shutdown.	1.PIC-7025 pressure indicator. 2.FIC-7030 flow indicator. 3.Trip the compressor/ turbine before damage. 4.PICA-2263 low pressure alarm.	3	2	1	N	

7001.4	low/no flow(HHPS)	1.Low/no flow of upstream.	1.Decreasing pressure in HHP header, cause compressor/turbine speed decreased(in case of low flow) and trip turbine/compressor(in case of no flow). 2.Low flow of HPS in downstream.	1.PIC-7025 pressure indicator. 2.PICA-2263 low pressure alarm. 3.Trip the compressor/ turbine before damage. 4.All safeguards for pre alarm before IS-01/02 trip. 5.Possibility of using import steam instead of HPS and preventing shutdown of plant. (owner to check with DMPC)	3	2	1	N	Possibility of using import steam instead of HPS and preventing shutdown of plant. (owner to check with DMPC)
7001.5	low/no flow(HPS inside plant)	1.Fail close of extraction steam valve of FT-3001. 2.PT/PIC/PV-7002 A fail closed.	1.Trip of HPS consuming turbines. 2.Causing low S/C ratio and coking H-2001 in worst case. 3.Decreasing pressure in HP header and causing less HP export to downstream.	1.PICA-7004 low pressure alarm. 2.PIC-7001 to control FV-409. (extraction control valve for HHPS let down to HPS in turbine package) 3.Refer to low/no flow(HPS) 2001.4.(in case of low S/C ratio) 4.Total /partial blockage of HP from trubine shall be prevented. (This subject shall be check with GE)	4	4	4	N	Total /partial blockage of HP from trubine shall be prevented. (This subject shall be check with GE)
7001.6	low/no flow(HPS export)	1.PT/PIC/PV-7025A/B fail closed.	Decreasing pressure in HP header and causing less HP export to downstream.	FIC-7030 flow indicator.	2	3	1	N	

7001.7	incorrect flow direction	1.PT/PIC/PV-7028 abnormally open. 2.PV-7028 bypass manual valve abnormally open due to operator error. 3.BFW pump trip led to HHPS go to BFW line.	Damage to BFW pump P-7001A/B/C.	Check valve in BFW line.	3	2	1	N	
7001.8	high pressure(HHPS)	1.High pressure in upstream.	Increasing pressure in HP header, maybe cause overpressure.	1.PSV-2380/2379/2378/2376/2377. 2.PICA-2361 high pressure alarm. 3.PV-2361 open. 4.PSV-2365. 5.PIC-7003 activate to open PV-7002A/B/C 6.Ask GE for safeguard in compressor package.	3	2	1	N	
7001.9	high pressure(HPS inside plant)	1.Fail open of extraction steam valve in FT-3001. 2.PT/PIC/PV-7002A/B/C fail open. 3.Low efficiency of turbine.	1.Increasing pressure in HP header, maybe cause overpressure. 2.Lower pressure of HHPS header.	1.PT/PIC/PV-7004 venting of excess steam. 2.PICA-7004 high pressure alarm. 3.PSV-7010/7011/7012.	3	3	2	N	
7001.10	high pressure(HPS export)	1.PT/PIC/PV-7025A/B fail open.	1.Increasing pressure in HP header, maybe cause overpressure. 2.Effect of higher pressure HPS to DMPC shall be checked(owner to check).	PI-7021 pressure indicator.	3	3	2	N	1.Add high alarm to PI-7021. 2.Effect of higher pressure HPS to DMPC shall be checked(owner to check).

7001.11	low pressure(HHPS)	1.Low pressure in upstream. 2.PV-7002A/B/C fail open. 3.PV-7025A/B fail open. 4.Low efficiency of turbine.	Low capacity and unstable operation of turbine, finally shutdown of compressor/turbine.	PICA-2363 low pressure alarm.	3	3	2	N	
7001.12	low pressure(HPS inside plant)	1.Low pressure in upstream due to defficiency of turbine. 2.PV-7002A fail closed.	1.Low efficiency of downstream turbines. 2.Causing low S/C ratio and coking H-2001 in worst case.	1.PICA-7004 high pressure alarm 2.PIC-7003 activate to open PV-7002A/B/C. 3.PIC-7001 to control outlet steam pressure of FT-3001.	3	3	2	N	
7001.13	low pressure(HPS export)	1.PV-7025 A/B fail closed.	Stop export and vent of HPS.		3	3	2	N	Add low alarm to PI-7021.
7001.14	high temperature(HHPS)	1.High temperature in upstream.	Damage FT-3001 turbine.	1.HH temperature trip in FT-3001 package. (TCC check with GE) 2.TICA-2360 high temperature alarm.	4	3	3	N	HH temperature trip in FT-3001 package. (TCC check with GE)
7001.15	high temperature(HPS inside plant)	[1] 1.TT/TIC/TV-7002/7003/7004 fail closed. 2.TV-7002/7003/7004 inlet manual valve abnormally closed due to operator error. 3.Failure of BFW in upstream.	Potentially exceeding design temperature in downstream, especially turbines.	1.TIA-7007 high temperature alarm. 2.TICA-7002/7003/7004 high temperature alarm. 3.Ask turbine vendor for more safeguards(TCC to check).	4	3	3	N	

7001.15	high temperature(HPS inside plant)	[2] 1.TV-7071A/B(DS-7011 A/B) fail closed. 2.TV-7071A/B(DS-7011 A/B) inlet manual valve abnormally closed due to operator error.	Potentially exceeding design temperature in downstream, and damage E-2008 HPS inlet line and E-2008.	1.TICA-7071 high temperature alarm. 2.TSAH-7071(2oo3) activate IS-02.	4	3	3	Y	
7001.16	high temperature(HPS export)	1.TT/TIC/TV-7026/7027 fail closed. 2.TV-7026/7027 inlet manual valve abnormally closed due to operator error. 3.TV-7025A/B(DS-7010 A/B) fail closed. 4.TV-7025A/B(DS-7010 A/B) inlet or outlet manual valve abnormally closed due to operator error. 5.Failure of BFW in upstream.	Potentially exceeding design temperature in downstream. (owner to check with DMPC)	1.TIA-7021 high temperature alarm. 2.TICA-7026/7027 high temperature alarm.	3	3	2	N	Potentially exceeding design temperature in downstream. (owner to check with DMPC)
7001.17	low temperature(HHPS)	1.Low temperature in upstream.	1.Decreasing temperature of HP header. 2.Unstable pressure of steam turbine FT-3001.	1.TICA-7002/7003/7004 low temperature alarm to prevent low temperature HPS line. 2.Ask from GE for safeguards (TCC to check).	2	3	1	N	Ask from GE for safeguards (for low temperature(HHPS)) (TCC to check).
7001.18	low temperature(HPS inside plant)	1.TT/TIC/TV-7002/7003/7004 fail open.	Unstable operation of turbines in downstream of HPS users if condensation happen.	1.TICA-7002/7003/7004 low temperature alarm. 2.TIA-7007 low temperature alarm.	2	3	1	N	
7001.19	low temperature(HPS export)	1.TT/TIC/TV-7026/7027 fail open.	Ask from DMPC	TIA-7021 low temperature alarm.	2	3	1	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Stream system

Node description： MP Steam Control System

Drawing no： 7000-PID-008

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： X-7013A/B, X-7014A/B, SI-7011

Design purpose： To provide MPS, temperature 240 Degree C, pressure 32.7 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
7002.1	High flow	1.PT/PIC/PV-7031 C/D fail open. 2.PV-7034 abnormally open. 3.PT/PIC/PV-7031 A/B fail open.	1.Decreasing pressure in MP header and less MPS export to T-6001.Refer to node 1003 low/no flow(MPS).(in case of cause 1&2),low S/C ratio, high demand for direct steam injection. 2.Increasing pressure in MP header and maybe cause overpressure and leakage.(in case of cause 3) 3.Refer to node 1003 high flow(MPS).(in case of cause 3)	1.PICA-7034 low pressure alarm.(in case of cause 1&2) 2.PSV-7036/7037,1 operate 1 spare. (in case of cause 3) 3.PICA-7034 high pressure alarm.(in case of cause 3)	3	3	2	N	

7002.2	low/no flow	1.Upstream MPS supply failure. 2.PT/PIC/PV-7031 C/D fail closed.	1.Decreasing pressure in MP header and less MPS export to T-6001.Refer to node 1003 low/no flow(MPS).(in case of cause 1) 2.Increasing pressure in MP header and maybe cause overpressure and leakage.(in case of cause 2) 3.Refer to node 1003 high flow(MPS).(in case of cause 2)	1.PICA-7034 low pressure alarm.(in case of cause 1) 2.PSV-7036/7037@45.0barG,1 operate 1 spare.(in case of cause 2) 3.PICA-7034 high pressure alarm.(in case of cause 2)	3	3	2	N	
7002.3	incorrect flow direction	1.BFW pump trip led to HPS go to BFW line.(in case of start-up or make-up MPS by way of PV-7031A/B)	Damage to BFW pump P-7001A/B/C.	Check valve in BFW line.	3	2	1	N	
7002.4	high pressure	1.PT/PIC/PV-7031 C/D fail open. 2.PT/PIC/PV-7031 A/B fail open.	1.Increasing pressure in MP header and maybe cause overpressure and leakage.(in case of cause 3) 2.Refer to node 1003 high pressure(MPS).(in case of cause 3)	1.PICA-7034 low pressure alarm.(in case of cause 1&2) 2.PSV-7036/7037,1 operate 1 spare. (in case of cause 3) 3.PICA-7034 high pressure alarm.(in case of cause 3)	3	3	2	N	
7002.5	low pressure	1.Upstream MPS supply failure. 2.PT/PIC/PV-7031 C/D fail open.	1.Decreasing pressure in MP header and less MPS export to T-6001.Refer to node 1003 low/no flow(MPS).	1.PICA-7034 low pressure alarm. 2.PT/PIC/PV-7031 A/B open.	3	3	2	N	

7002.6	high temperature	1.TV-7032/7033 fail closed. 2.TV-7032/7033 inlet manual valve abnormally closed due to operator error. 3.Failure of BFW in upstream.	Potentially exceeding design temperature in downstream, especially T-6001.	1.TIA-7031 high temperature alarm. 2.TICA-7032/7033 high temperature alarm.	3	3	2	N	
7002.7	low temperature	1.TV-7032/7033 fail open.	Unstable operation in downstream of user(T-6001), increase the consumption of MPS.	1.TICA-7032/7033 low temperature alarm. 2.TIA-7031 low temperature alarm.	2	3	1	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Establish dt：2016/8/10

Company name： Middle East Kimiaye Pars Company

Plant site：

Project no：

Risk matrix： 8X7(TCC)

Process name： Stream system

Node description： LP Steam Control System

Pipe / equipment no： X-7015A/B, SI-7012

Drawing no： 7000-PID-009/011

Design purpose： To provide LPS, temperature 188 Degree C, pressure 7 barG.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
7003.1	High flow	1.Fail open of FT-3001 1/2 extraction valve FV-410. 2.Fail open of FT-2001/2002,FT-7001A/B,FT-8001A/B extraction valve. 3.Fail open of letdown valve PV-7051 A/B from HP steam header. 4.Fail open of letdown valve PV-7031 C/D from MP steam header.	Increasing pressure in LP header, potentially exceeding design pressure and leakage.	1.PT/PIC/PV-7056 open and vent to atmosphere. 2.PSV-7057/7058/7059/7060/7061,4 operate 1 spare. 3.PICA-7056 high pressure alarm.	3	3	2	N	

7003.2	low/no flow	1.FT-3001 1/2 extraction valve FV-410 fail closed. 2.Trip/Decrease consumption of HPS user's turbines (FT-2001/2002,FT-7001A/B,FT-8001) 3.Downstream cut-off or manual valve abnormally closed due to operator error.	1.Decreasing pressure in LP header, less LPS export to E-5003 and effect methanol production.(in case of cause 1&2) 2.Incresing pressure in LP header, maybe cause overperssure and leakage.(in case of cause 3) 3.Affect efficiency of distillation and production quantity.	1.PICA-7056 low pressure alarm.(in case of cause 1&2) 2.PT/PIC/PV-7051 A/B open.(in case of cause 1&2) 3.PICA-7056 high pressure alarm..(in case of cause 3) 4.PT/PIC/PV-7056 open and vent to atmosphere..(in case of cause 3) 5.PSV-7057/7058/7059/7060/7061,5 operate 1 spare.(in case of cause 3)	3	3	2	N	
7003.3	incorrect flow direction	1.BFW pump trip led to HPS go to BFW line.(in case of make-up LPS by way of PV-7051A/B). 2.Extraction manual valves of HPS steam turbines abnormally open due to operator error during turbine shut down.	1.Damage to BFW pump P-7001A/B/C. 2.Damage to D-7002.	1.Check valve in BFW line. 2.PSV-7253/7254. 3.Check valve in HPS turbine outlet.	3	2	1	N	
7003.4	high pressure	1.Same as high flow 7003.1. 2.The consumption of users decrease.	Same as high flow 7003.1.	Same as high flow 7003.1.	3	3	2	N	
7003.5	low pressure	1.Same as low/no flow 7003.2.	Same as low/no flow 7003.2.	Same as low/no flow 7003.2.				N	

7003.6	high temperature	1.TV-7052/7053 fail closed. 2.TV-7052/7053 inlet manual valve abnormally closed due to operator error. 3.Failure of BFW in upstream. 4.Damage of HPS user's turbines.	Potentially exceeding design temperature in downstream, especially E-5003.	1.TIA-7056 high temperature alarm. 2.TICA-7052/7053 high temperature alarm.	3	3	2	N	
7003.7	low temperature	1.TV-7052/7053 fail open.	Unstable operation in downstream of user(E-5003), increase the consumption of LPS.	1.TICA-7052/7053 low temperature alarm. 2.TIA-7056 low temperature alarm.	3	2	1	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Establish dt：2016/8/10

Company name： Middle East Kimiaye Pars Company

Plant site：

Project no：

Risk matrix： 8X7(TCC)

Process name： Stream system

Node description： BFW

Pipe / equipment no： TK-7001 1/2, P-7002A/B,D-7001, P-7001A/B, FT-7001A/B, P-7001C, TK-7050, P-7051A/B, P-7052A/B, TK-7060, P-7060A/B, TK-7070, P-7070A/B, D-7002, D-7003, D-7004, E-7001, P-7005A/B

Drawing no： 7000-PID-012/013/014; 7000-PID-023/024/025/026; 7200-PID-003

Design purpose： Steam condensate deaerating and pumping to 120 barG(HHP BFW) and 50 barG(HP BFW).

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
7004.1	High flow(BFW pump)	1.High pressure in steam driving the turbine. 2.FV-2417 or LV-2372 fail open. 3.FV-3041 fail open. 4.HV-2371 fail open.	1.High level in D-2001. 2.High level in D-3003. 3.Low level in D-7001.	1.LICA-2372 high level alarm. 2.LICA-3042 high level alarm. 3.LICA-7091 low level alarm. 4.Turbine control SC-7131/7136.	3	2	1	N	
7004.2	high flow(Amine)	1.Wrong adjustment of dosing pump P-7060A/B. 2.Failure of analyzer AIC-7099. 3.Human error in turn on both pumps at the same time.	1.Increased chemical consumption and economical loss. 2.Higher pH value.	1.Overconsumption to be seen by operator. 2.Regular analysis of BFW AP-7100(for pH).	1	2	1	N	

7004.3	high flow(Oxygen scavenger)	1.Wrong adjustment of dosing pump P-7070A/B. 2.Human error in turn on both pumps at the same time.	Increased chemical consumption and economical loss.	1.Overconsumption to be seen by operator. 2.AP-7126 (for O2)	1	2	1	N	
7004.4	low/no flow(BFW pump)	1.Failure of steam/turbine. 2.P-7001A/B/C failure.	1.Low level in steam drums D-2001/3003. 2.Low/no flow of BFW into letdown station and desuperheater. 3.High level in D-7001.		4	3	3	N	Add flow indicator in BFW pump outlet line.
7004.5	low/no flow(Amine)	1.Wrong adjustment of dosing pump P-7060A/B. 2.Manual valve abnormally closed due to operator error. 3.Stop of both pumps at the same time. 4.Blockage of strainer in suction of pump.	1.pH decrease and accelerated corrosion due to boiler feed water. 2.Exceeding dosing pump discharge pressure.	1.Regular analysis of BFW (AP-7100 for pH). 2.PSV-7195/7198@7.0barG. 3.XA-7060A/B(fault status), ML-7060A/B(running status).	4	3	3	N	
7004.6	low/no flow(Oxygen scavenger)	1.Wrong adjustment of dosing pump P-7070A/B. 2.Manual valve abnormally closed due to operator error. 3.Stop of both pumps at the same time. 4.Blockage of strainer in suction of pump.	1.Increase corrosion in downstream. 2.Exceeding dosing pump discharge pressure.	1.Regular analysis of BFW(AP-7126 for O2). 2.PSV-7215/7218. 3.XA-7070A/B(fault status), ML-7070A/B(running status).	4	3	3	N	

7004.7	reverse flow	1.P-7001 A/B/C fail stop suddenly. 2.Low flow of condensate in case of 5000 area start-up operation.	HHP BFW or HP BFW inversely flow to deaerator and damage deaerator and pump/turbine.	1.ARV-7001 A/B/C in HHP BFW outlet line. 2.Check valve in HP BFW outlet line.	4	3	3	N	1.Add check valve on 10"-LPC-70-116-B24-H1 and 6"-LPC-70-113-B24-H1 to prevent reverse flow to E-5003 and P-5011A/B (during start-up). 2.Change bypass of LSV-5070 from gate to globe valve.
7004.8	part of flow/composition(D-7001)	1.Same as low/no flow(Amine)7004.5. 2.Same as low/no flow(Oxygen scavenger)7004.6.	1.Same as low/no flow(Amine)7004.5. 2.Same as low/no flow(Oxygen scavenger)7004.6.	1.Same as low/no flow(Amine)7004.5. 2.Same as low/no flow(Oxygen scavenger)7004.6. 3.AIC-7099 online analyzer for pH. 4.AP-7100 sampling point for pH. 5.AP-7126 sampling point for O2.				N	
7004.9	as well as flow/impurity	1.Impurity in chemical.	Impurity in BFW and steam, need for more BFW blowdown.		2	2	1	N	Supply chemical from well known vendor and check the quality before purchase.
7004.10	high concentration(Amine)	1.Same as high flow(Amine) 7004.2.	Same as high flow(Amine) 7004.2.	Same as high flow(Amine) 7004.2.				N	

7004.11	high concentration(Oxygen scavenger)	1.Same as high flow(Oxygen scavenger) 7004.3.	Same as high flow(Oxygen scavenger) 7004.3.	Same as high flow(Oxygen scavenger) 7004.3.				N	
7004.12	low concentration(Amine)	1.Same as low/no flow(Amine) 7004.5.	Same as low/no flow(Amine) 7004.5.	Same as low/no flow(Amine) 7004.5.				N	1.The volume of TK-7060 shall be increased to 3.6 m3. 2.Increased the capacity of ammonia pump P-7060A/B from 17 L/h to 40 L/h.
7004.13	low concentration(Oxygen scavenger)	1.Same as low/no flow(Oxygen scavenger) 7004.6.	Same as low/no flow(Oxygen scavenger) 7004.6.	Same as low/no flow(Oxygen scavenger) 7004.6.				N	
7004.14	high pressure(Deaerator)	1.PT/PIC/PV-7094 fail open. 2.Higher temperature DMW into D-7001. 3.High temperature LPC, MPC, HPC inlet to D-7001.	1.D-7001 overpressure, cause damage and leakage. 2.High temperature of BFW in D-7001 lead to damage BFW pump.	1.PICA-7094 high pressure alarm. 2.PV-7101 open. 3.PSV-7095/7096/7097,2 operate 1 spare.	3	2	1	N	TCC study and find safeguard for bad effect of high pressure on separation of O2 (for Deaerator).
7004.15	high pressure(BFW)	1.P-5001 A/B accidently stop working. 2.FT/FIC/FV-5041 fail closed. 3.Inlet or outlet cut-off manual valve of P-5001A/B abnormally closed due to operator error. 4.Blockage of strainers in suction of P-5001A/B.	1.Overpressure of 50barG BFW line. 2.Overpressure of downstream.	1.PSV-7142/7143 @80 barG. 2.PI-7127 pressure indicator.	3	2	1	N	Add silencer for vent of warm up HPS line to FT-7001A/B.

7004.16	high pressure(TK 7001 1/2)	1.External fire. 2.High temperature of product.	Damage the tank and rupture the tank.	Vent and overflow line.	3	1	1	N	
7004.17	low pressure(Deaerator)	1.PT/PIC/PV-7094 fail closed.	1.Temperature decrease lead to BFW oxygen increase. 2.High demand for Oxygen scavenger.	1.PICA-7094 low pressure alarm. 2.AP-7126 analyzer (for O2).	2	3	1	N	
7004.18	vacuum	1.Not possible.						N	
7004.19	high level	[1] 1.FT/FIC/FV-5301 fail open. 2.FT/FIC/FV-7091 fail open. 3.LT/LIC/LV-6021B fail open. 4.LT/LIC/LV-2016 fail open. 5.PT/PIC/PV-7094 fail open. 6.P-7001A/B failure.	1.D-7001 flood and high temperature BFW blow out and injury personnel. 2.D-7001 flood and affect deaerating efficiency.	LICA-7091 high level alarm.	3	5	4	Y	Develop and implement of a suitable level control philosophy (for Deaerator).
7004.19	high level	[2] 1.P-7001A/B/C inlet manual valve abnormally closed.	1.D-7001 flood and high temperature BFW blow out and injury personnel. 2.D-7001 flood and affect deaerating efficiency.	1.PI-7112/7116/7120 low pressure alarm. 2.PSAL-7112/7116/7120 activate IS-71/72/73 to trip P-7001 A/B/C.	3	4	3	Y	

7004.20	low/no level	1.FT/FIC/FV-5301 fail closed. 2.FT/FIC/FV-7091 fail closed. 3.LT/LIC/LV-6021B fail closed. 4.LT/LIC/LV-2016 fail closed. 5.PT/PIC/PV-7094 fail closed.	1.P-7001A/B/C cavitation and damage. 2.BFW supply failure.	1.LICA-7091 low level alarm. 2.LSAL-7091(2oo3) activate IS-70 to trip P-7001A/B/C.	4	3	3	Y	
7004.21	high temperature(Deaerator)	1.High pressure of D-7001.	Low NPSHa of P-7001A/B/C, cavitation risk.	Same as high pressure(Deaerator) 7004.14.	3	2	1	N	
7004.22	low temperature(Deaerator)	1.Same as low pressure 7004.17.	Same as low pressure 7004.17.	Same as low pressure 7004.17.				N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Stream system

Node description： Instrument air

Drawing no： 7000-PID-019

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no：

Design purpose：

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
7005.1	as well as flow/impurit	1.Impurity in upstream.	Same as low pressure 7005.2.		4	3	3	N	
7005.2	low pressure	1.Low pressure of upstream.	Unstable operation and failure of control valve finally lead to plant shut down.		4	3	3	N	1.A total shut down (IS-1) have to be added from low low or no pressure . Based on this requirement, a 2oo3 voting system is necessary so 2 more PT shall be add too 2.Add an emergency N2 line which tie-in to 3"-IA-70-101-B50-N before PT's with regulator, solenoid valve (FO) and manual valve (LO) for keeping available and stable pneumatic function in case of low pressure instrument.

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Stream system

Node description： Power system

Drawing no：

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no：

Design purpose：

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
7006.1	no power	1.Power failure from power supply.	Plant shut down.	1.UPS(for essential control power supply including FCS,ESD,F&G and PDCS systems). 2.Diesel generator (just for critically important power consumers).	4	3	3	N	A shut down command (IS-1) shall be added for "total power failure".

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Polishing Unit

Node description： Polishing Unit

Drawing no： 7200-PID-001～005

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： TK-7001 1/2, P-7002A/B, P-7204A/B, TK-7202/7204, P-7202/7203, J-7201/7202, D-7205, PD-7206, P-7205A/B, TK-7201, P-7201A/B, R-7201A/B, X-7201, E-7201A/B

Design purpose： cooling water circulating, CW supply 38 degree C, CW return 48 degree C, Cl- less than 65 mg/L.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
7201.1	High flow(DMW inlet)	1.DMW from BL high flow. 2.LV-7202 fail open. 3.LV-7202 bypass valve abnormally open due to human error .	1.TK-7001 1/2 high level and flood. 2.High consumption of DMW.	1.LICA-7202A/B high level alarm. 2.Overflow line.	3	3	2	N	
7201.2	High flow(DMW outlet)	1.P-7002 A/B standby pump abnormally start. 2.FV-7091 fail open.	1.TK-7001 1/2 low level and P-7002 A/B damage. 2.D-7001 high level. Refer to node 7004 high level(D-7001).	1.FV-7091 control 2.FIC-7091 high flow alarm. 3.FI-7205 flow indicator.	3	3	2	N	

7201.3	High flow(condensate inlet)	1.High flow in upstream. 2.P-7201 A/B standby pump abnormally start.	1.R-7201 A/B high d/p and running period decrease(in case of cause 2). 2.TK-7201 low level and P-7201 cavitation and damage(in case of cause 2). 3.TK-7001 1/2 high level and flood(in case of cause 1).	1.PDIA-7207/7208 high d/p alarm and resin regeneration. 2.LIA-7201 low level alarm. 3.LALL-7201 activate I-721 to trip P-7201 A/B. 4.LICA-7202 A/B high level alarm. 5.LT/LIC/LV-7202 level control.	3	3	2	N	
7201.4	low/no flow(DMW inlet)	1.Low/no flow in upstream. 2.LT/LIC/LV-7202 fail closed. 3.TK-7001 1/2 inlet line manual valve abnormally closed due to operator error. 4.Condensate from upstream low flow.	1.TK-7001 1/2 low level and P-7002 A/B cavitation and damage. 2.Low/no flow in downstream especially deaerator and steam drum.	1.LICA-7202 A/B low level alarm. 2.LALL-7202 A/B activate I-723 to trip P-7002 A/B. 3.FIC-7091 low flow alarm. 4.FI-7205 flow indicator.	4	2	2	N	
7201.5	low/no flow(DMW outlet)	1.P-7002 A/B failure. 2.P-7002 outlet manual valve abnormally closed due to operator error. 3.FT/FIC/FV-7091 fail closed. 4.TK-7001 1/2 outlet manual valve abnormally closed due to operator error. 5.ARV in the discharge of pump fail and return maximum possible flow back to TK-7001 1/2.	1.TK-7001 A/B high level and flood. 2.Refer to node 7004 low flow(DMW). 3.Low/no flow of BFW in downstream especially steam drum. 4.P-7002 A/B cavitation and damage.(in the case of cause 4)	1.P-7002 A/B 1 operate 1 spare. 2.FI-7205 flow indicator. 3.LICA-7202 A/B high level alarm. 4.Refer to node 7004 low flow(DMW).	3	3	2	N	

7201.6	low/no flow(condensate intlet)	1.Low/no flow in upstream. 2.Human error in closing manual valve. 3.X-7201 blocked. 4.E-7201 A/B blocked. 5.R-7201 A/B blocked. 6.XV-7201 A/B fail closed. 7.XV-7209 A/B fail closed. 8.P-7201 A/B failure. 9.Pump strainers blockage.	1.TK-7001 1/2 low level, low/no to downstream. 2.TK-7201 low level and P-7201 A/B cavitation and damage.(in case of cause 1&2) 3.P-7201 A/B outlet pressure increase.(in case of cause 6,7,9)	1.FI-7201 flow indicator. 2.FT-7203 A/B flow indicator. 2.LIA-7201 low level alarm.(in the case of cause 1&2) 3.LALL-7201 activate I-721 to trip P-7201.(in the case of cause 1&2) 4.PDIA-7202 high d/p alarm(just for cause 3). 5.X-7201 bypass.(in case of cause 3) 6.E-7201 A/B, 1 operate 1 spare.(in case of cause 4) 8.PDIA-7207/7208 high d/p alarm.(in case of cause 5) 9.PDIA-7207/7208 activate I-727A/B to resin regeneration. 10.LIA-7201 high level alarm.(in case of cause 3~6). 11.P-7201 A/B outlet minimum flow and check valve.(in case of cause 1&2)	3	3	2	N	

7201.7	as well as flow/impurity	1.R-7201 A/B failure. 2.X-7201 failure. 3.Impurity in upstream(DMPC). 4.Failure of turbine surface exchanger lead to impurities in condensates. 5.Impurity in chemicals NaOH and H2SO4.	1.Fe2+ and SiO2 carry over to downstream and affect steam quality and damage turbine. 2.High demand to blowdown in deaerator and steam drum. 3.Incorrect pH in downstream and corrosion.	1.R-7201 A/B ,1 operate 1 spare. 2.AI-7203 high SiO2 alarm. 3.AI-7204A/B high conductivity alarm. 4.AAHH-7203,AAHH-7204A/B activate I-727A/B to regeneration.	3	2	1	N	Supply chemical from well known vendor, with high quality and test before use in plant.
7201.8	high pressure(condensate)	1.X-7201 blockage 2.P-7201 A/B outlet manual valve open position too small. 3.R-7201 blockage. 4.Human error in operating both pump at the same time. 5.High pressure in upstream.	1.P-7201 overpressure and damage.(in case of cause 2&3) 2.Overpressure damage equipment and pipe.	1.PDIA-7202 high d/p alarm.(in case of cause 1) 2.FIQ-7203A/B flow indicator.(in case of cause 3) 3.PSV-7202 A/B @10.5bar.(in case of cause 3)	3	3	2	N	Consider two individual ARV for discharge line for each line.
7201.9	high pressure(DMW)	1.P-7002 A/B outlet manual valve abnormally closed due to operator error. 2.High pressure in upstream.	1.P-7002 A/B outlet line high pressure. 2.Refer to node 7004 low flow(DMW).	1.Minimum flow and check valve. 2.FIC-7091 low flow alarm. 3.PI-7204 pressure indicator. 4.Refer to node 7004 low/no flow (DMW).	3	3	2	N	
7201.10	low pressure	1.Low pressure in upstream. 2.High flow through pump. 3.Blockage of resin trapper. 4.Blockage filter and E-7201A/B.	1.Damage to Pump. 2.High or low flow based on the prevailing cause.	Different pressure transmitters add flow transmitters on piping systems.	3	2	1	N	
7201.11	vacuum	1.Not possible.						N	

7201.12	high temperature	1.CW failure. 2.High temperature from upstream.	1.Process condensate temperature increased and resin failure. 2.Fe2+ and SiO2 carry over to downstream and affect steam quality and damage turbine. 3.Damage pump due to low NPSHa.	1.TIC-7201 temperature indicator, TV-7201 control. 2.FI-7202 flow indicator. 3.AI-7203 high SiO2 alarm. 4.AI-7204A/B high conductivity alarm. 5.AAHH-7203,AAHH-7204A/B activate I-727A/B to regeneration.	4	2	2	N	
7201.13	low temperature	1.Not possible.						N	
7201.14	concentration	1.Failure of H2SO4 injection system. 2.Failure of NaOH injection system. 3.High or low concentration in upstream. 4.Low quality of raw chemical material. 5.Low flow rate of DMW for preparing solution.	1.Low quality and high impurity of final DMW product. 2.Incomplete resin regeneration(in case of low concentration), or high temperature inside ion exchanger(in case of high concentration). 3.Need for more blowdown in downstream.	1.AAHH-7203 high high SiO2 concentration alarm activate I-727A/B to regeneration. 2.AIA-7206 high conductivity alarm. 3.AIA-7207 pH indicator.	3	3	2	N	Two pH indication in discharge line of each ion exchanger shall be considered.
7201.15	high level(TK-7201)	1.Outlet blockage. 2.Pump failure. 3.High flow in upstream.	TK-7201 overflow and damage and rupture.	1.LIAH-7201 high level alarm. 2.Overflow line.	3	2	1	N	

7201.16	high level(TK-7001 1/2)	1.Blockage of outlet. 2.Pump failure. 3.High flow in upstream.	1.TK-7001 1/2 high level and flood. 2.High consumption of DMW.	1.LICA-7202A/B high level alarm. 2.Overflow line.	3	2	1	N	
7201.17	high level(PD-7206)	1.XV-7207~7210 A/B fail open after regeneration.	PD-7206 high level and may flood since liquid content is acid or base so environmental pollution or injury personnel is possible.	1.LIA-7205 high level alarm. 2.The pond is located in a curb.	3	2	1	N	
7201.18	low/no level(TK-7201)	1.Low/no flow in upstream. 2.Human error in opening drain valve.	1.Damage to pump. 2.Low/no flow in downstream, perhaps low/no of BFW.	1.LALL-7201 low low level activate I-721 trip P-7201A/B. 2.FIQ-7203A/B flow indicator.	3	3	2	N	
7201.19	low/no level(TK-7001 1/2)	1.Low/no flow in upstream. 2.Human error in opening drain valve.	1.Damage to pump. 2.Low/no flow in downstream, perhaps low/no of BFW.	1.LALL-7202A/B low low level activate I-723 to trip P-7002A/B, P-7204A/B. 2.FI-7205 flow indicator.	3	3	2	N	
7201.20	low/no level(PD-7206)	1.Emptying the pond by manual turning on the pump.	Damage to pump.	1.LIA-7205 low level alarm. 2.LALL-7205 low low level activate I-726 trip P-7205A/B.	2	5	3	N	

HAZOP analyzing record

2016/8/11

Project name： MKP Methanol Project

Company name： Middle East Kimiaye Pars Company

Project no：

Process name： Cooling Water Unit

Node description： Cooling water system

Drawing no： 0500-PID-001~005; 7000-PID-016

Establish dt：2016/8/10

Plant site：

Risk matrix： 8X7(TCC)

Pipe / equipment no： F-0501A/B/C/D, T-0501A/B/C/D, PD-0501, P-0501 1/2, P-0502A/B, P-0504A/B, F-0502 1/2, P-0505A/B, PD-0502, P-0506A/B, TK-0503, P-0507, TK-0508, P-0510A/B, TK-0509, P-0511A/B, TK-0510, P-0512A/B, E-0501

Design purpose： Cooling water circulating, CW supply 38 degree C, CW return 48 degree C, Cl- less than 65 mg/L.

Serial #	Deviation	Cause	Consequence	Safeguard	Severity	Likelihood	Risk	LOPA	Recommendation
501.1	High flow(CW)	1.Incorrect pump selection which lead to high flow, pressure and velocity. 2.P-0501 1/2 turbine steam flow increased. 3.Manual valve of consumers abnormally open too big due to human error. 4.Exchanger or cooling water line leak or rupture. 5.Human error in opening manual valves at the end of CWS for circulating into CWR.	1.CW system pressure decreased. 2.Inlet pressure to all CW consumers decreased (especially E-3003 1/2/3 and E-5010 which are located the highest location) hence complete cooling is not achieved.	1.FIA-0514 high flow alarm. 2.FIA-0511 high flow alarm. 3.PIA-0514 low pressure alarm. 4.Turbine control system adjust turbine speed.	4	2	2	N	

501.2	High flow(FT-0501 1/2 steam)	1.HPS header pressure increasing.	1.High flow and pressure in CWS. 2.High speed of steam turbine shaft.	1.FIA-0514 high flow alarm. 2.FIA-0511 high flow alarm. 3.PIA-0514 low pressure alarm. 4.Turbine control system adjust turbine speed. 5.Same as high pressure(HPS inside plant) 7001.9.	2	2	1	N	
501.3	low/no flow(CW)	1.HPS flow decreased. 2.P-0501 1/2 or P-0502A/B failure. 3.Tuibine of P-0501 1/2 failure. 4.Manual valve of consumers abnormally closed due to human error. 5.Exchanger or cooling water line blockage or rupture. 6.Pump strainers blockage. 7.Manual valves on inlet or outlet route closing due to human error. 8.Failure of check valve, remaining in semi-open situation.	1.Plant shutdown. 2.Shortage of CW in consumers, lead to high temperature and finally failure of cooling in CW exchanger.	1.PIA-0514 low pressure alarm at P-0501 1/2, P-0502A/B outlet. 2.FIA-0514 flow indicator. 3.FIA-0511 flow indicator. 4.CW pumps 3 operate 1 spare(two pumps running with steam turbine and one with electrical driven, so in this case only one pump will be in the service up to another electrical driven pump come in the service and the plant maybe face to the shutdown).	4	3	3	N	Develop SOP for proper adjusting CW distribution in case of two pumps running and low plant loading situation.

501.4	low/no flow(FT-0501 1/2 steam)	1.HPS header pressure decreasing. 2.Rupture of HPS pipe. 3.Loss of hydraulic oil pressure and close the steam valve.	1.Plant shutdown. 2.Shortage of CW in consumers, lead to high temperature and finally failure of cooling in CW exchanger.	1.PIA-0514 low pressure alarm at P-0501 1/2, P-0502A/B outlet. 2.FIQ-0514 indicator. 3.CW pumps 3 operate 1 spare(two pumps running be able to keep plant operation).	4	3	3	N	
501.5	part of flow/composition(H2SO4)	1.P-0512A/B failure. 2.TK-0510 empty. 3.Blockage or rupture of pipe. 4.Concentration of H2SO4 is lower than normal.	1.pH increase. 2.Increasing of exchanger and pipe fouling.	1.LALL-0517 low level alarm. 2.P-0512 A/B 1 operate 1 spare. 3.ML-0512A/B(running status), XA-0512A/B(fault status). 4.AIA-0511 online analyzer(for pH). 5.AIH-0511 high pH alarm and auto-start P-0512A/B. 6.AI-0512 online analyzer(for conductivity) 7.AI-0513 online analyzer(for ORP) 8.AP-0501 sampling point.	4	3	3	N	Add AT-0511 low pH alarm and interlock to auto-stop H2SO4 injection pump.

501.6	part of flow/composition(anti-scale)	1.P-0511A/B failure. 2.TK-0509 empty. 3.Pipe leakage or rupture.	Exchanger and pipe fouling	1.LALL-0516 low level alarm. 2.P-0511 A/B 1 operate 1 spare. 3.ML-0511A/B(running status), XA-0511A/B(fault status). 4.AIA-0515 online analyzer(for anti-scale agent). 5.AIL-5015 low alarm and auto-start P-0511A/B. 5.AP-0501 sampling point.	4	3	3	N	
501.7	part of flow/composition(inhibitor)	1.P-0510A/B failure. 2.TK-0508 empty. 3.Pipe leakage or rupture.	Exchanger and pipe corrosion.	1.LALL-0515 low level alarm. 2.P-0510 A/B 1 operate 1 spare. 3.ML-0510A/B(running status), XA-0510A/B(fault status). 4.AIA-0514 online analyzer(for corrosion inhibitor). 5.AIL-0514 low alarm and auto-start P-0510A/B. 6.AI-0512 online analyzer(for conductivity) 7.AI-0513 online analyzer(for ORP) 8.AP-0501 sampling point.	4	3	3	N	

501.8	part of flow/composition(NaClO)	1.P-0506A/B failure. 2.TK-0503 empty. 3.Pipe leakage or rupture. 4Low concentration of NaClO in TK-0503.	1.Algae formation in CW. 2.Affect CW quality. 3.Increasing CW temperature for decreasing the cooling tower efficiency.	1.LALL-0503 low level alarm. 2.P-0506 A/B 1 operate 1 spare. 3.ML-0506A/B(running status), XA-0506A/B(fault status). 4.AP-0501 sampling point.	4	3	3	N	
501.9	high concentration (H2SO4)	1.P-0512A/B adjustment failure cause H2SO4 exceeding. 2.Human error. 3.AT-0511 failure. 4.High concentration of H2SO4 in TK-0510.	1.Corrosion in the equipments and pipe. 2.High consumption of H2SO4.	1.AIA-0511 online analyzer(for pH). 2.AI-0512 online analyzer(for conductivity) 3.AI-0513 online analyzer(for ORP) 4.AP-0501 sampling point.	4	3	3	N	Add AT-0511 low pH alarm and interlock to auto-stop H2SO4 injection pump.
501.10	high concentration (NaClO)	1.P-0506A/B adjustment failure cause NaClO exceeding. 2.Human error in starting both pump at the same time. 3.High concentration NaClO in TK-0503.	ClO- increase in CW, cause stress corrosion in case of stainless steel exchanger.	1.AP-0501 sampling point. 2.COC of Cl- control to keep to 4. 3.AI-0512 conductivity analyzer. 4.AI-0512 ORP analyzer.	3	3	2	N	TCC to check: relation between ClO- and Cl- concentration and relevant reactions (for NaClO dosing in CW).
501.11	low concentration	1.Same as part of flow/composition(H2SO4),part of flow/composition(anti-scale), part of flow/composition(inhibitor), part of flow/composition(NaClO) 0501.5/6/7/8	Same as part of flow/composition(H2SO4),part of flow/composition(anti-scale), part of flow/composition(inhibitor), part of flow/composition(NaClO) 0501.5/6/7/8	Same as part of flow/composition(H2SO4),part of flow/composition(anti-scale), part of flow/composition(inhibitor), part of flow/composition(NaClO) 0501.5/6/7/8				N	

501.12	high pressure	1.Exchanger blockage. 2.Manual valve abnormally closed (partial or total) due to human error(along the circulation route from pump discharge to cooling tower). 3.High pressure of HPS. 4.Low pressure in LPS header.	1.Ciculation water pressure increased. 2.P-0501 1/2, P-0502A/B trip. 3.Plant shutdown. 4.Due to high discharge pressure of turbine driver pumps, electrical pumps may not be able to deliver the same pressure and may damage. 5.Rate of water circulation increased (in case of cause 3&4).	1.FIA-0514 high flow alarm(in case of cause 3&4). 2.FIA-0511 high flow alarm(in case of cause 3&4). 3.Turbine control system adjust turbine speed. 4.Same as high pressure(HPS inside plant) 7001.9.	4	3	3	N	Add high alarm to PIA-0514.
501.13	low pressure	1.Incorrect pump selection which lead to high flow, pressure and velocity. 2.P-0501 1/2 turbine steam flow or pressure decreased. 3.Manual valve of consumers abnormally open too big due to human error. 4.Exchanger or cooling water line leak or rupture. 5.Human error in opening manual valves at the end of CWS for circulating into CWR. 6.Strainers blockage.	1.Inlet pressure to all CW consumers decreased (especially E-3003 1/2/3 and E-5010 which are located the highest location) hence complete cooling is not achieved. 2.Loss of production capacity due to high temperature in C-3001 inlet and incomplete cooling in 5000 unit exchangers, finally high high temperature and shut down.	1.FIA-0514 high flow alarm. 2.FIA-0511 high flow alarm. 3.PIA-0514 low pressure alarm. 4.Turbine control system adjust turbine speed. 5.TIA-0511 high temperature alarm.	4	2	2	N	1.Add TE-0511 low temperature alarm. 2.Add PT-0511 low pressure alarm.

501.14	vacuum	1.Pump suction strainer blockage.	1.Damage to P-0501 1/2, P-0502A/B. 2.Loss of CW system, overtemperature and shut down.	PIA-0512A/B, PIA-0513A/B low pressure alarm and low low pressure alarm.	4	2	2	N	
501.15	high temperature	1.Cooling tower failure. 2.High temperature of CWR. 3.High temperature and humidity of ambient. 4.High flow rate of CW.	1.Process temperature increased, high temperature in process units, in extreme case plant shut down. 2.Excessive growth of algae, high consumption rate of NaClO.	1.TIA-0513 high temperature alarm. 2.Possibility of using all of 4 cooling towers to reduce the CWS temperature.	4	3	3	N	
501.16	low temperature	1.non actual hazard and operation identify						N	
501.17	action not execute(CW filter operation)	1.PDI-0518A/B failure. 2.Failure of valving system. 3.Human error in closing the valve. 4.P-0504A/B failure.	1.Affect CW quality, suspended solid formation. 2.Blockage of heat exchangers.	PIA-0515 low pressure alarm.	4	3	3	N	1.Tag number of F-5020A/B shall be modified to F-5020 1/2. 2.Lines from each filter to PD-5020 for discharge of CSW shall be sloped down towards PD-0502.
501.18	extra action execute(CW filter operation)	1.PDI-0518A/B failure. 2.Failure of valving system.	1.Waste CW and increase R.O. water as make-up. 2.Increasing CSW output from unit towards DMPC.	1.FIQ-0516 flow indicator. 2.LI-0512 flow indicator.	2	3	1	N	