

# Your Company Header

Example Project

IEC 61511-3:2016 - Annex F

**SAFETY INTEGRITY LEVEL DETERMINATION**

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## 1. EXECUTIVE SUMMARY

### 1.1. Results

The results are summarised in Table 1.

**Table 1. Summary of LOPA**

PHA ID	SIF Tag	Hazardous Event (Deviation)	Consequence category	PFD Reqt	SIL Reqt	Selected PFD Target	Selected SIL Target
HAZOP	SIF	<p>High / More Pressure leading to:</p> <p>(Safety) Temperature increase in distillation column condenser. Loss of condensation capacity. Pressure increase in column overhead system exceeding design conditions. Column rupture. Flammable material release leading to flammable pool/dispersion. Potential fire leading to fatalities,</p> <p>AND</p> <p>(Safety) Excessive heat input to column reboiler leading to increase in vapour generation. Capacity of the condenser is surpassed. Pressure increase in column overhead system exceeding design conditions. Column rupture. Flammable material release leading to flammable pool/dispersion. Potential fire leading to fatalities</p>	Safety:	9.1E-02	SIL 1	9.1E-02	SIL 1

The LOPA was conducted using ProSET® v.5.5.1.0

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### 1.2. Meeting Records

The LOPA meeting was held at [...]. The members of the LOPA team and the dates of their attendance is detailed in Table 2.

**Table 2. LOPA Team**

Name	Company	Role	01/01/2017		02/01/2017	
			AM	PM	AM	PM
John Black	Company 1	Role 1	Y	Y	Y	Y
Sarah White	Company 2	Role 2	Y	Y	Y	Y
Bill Orange	Consultant	Chairman	Y	Y	Y	Y
Gill Blue	Consultant	Scribe	Y	Y	Y	Y

### 1.3. List of SIFs

Table 3 gives a summary of the SIFs and the corresponding Hazard IDs.

**Table 3. List of SIFs**

PHA ID	SIF Tag	SIF Description
HAZOP	SIF	Safety Instrumented Function will close shut-off valve in steam supply in case of high high pressure in column overhead.

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#### 1.4. Assumptions

Table 4 summarises the assumptions applied in the analysis.

**Table 4. Summary of Assumptions**

<b>Assumptions</b>
Example Assumption 1
Example Assumption 2

#### 1.5. Recommendations

**Table 5. Summary of Recommendations**

PHA ID	SIF Tag	SIL Target	Recommendation
HAZOP	SIF	SIL 1	Example Recommendation 1

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## APPENDIX A

### IPL REGISTER

Tag	Type	Description	Justification
BPCS	BPCS	Temperature control loop will close steam supply control valve to jacket.	The BPCS is a reliable DCS and the production personnel have never experienced a failure that would disable the temperature control loop.
Alarm	Alarms	Low flow alarm in cooling water supply to condenser. Operator has sufficient time to shut off steam input to reboiler.	The alarm is wired to a different BPCS input and controller than the temperature control loop.
PSV	Mechanical	PSV properly sized for the loss of condensation scenario.	The relief valve is set below the design pressure of the column. There is no possibility of human error leading to isolation of the column from the relief valve.

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## APPENDIX B

### Risk Targets Guidance

Table 6 presents the risk targets applied in the LOPA.

**Table 6. Risk Classification Matrix**

Category	Consequence Description	Number of Potential Fatalities/Injuries Averted	Implied Cost of Averting Fatalities/Injuries	Broadly Acceptable Risk (/yr)	Target Risk Frequency (/yr)
Safety					
5	Fatality / Serious Disability / Life Threatening Health Effect	1	2,200,000	1.0E-6	1.0E-5
4	Major Injury / Lost Time Injury (>3 days) / Irreversible Health Effect	1	100,000	1.0E-5	1.0E-4
3	Lost Time Injury (1 day) / Medium-term Health Effect	1	50,000	1.0E-4	1.0E-3
2	Minor Injury / Reversible Health Effect / Restriction to Work Activity	1	10,000	1.0E-3	1.0E-2
1	Very minor / No restriction to work activity	1	1,000	1.0E-1	1.0E0
Environmental					
5	Major - Serious toxic effect on beneficial or protected species / Contamination over public area / Extensive Remediation / Multiple Breach to Operating Licence				1.0E-4
4	Severe - Release to Sensitive Receptor / Minor contamination over public area / Easily Recoverable / Single Breach to Operating Licence				1.0E-3
3	Minor - Noticeable nuisance off site, e.g. discernible odours / Minor breach of permitted emission limits, but no environmental harm / Release inside the fence - recoverable				1.0E-2
2	Negligible - Minor release inside fence, Easily cleaned				1.0E-1
1	None - No effect				1.0E0
Financial					
5	Major - Disruption to Operation (< 3 month) / Cost > £5,000,000 - < £50,000,000				1.0E-4
4	Severe - Disruption to Operation (< 1 week) / Cost > £500,000 - < £5,000,000				1.0E-3
3	Minor - Disruption to Operation (< 1 day) / Cost > £50,000 - < £500,000				1.0E-2
2	Negligible - Disruption to operation (< 1 hour) / Cost: < £50,000				1.0E-1
1	None - No loss				1.0E0
Reputation					
6	[HOLD]				1.0E-6
5	[HOLD]				1.0E-5
4	[HOLD]				1.0E-4
3	[HOLD]				1.0E-3
2	[HOLD]				1.0E-2
1	[HOLD]				1.0E-1

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**APPENDIX C**  
**LOPA WORKSHEETS**



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PHA ID	HAZOP	SIF Tag	SIF		
Drawing Numbers					
SIF Description	Safety Instrumented Function will close shut-off valve in steam supply in case of high high pressure in column overhead.				
Hazardous Event (Deviation)	High / More Pressure leading to: (Safety) Temperature increase in distillation column condenser. Loss of condensation capacity. Pressure increase in column overhead system exceeding design conditions. Column rupture. Flammable material release leading to flammable pool/dispersion. Potential fire leading to fatalities, AND (Safety) Excessive heat input to column reboiler leading to increase in vapour generation. Capacity of the condenser is surpassed. Pressure increase in column overhead system exceeding design conditions. Column rupture. Flammable material release leading to flammable pool/dispersion. Potential fire leading to fatalities				
Mode Of Operation	Low Demand	Nodes	Node 1		
Notes	Example Note 1 Example Note 2				
LOPA Summary					
Category	Target Risk Frequency (/yr)	Consequence Description	Total Inter. Event Freq. (/yr)	PFD Target	SIL Target
Safety	1.0E-5	Fatality / Serious Disability / Life Threatening Health Effect	1.1E-4	9.1E-2	SIL 1
Environmental	1.0E-3	Severe - Release to Sensitive Receptor / Minor contamination over public area / Easily Recoverable / Single Breach to Operating Licence	1.1E-3	9.1E-1	SIL a
Financial	1.0E-3	Severe - Disruption to Operation (< 1 week) / Cost > £500,000 - < £5,000,000	1.1E-3	9.1E-1	SIL a
Selected SIL Target					<b>SIL 1</b>

Ref	Initiating Events			IPLs			Conditional Modifiers		Inter. Event Freq. (/yr)
	Description / Justification	Freq. (/yr)		A	B	C	Type	D	
1	Loss of cooling water.	1.0E-1		Y	Y	Y	Safety	Y	1.0E-5
	Plant operations have experienced loss in cooling water supply once in 15 years in this area.		Environmental				1.0E-4		
			Financial				1.0E-4		
2	Failure of temperature control fully opening steam supply control valve.	1.0E-1		Y	Y		Safety	Y	1.0E-4
	<Imported from PHA Comp>		Environmental				1.0E-3		
			Financial				1.0E-3		

IPLs / Conditional Modifiers				
Ref.	Type	Tag	Description / Justification	Credit
A	BPCS	BPCS	Temperature control loop will close steam supply control valve to jacket. The BPCS is a reliable DCS and the production personnel have never experienced a failure that would disable the temperature control loop.	1.0E-1
B	Alarms	Alarm	Low flow alarm in cooling water supply to condenser. Operator has sufficient time to shut off steam input to reboiler. The alarm is wired to a different BPCS input and controller than the temperature control loop.	1.0E-1
C	Mechanical	PSV	PSV properly sized for the loss of condensation scenario. The relief valve is set below the design pressure of the column. There is no possibility of human error leading to isolation of the column from the relief valve. The relief valve is removed and tested once a year. Plugging has been detected once in the last 15 years.	1.0E-1

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IPLs / Conditional Modifiers				
D	Probability Of Ignition		<p>The process area is designed with an explosion proof electrical classification and the are has a process safety management plan in effect. One element of the plan is a MoC procedure for replacement of electrical equipment in the area.</p> <p>The LOPA team estimates that the risk of and ignition source being present is reduced by a factor of 10 due to the MoC procedures.</p>	1.0E-1