

SaSI Innovation Company Limited



GENERAL INFORMATION - H-Analyst™ v2

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INTRODUCTION



H-Analyst[™] is another sophisticated tool developed by SaSI Innovation. It is aimed at aiding the hazard identification study, i.e. HAZOP and HAZID, early in the detailed engineering phase.

One of the major problems arising during the design of the Safety Instrumented Function (SIF) is that data transferred from a HAZOP study provide insufficient details for the SIL assessment workshop.

Moreover, some data are inconsistent when conducting the HAZOP and the SIL workshops. This generally extends the time required for the SIL assessment for related activities, i.e. hazard identification, demand scenario development and consequence analysis.

H-Analyst[™] can eliminate the above mentioned problems because it shares the same quantitative data with InnoSIF[™] (SIL Study Tool). This ensures the consistency between HAZOP and SIL Study. In addition, the study results from H-Analyst[™] can easily be transferred to InnoSIF[™]. Thus, every efforts are counted!!!

Best Practices Integrated

H-Analyst[™] provides the different guide words which are specific for HAZOP and HAZID, yet the worksheet format and the working environment for both studies are identical. Moreover, the results of HAZOP can be directly exported to SIL Study with just few easy steps.

naiysis										
SET Consequence	Analysis : 💽 Hea	th_Safety	📩 Environment 🔞	Economic ' Repu	itation					
Hea	alth and Safety	M								
	Environment	М								
	Economic	H				L]	[]			
	Reputation	М				11			L	
	Conseque	nce	No Impact	Slight	Minor	Moderate	Major	Massive	Extreme	
Likelihood Criteria	Likelihood / S Level	everity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
> Once a year at the location	(6)		М	М	М	н	H	H	Н	
Occurred in the location	(5)		М	м	м	М	н	н	H	
> Once a year in the company	(4)		L	М	м	М	М	н	н	
Occurred in the company	(3)		L	L	М	М	М	м	Н	
Occurred in the industry	(2)		L	L	E	М	M	М	М	
Never heard in	(1)		L	L	L	L	М	м	м	

SMART RISK MATRIX

The Smart Risk Matrix built in H-Analyst[™] version, supports both qualitative and quantitative analysis methods and configurable up to 8X8 matrix. Example above is qualitative analysis matrix for support HAZID study.



nalysis									
SET Consequence	Analysis : 💽 Health Safety	Environment 🔞	Economic 🔮 Repu	utation					
	Environment M								
	Economic MH								
	Consequence	No Impact	Slight	Minor	Moderate	Major	Massive	Extreme	
Likelihood Criteria	Likelihood / Severity Level	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
< 10	(6)	N T	SL ≻1	L ≻ 10	M > 100	H ≻ 1,000	MH ≻ 10,000	EH > 100,000	
10 - 100	(5)	N ÷	N ÷	SL 1 - 10	L 10 - 100	M 100 - 1,000	H 1,000 - 10,000	MH 10,000 - 100,	
100 - 1,000	(4)	N -	N -	N -	SL 1 - 10	L 10 - 100	M 100 - 1,000	H 1,000 - 10,0	
1,000 - 10,000	(3)	N T	N T	N -	N -	SL 1 - 10	L 10 - 100	M 100 - 1,00	
10,000 - 100,000	(2)	Ň	Ň	N -	N -	N -	SL 1 - 10	L 10 - 100	
> 100,000	(1)	N	N	N	N	N	N	SL	

Quantitative analysis matrix which is consistent with InnoSIF[™] (Simplified SIL Classification).

Rules Set	Data Configuration				×
Risk Clas	Risk Matrix				
RAN	CLASS NAME	RRF THRESHOLD	HPR	ACTIVATED	Save
EH	Extreme	100,000			Cancel
МН	Massive	10,000			
н	High	1,000			
М	Medium	100			
L	Low	10			
SL	Slight	1			
N	No Impact	0			Reset

H-Analyst[™] generates the predefined risk classification of 7 levels. The user can customise the risk level to be in line with Company's Risk Tolerability policy by activating or deactivating any items of risk level provided.

User Friendly

H-Analyst[™] interface is easy-to-use, it makes user focus on the deviation and hazard being analysed. The tools provided are developed from the intention of working better, faster and more effective for the overall HAZOP / HAZID processes.



H-Analyst (HAZOP)) - HAZOP Study for Gas Processing	Fianc - Loas Floce									
Nodoo	(Total) : 6	Create New	Node ID	Name				Category	Service	Status	
Nodes	(10tal). 6		Node 01	Main Stream Process (Gae tra	nefore to GSP4 and E	lower Plant)	DPCI I Inlot	Gae - Sour/Acid	Po Analys	
Deviation	n items : 20/41	Edit	Node 01 1	Procesure Control #P /S	In Stream Process (Gas transfers to GSP4 and Power Plant)				Gas - Sour/Acid	Ro Analys	sis Require
High Potentia	al Risk: 2/4	Delete	Node 01.1	Closed Drain (Sub nor	to of Mr	in Stream Process)	Jess)	DRCLUniot	Liquid Dirty Procose	Ro Analys	Re-Analysis Require
Action Items	(Total): 16		Node-02	Sub-Stream Process ((Conden	ate transfers to GSP	1)	DPCUInlet	Liquid - Dirty Process	Re-Analys	ie Roquin
Critical Action	n Items: 10	Participation	Node-02	Heating Medium Oil D	rain Ta		<i>'</i>	DRCI Liniet	Liquid - Clean Process	Ro-Analys	ie Roquir
Analysis	Status : Analysis	Document	Node-04	Temporan/ Eilter and	Ronarat	IK.		DPCU Inlet	Gas - Sour/Acid	Re-Analys	is Requir
				, angenary , mar und v		10.					. to qui
v	IC 5 of 20 ><	Add Edi	t Delete C COP	Duplicate	L	Risk Ranking 5 RR (IRRF)	Safegua	rd 💽 👿 Conditional SAFEGUARD	Adifier 💽 🗐 📄	DDIFIER	REQU
CEVIATION No Flow	I 5 of 20 > >I CAUSE 2001-SDV-110 Fails to Close	Add Edi	t Delete C CO coss gas supply I Hour lost as tot	Duplicate NSEQUENCE to power plant and GSP4 tal plant S/D scenario	L 4	Resk Ramking S RR (IRRF) 2 L 0	4 200 22 200	rd 💽 🗐 Londitional SAFEGUARD 01-PT-005 Alarm L 01-ZSC-110 Close Positio	Aodifier 🎦 🛒 🖿 CONDITIONAL MC	DDIFIER	REQU RF
> DEVIATION No Flow	IC 5 of 20 > > CAUSE 2001-SDV-110 Fails to Close	Add Edi	t Delete C CO Loss gas supply Hour lost as tot	Duplicate NSEQUENCE to power plant and GSP4 tal plant S/D scenario	L 4	Risk Ranking S RR (IRRF) 2 L 0 0	Safegua 4 200 22 200	rd 💽 🗊 🗖 Conditional SAFEGUARD D1-PT-005 Alarm L D1-Z8C-110 Close Positio Manage Action List	Aodifier 📑 🗐 🔲 CONDITIONAL MC	DDIFIER ment / Rationa	REQU RF (
⊃ DEVIATION No Flow	I<	Add Edi	t Delete C COP oss gas supply Hour lost as to	Duplicate NSEQUENCE to power plant and GSP4 tal plant S/D scenario	L	Risk Ranking S RR (IRRF) 2 L ()	Safegua 4 200 22 200	rd 💽 🗊 Conditional SAFEGUARD 01-PT-005 Alarm L 01-ZSC-110 Close Positio Manage Action List ACTION	Addifier CONDITIONAL MC	DDIFIER ment / Rationa ENT / RATIO	REQU RF (

LAYER OF PROTECTION ANALYSIS (LOPA)

When qualitative analysis cannot provide enough resolution for risk reduction measures development. LOPA technique will take the risk ranking into account as (semi-) quantitative analysis method. Required RRF (residual risk) will be reported and carried to further safety study e.g. SIL study.

DEVIATION	CAUSE	CONSEQUENCE	L	s	RR	SAFEGUARD	REQUIRED RRF
No Flow	100-PV-100 Valve Failure	Multiple fatalities case possibly occurred from Fire and Explosion Environmental damaged with reversible outside the fence 2001-E-202A/B damaged (130k USD / unit) 12 Months lost as total S/D scenario > 30M USD lost of asset property	5	7	МН	100-PT-002 Alarm and Operator R SIF-100-001 SIF Overpressure Prot 100-PIC-003 BPCS Pressure Control	100

PRODUCTION LOSS EQUATION (PLE)

Production loss equation (PLE) is a good practice to make high resolution of the economic impact assumption on the hazardous event, The PLE can be built one or more cases depending on the production loss scenario specific on the evaluated plant.

Start(Hrs)	End(Hrs)	Loss(per Hr)
0	5	2000
5	12	2500
12	0	300





SMART BOW-TIE MODELLING

H-Analyst[™] incorporates multiple hazard scenarios, which lead to the same consequence into a comprehensive graphical Bow-tie model. This function is an effective way to present overview of a major accident hazard (MAH).



IGNITION PROBABILITY ESTIMATOR

H-Analyst[™] provides Ignition Probability estimator tool to support quantitative risk analysis as a built-in function. The Ignition Probability estimator is based on the calculation presented in "Guidelines for Determining the Probability of Ignition of a Released Flammable Mass.", a book in risk analysis collection of CCPS, American Institute of Chemical Engineers (AIChE).

👌 Ignition Probability Estimator		- 🗆 X
Setup Release Scenario Ignitio	on Scenario Result	
Ignition Interm. Parameters	Explosion Interm. Parameters	Results
POIIS	POEGDI (magmult)	Probability of Immediate Ignition (Fire)
POIIAI	POEGDI	0.0500
PODI (s/d)		Probability of Delayed Ignition (Fire or Explosion)
POII 0.050p		0.2855
PODI 0.3005		0.2055
		Probability of Delayed Ignition (Fire)
POII : The probability of immed the source such that an unignite	liate ignition (that is, ignition close enough to ed flammable cloud large enough to result in	
an explosion has not formed).		
		Probability of Delayed Ignition (Explosion)
	Calculate	



REPORTING CAPABILITY

H-Analyst[™] has a built-in report generating tool. The report is automatically developed in the MS Excel file format so it's customisable. Information generated in the report includes the study team members, a list of reference and related documents, the risk criteria, assumptions, the major accident hazard list, Safety Critical Elements (SCEs), the study worksheet and action/response sheets.

FILE		S - ∂ - ÷ HOME INSERT	F PAGE LAYOUT FORMUL	AS DATA REVIEW	VIE	ł	HRep T	ort_T EAM	emp	olate_	Rev'	[Read-Only] - Excel	T A	017 14	? 🗷 –	5 ×
Norma	il Pag P W	ge Break Page Cus Ireview Layout Vir Vorkbook Views	stom ews Gridlines Gridlines Show	Bar Q Difference Communication Selection Zoom	v	New	A	rrang All	e Fr Pa	reeze ines *		Split ID View Side by Side Hide ID Synchronous Scr Unhide ID Reset Window Po Window	olling sition Window	Macros Macros		^
P19		• : X	$\checkmark f_x$													~
A	в	с	D	E	F	G	н	1	I.	к	L	м	N	0	P Q	R
, H	AZC	OP STUDY REPORT	T - Worksheet											10	H-An≰lyst	
4		Project :	HAZOP Study Project	Plant :	Ga	s Prod	Jeton	No.1				Node ID :	HZP-01	Node Category :	Gas Process	
5		Client :	SaSI Innovation Company Limited	Unit :	All	Units	200.00	-			_	Node Name :	Gas Feed Transferri	ng to F-101	0.00.000	
7		Related Document :	RAZOP Study Project (Demo) SSI-PID-09-0001.Rev.C Page(001-007)	Prepared By :		Mada J	aruxa	6.				Node Description :	Gas - General Gas feed transferre	d from Company-A to the Unit by Compr	Node Identification	
	1				8	everity	Lave	4	1							
1	ID	Guideword	Cause	Consequence	Health & Safety	Environment	Economic	Reputation		Risk Ranking	ALARP? (Y.N)	Safeguard	Residual Risk (Required RRF)	ACTIONS	Commenta / Rationale	
2	001	No Flow	100-CV-101 Failure	Loss Gas to F-101, leading to Loss of production and Pass flow coils democed from overtemperature.	1	1	6	0	5	н		01: SIL1-SIF, 100-FSLL-10X 02: BPCS, Temp Control	100	001: Upgrade Piping Class to be Higher		
3	002	No Flow	Human Error	Loss Gas to F-101, leading to Loss of production and Pass flow colls damaged from overtemperature.	1	1	6	0	5	н		01: SIL1-SIF, 100-FSLL-10X 02: BPCS, Temp Control	300	001: Upgrade Piping Class to be Higher		
4	003	More Flow	100-CV-101 Failure	Gas overflow to F-101, leading to products poor quality.	1	1	3	0	5	SL		02: BPCS, Temp Control	1	004: Add Alarm H to 100-FT-001		
5		Less Flow	N/A													
6		Misdirected Flow	N/A													
- 14	Ð	Cover	General Criteria Recom	mendation HZP-01 H	IZP-	02	Н	ZP-0	3		•	1 1				Þ
READY															🗐 🛄 – — Thursday, Ma	ay 5, 2016



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