SaSI Innovation Company Limited

H-Analyst™

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.

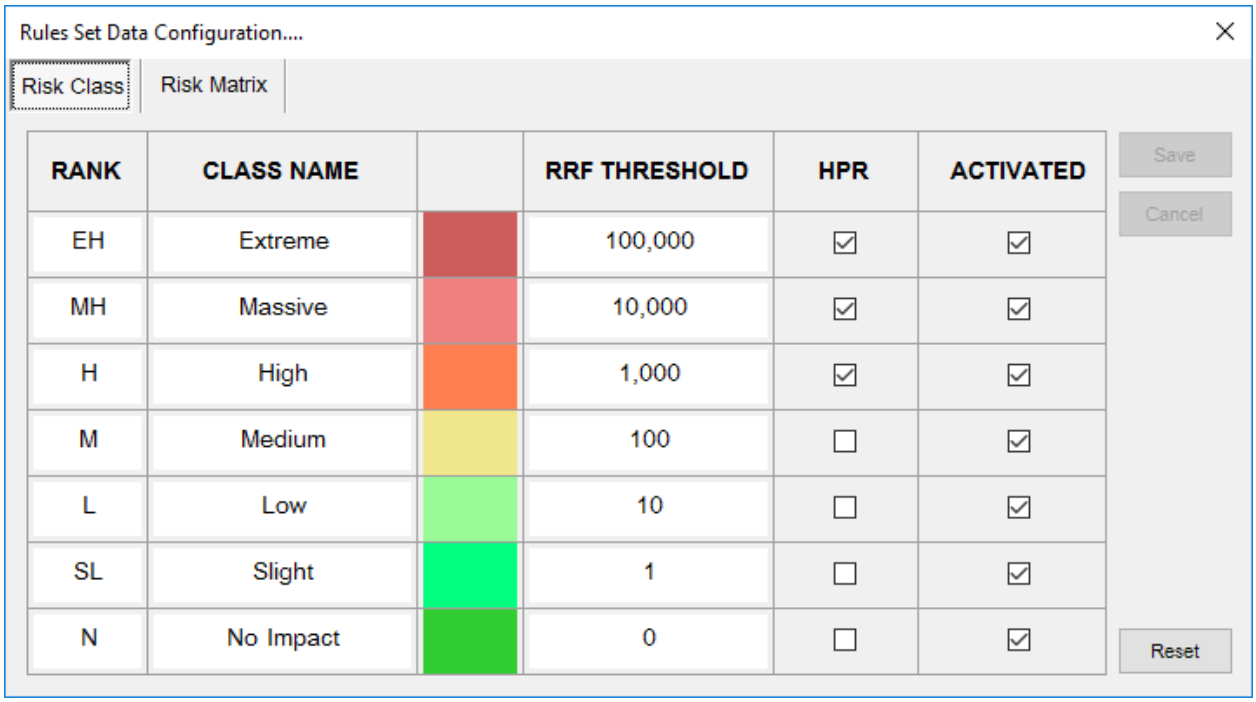
SMART RISK MATRIX

	Consequence	No Impact	Slight	Minor	Moderate	Major	Massive	Extreme
Likelihood Criteria	Likelihood / Severity Level	(1)	(2)	(3)	(4)	(5)	(6)	(7)
> Once a year at the location	(6)	M	M	M	H	H	H	H
Occurred in the location	(5)	M	M	M	M	H	H	H
> Once a year in the company	(4)	L	M	M	M	M	H	H
Occurred in the company	(3)	L	L	M	M	M	M	H
Occurred in the industry	(2)	L	L	L	M	M	M	M
Never heard in the industry	(1)	L	L	L	L	M	M	M

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.

Likelihood Criteria	Likelihood / Severity Level	No Impact (1)	Slight (2)	Minor (3)	Moderate (4)	Major (5)	Massive (6)	Extreme (7)
< 10	(6)	N -	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 - 100,000
100 - 1,000	(4)	N -	N -	N -	SL 1 - 10	L 10 - 100	M 100 - 1,000	H 1,000 - 10,000
1,000 - 10,000	(3)	N -	N -	N -	N -	SL 1 - 10	L 10 - 100	M 100 - 1,000
10,000 - 100,000	(2)	N -	N -	N -	N -	N -	SL 1 - 10	L 10 - 100
> 100,000	(1)	N -	N -	N -	N -	N -	N -	SL < 10

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

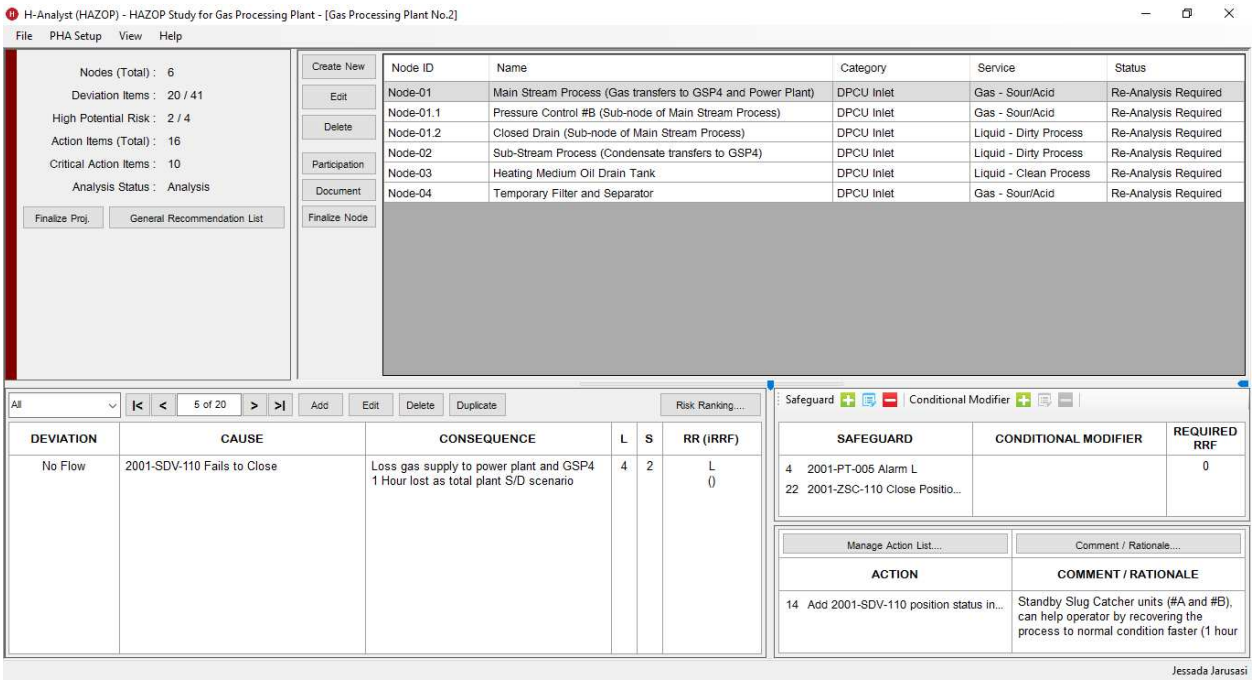


RANK	CLASS NAME	RRF THRESHOLD	HPR	ACTIVATED
EH	Extreme	100,000	☑	☑
MH	Massive	10,000	☑	☑
H	High	1,000	☑	☑
M	Medium	100	☐	☑
L	Low	10	☐	☑
SL	Slight	1	☐	☑
N	No Impact	0	☐	☑

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.



LAYER OF PROTECTION ANALYSIS (LOPA)

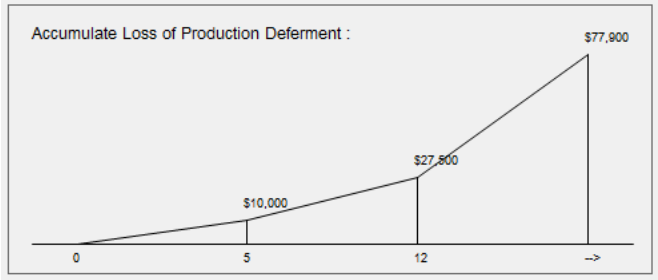
When qualitative analysis cannot provide enough resolution for risk reduction measures development. LOPA technique will take the risk ranking into account as (semi-) quantitative analysis method. Required RRF (residual risk) will be reported and carried to further safety study e.g. SIL study.

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 V-100 damaged (loss 200k USD) and 2001-E-202A/B damaged (130k USD / unit) 12 Months lost as total S/D scenario > 30M USD lost of asset property	5	7	MH	1 100-PT-002 Alarm and Operator R... 2 SIF-100-001 SIF Overpressure Prot... 3 100-PIC-003 BPCS Pressure Control	100

PRODUCTION LOSS EQUATION (PLE)

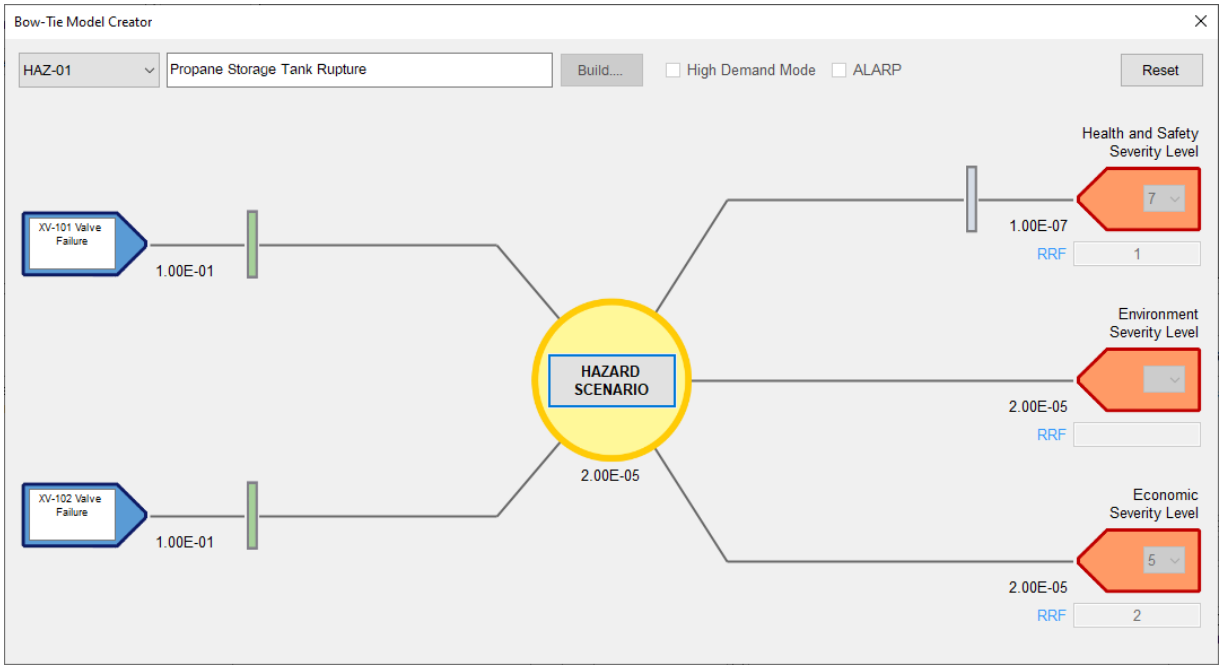
Production loss equation (PLE) is a good practice to make high resolution of the economic impact assumption on the hazardous event, The PLE can be built one or more cases depending on the production loss scenario specific on the evaluated plant.

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



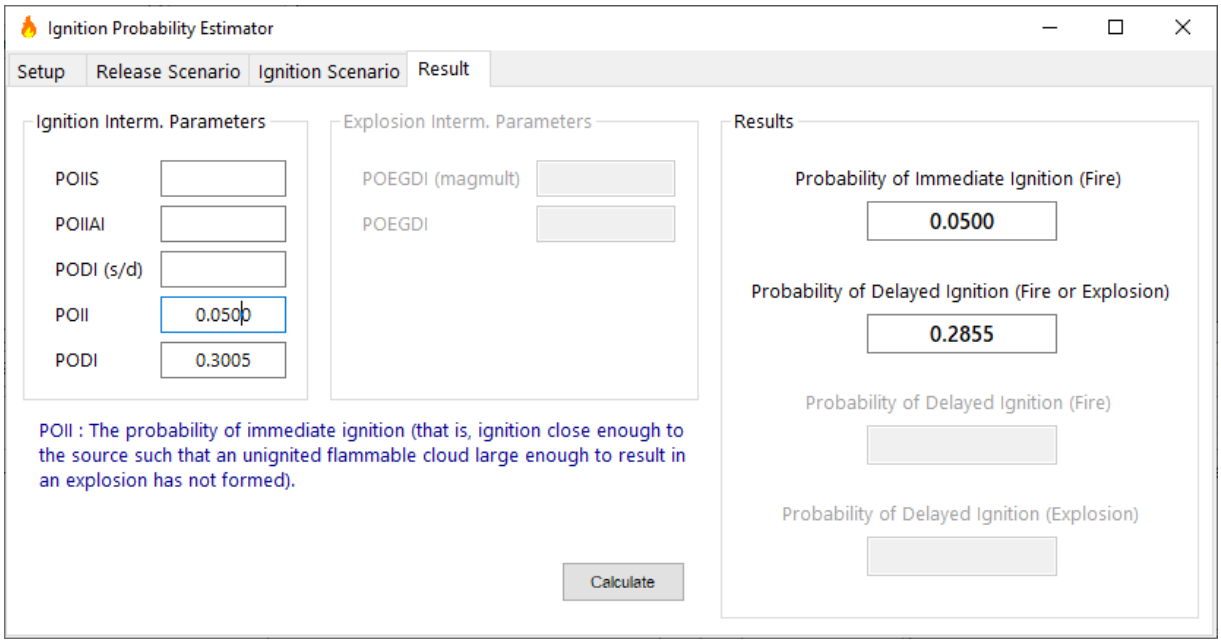
SMART BOW-TIE MODELLING

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).



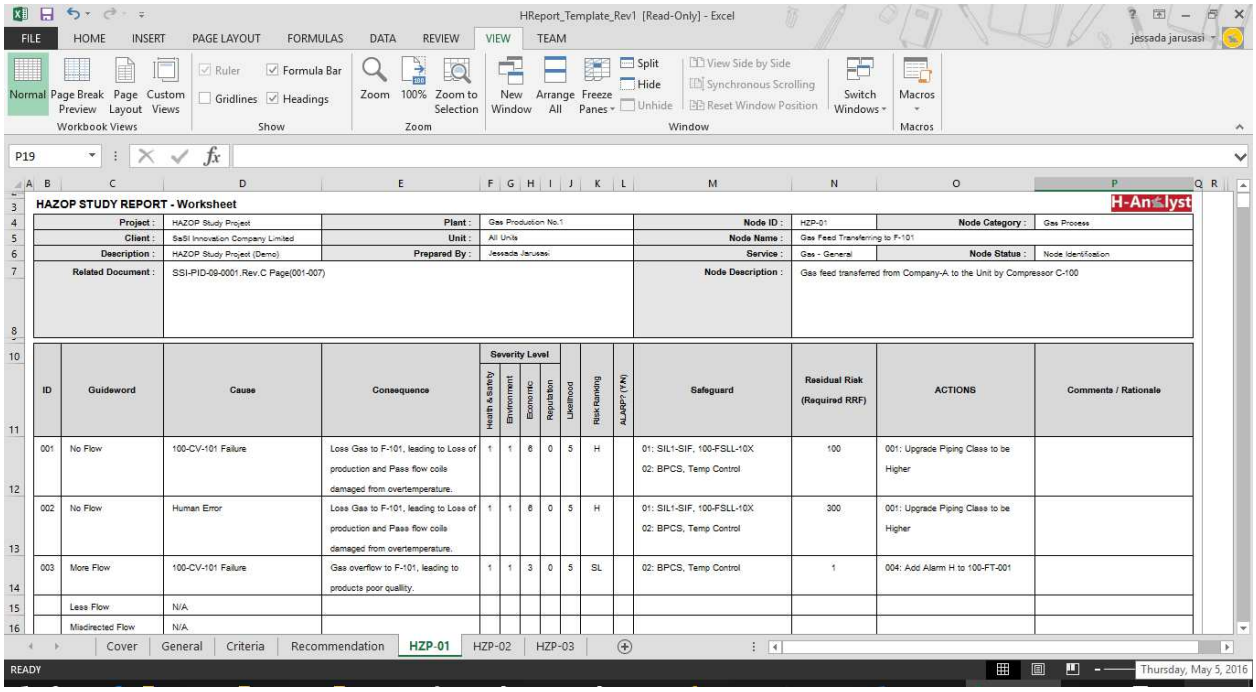
IGNITION PROBABILITY ESTIMATOR

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).



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.



HAZOP STUDY REPORT - Worksheet

Project :	HAZOP Study Project	Plant :	Gas Production No.1	Node ID :	HZP-01
Client :	SaSI Innovation Company Limited	Unit :	All Units	Node Name :	Gas Feed Transferring to F-101
Description :	HAZOP Study Project (Demo)	Prepared By :	Jessada Jarusasi	Service :	Gas - General
Related Document :	SSI-PID-09-0001,Rev.C Page(001-007)			Node Description :	Gas feed transferred from Company-A to the Unit by Compressor C-100

ID	Guideword	Cause	Consequence	Severity Level: Health & Safety	Environment	Economic	Reputation	Likelihood	Risk Ranking	ALARP? (Y/N)	Safeguard	Residual Risk (Required RRF)	ACTIONS	Comments / Rationale
001	No Flow	100-CV-101 Failure	Lose Gas to F-101, leading to Loss of production and Pass flow coils damaged from overtemperature.	1	1	6	0	5	H		01: SIL1-SIF, 100-FSLL-10X 02: BPCS, Temp Control	100	001: Upgrade Piping Class to be Higher	
002	No Flow	Human Error	Lose Gas to F-101, leading to Loss of production and Pass flow coils damaged from overtemperature.	1	1	6	0	5	H		01: SIL1-SIF, 100-FSLL-10X 02: BPCS, Temp Control	300	001: Upgrade Piping Class to be Higher	
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	
	Less Flow	N/A												
	Misdirected Flow	N/A												

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