



7th CPSS

Chemical Process Safety Sharing

Bow-tie in EBSM plant (Fire heater)



*Webinar (Zoom)
May 07, 2021*

Taweesak Tipnak (IRPC)





Presenter Biography



Company : IRPC



Current Position : Engineer

Working Experience : 20 years

Presentation Abstract:

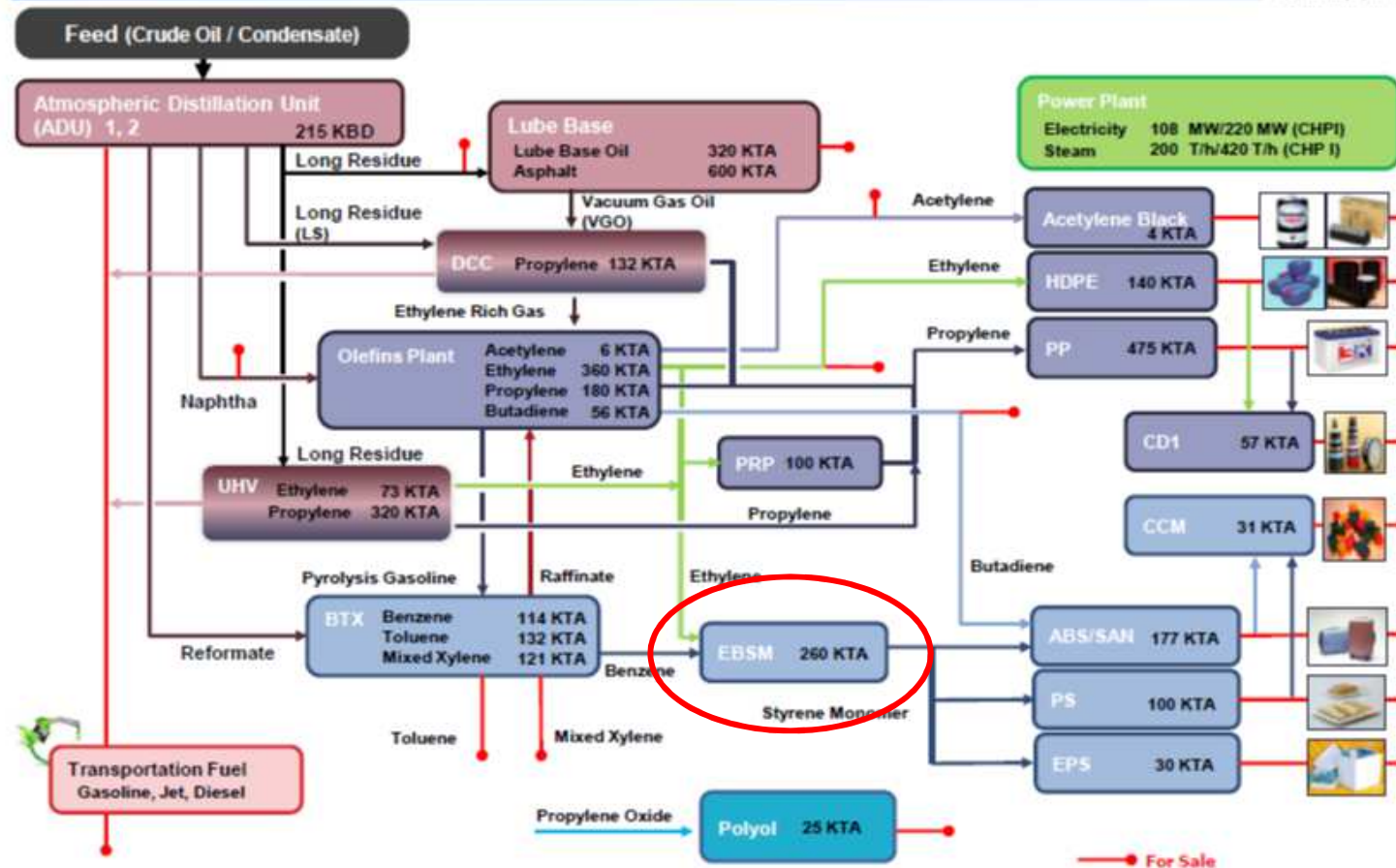
- Bow-tie identification
- EBSM Bow-tie cases study in terms of gap of Bow-tie
- LOPA with Bow-tie



Taweesak Tipnak

IRPC Bow Tie

Highly Integrated and Optimized Configuration



Bow Tie of EBSM



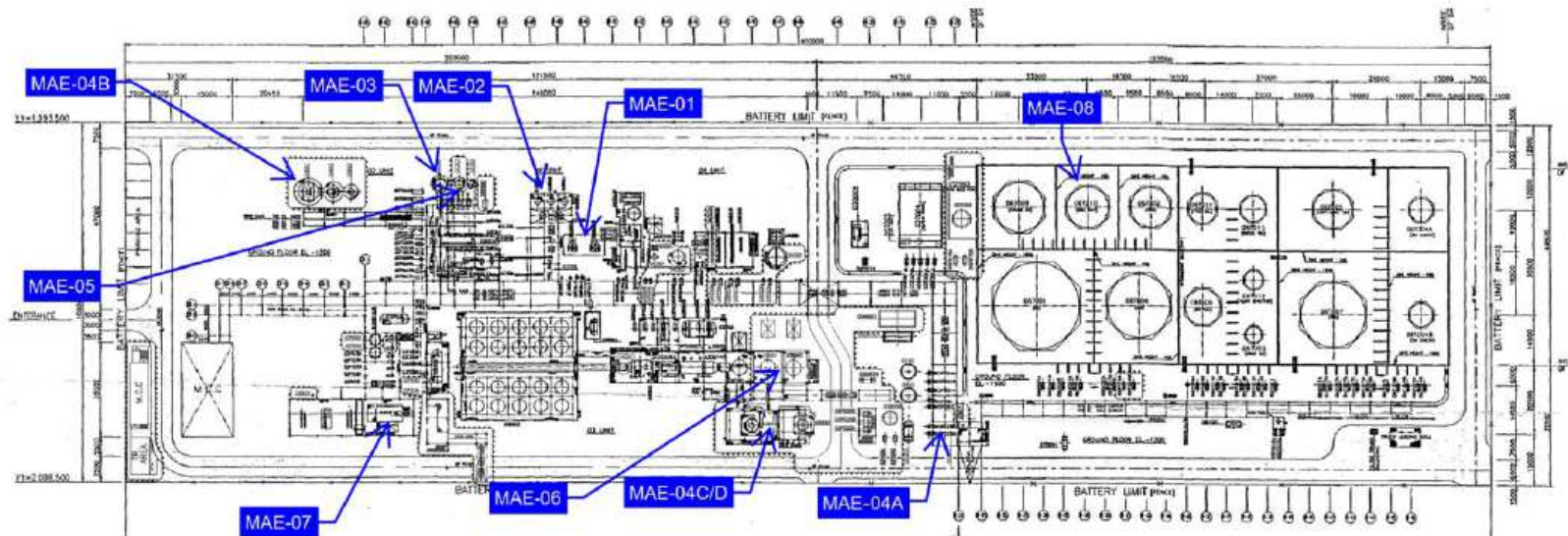
EBSM Plant, Rayong, Thailand

Bow Tie Identification:



MAEs Location

Figure 1.1: Overview – EBSM MAEs



Bow Tie of EBSM

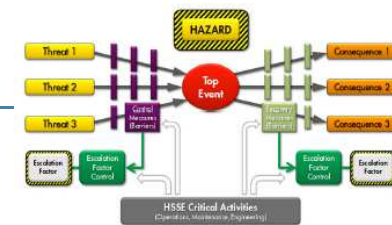


Table 1.1: List of EBSM MAEs

ID	Substance	Phase	Pressure (barg)	Temperature (°C)	Top Event
MAE-01	Ethylene	Vapour	45	77	LOPC from Ethylene Gas compressors (01K001A/B)
MAE-02A	Hydrocarbon Mixture (Ethylene, benzene, ethylbenzene)	Vapour/liquid	39	258	LOPC from Alkylator 1 (01R001)
MAE-02B	Hydrocarbon Mixture (Ethylene, benzene, ethylbenzene)	Vapour/liquid	36	257	LOPC from Alkylator 2 (01R002)
MAE-02C	Hydrocarbon Mixture (benzene, diethylbenzene, polyethylbenzene)	Vapour/liquid	29	191	LOPC from Transalkylator (01R003)
MAE-03	Benzene	Vapour/Liquid	11.5	195	LOPC from Benzene Column (02C001)
MAE-04A	Fuel Gas (LPG/NG)	Vapour	2.5	70	LOPC from Fuel Gas KO drum (05D005) and all burners
MAE-04B	Fuel Gas (LPG/NG)	Vapour	-	-	Loss of control from Reboilers (02B001/2/3)
MAE-04C	Fuel Gas (LPG/NG)	Vapour	0.9	600-800	Loss of control from Superheater (03B001)
MAE-04D	Fuel Gas (LPG/NG) and Hydrogen	Vapour	0.9	600-820	Loss of control from Secondary superheater (03B002)
MAE-05	Ethylbenzene	Vapour/Liquid	3	198	LOPC from Ethylbenzene Column (02C003)
MAE-06	Hydrocarbon Mixture (styrene, Ethylbenzene) and hydrogen	Vapour	0.4-0.7	552-820	LOPC from Dehydrogenation system (03R001/2/3)
MAE-07	Hydrogen	Vapour	36	40	LOPC from Off Gas Compressors (03K001/2)
MAE-08	Benzene	Liquid	50 (mmHzO)	30	LOPC from Benzene Storage Tank (08T010) and pump bay

CASE STUDY I

Liq. Hydrocarbon Carryover to Furnace

0.2 Event/Yr.

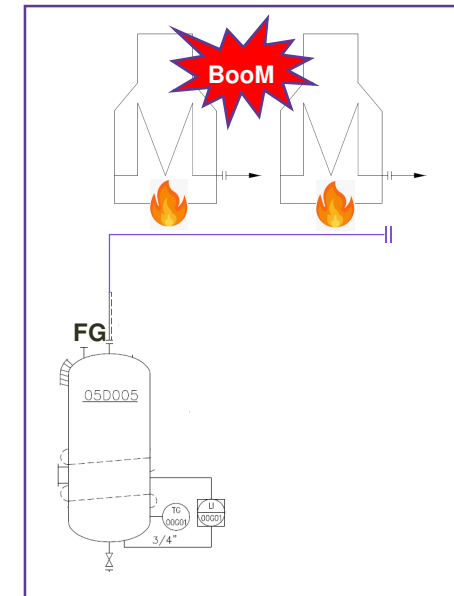
Carry over of wet gas from 05D005 due to Liquid contamination from mixing drum of LBOP utility causing evaporate failure

0.1

[KO Drum] LAH00G01 and operator response

RRF= 200
PFD= 0.005

New Barrier Required!! SIL2 is required.

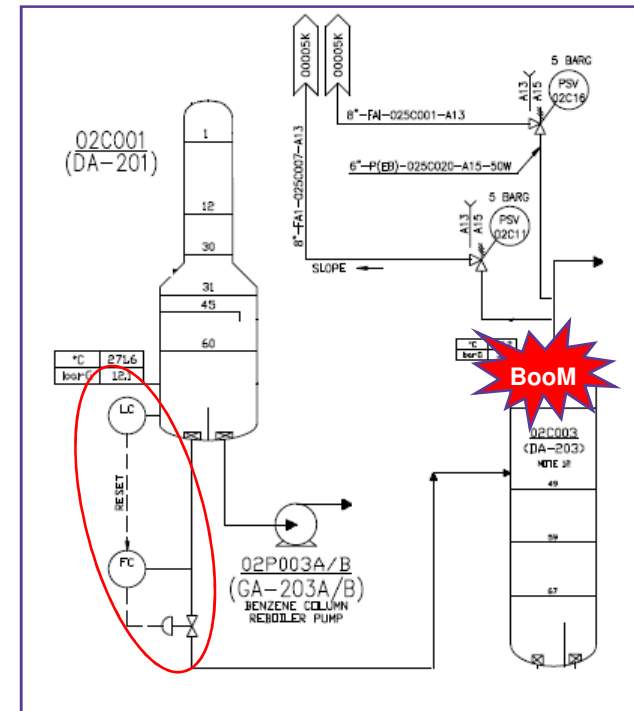
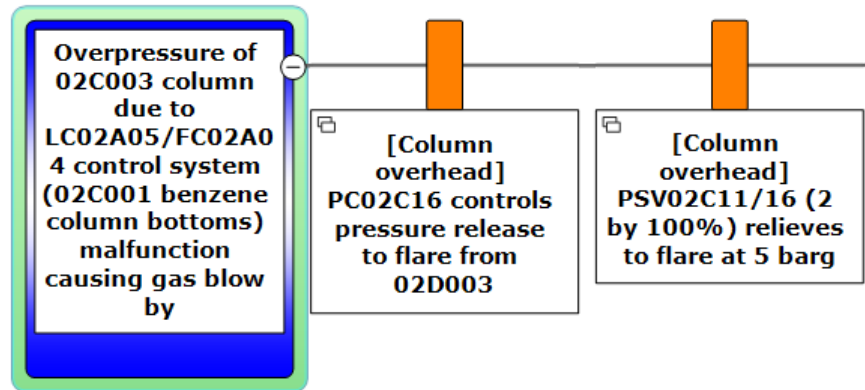


$$\text{LOPA} = 0.2 * 0.1 = 0.02$$

- Target Event Frequency = 1.00E-04.
- We need more valid barrier which PFD fit to 0.005 (SIL2) .

CASE STUDY II

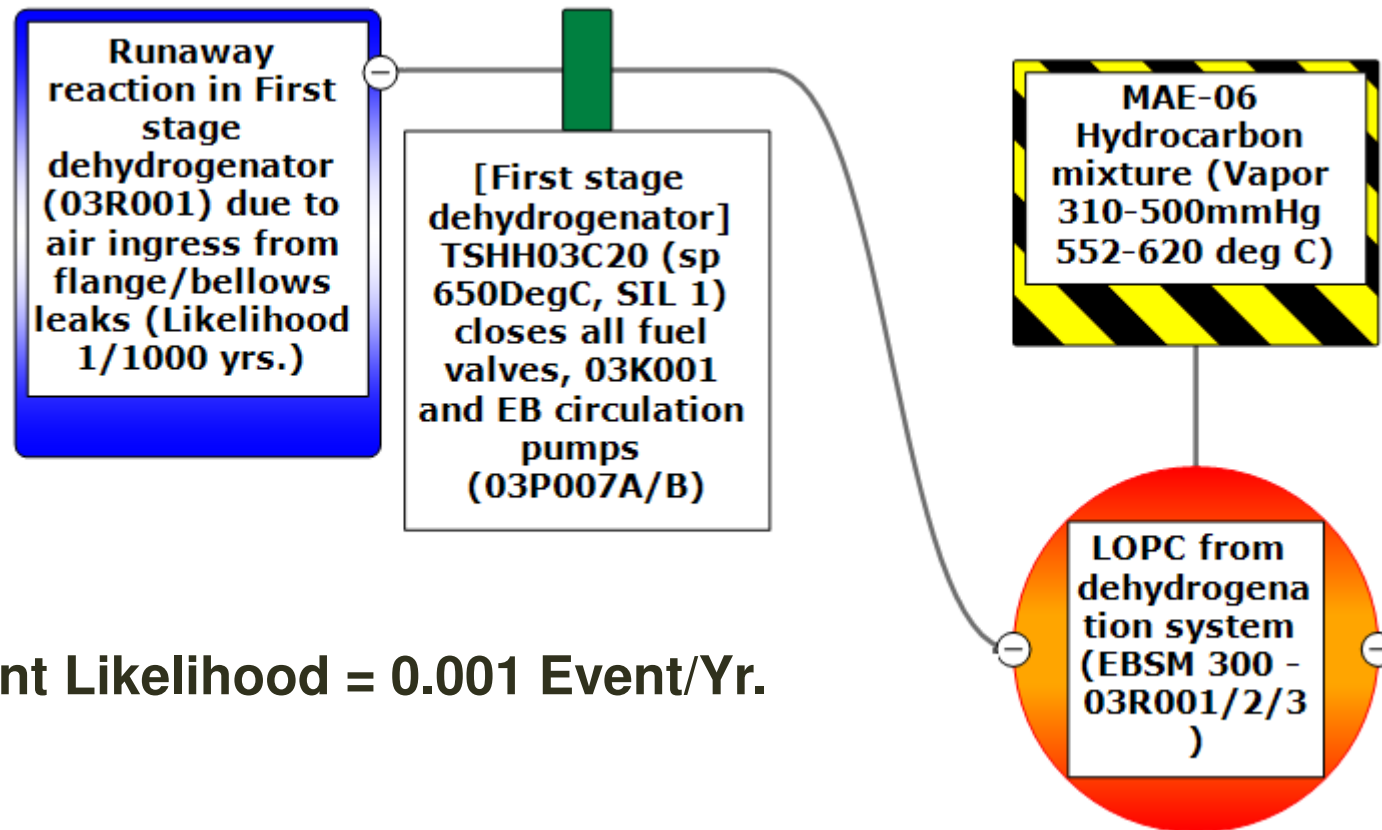
Gas Blow by from 02C001 to 02C003



- PC02C16 is not fast enough?
- PSV are not designed in case of blow by case?

CASE STUDY III

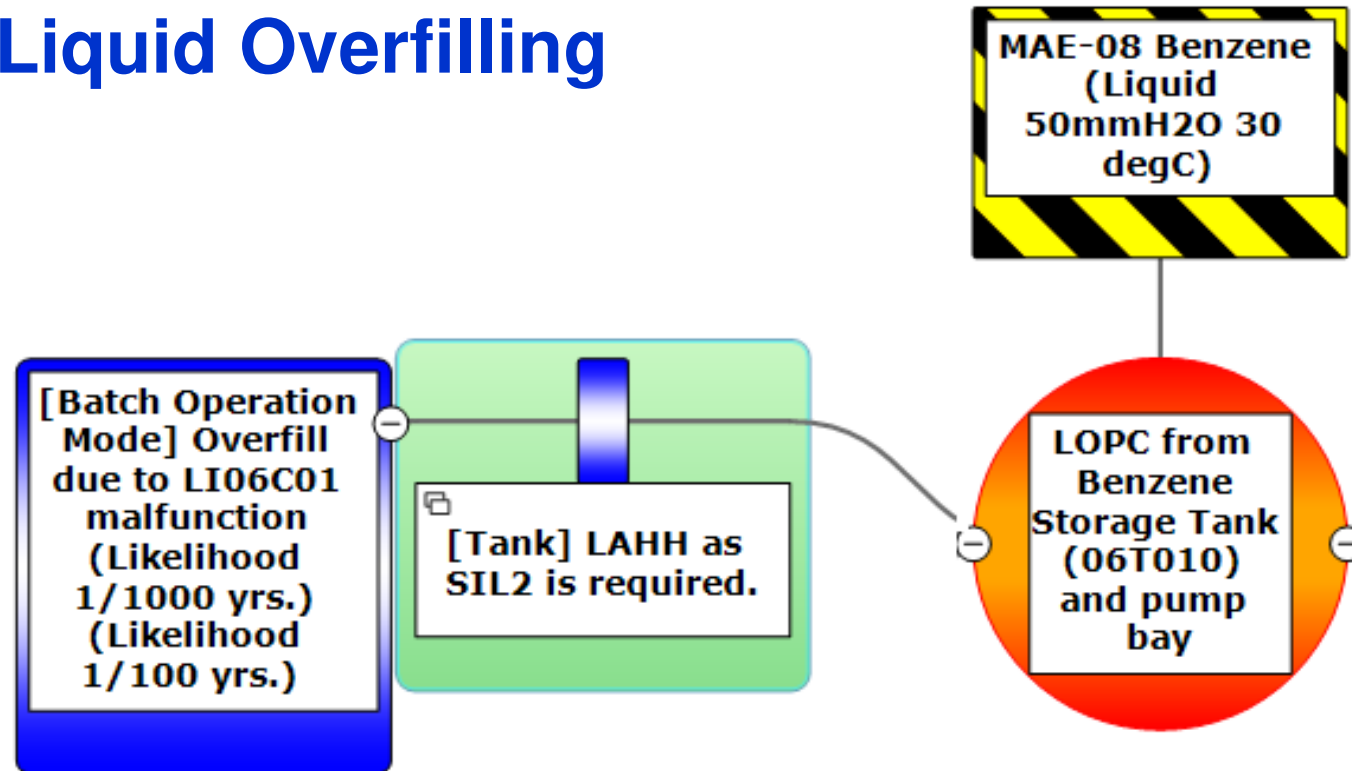
Reaction Runaway



- Event Likelihood = 0.001 Event/Yr.

CASE STUDY IV

Liquid Overfilling



- Target Event Frequency = 1.00E-04.
- LOPA = 0.01
- We need more valid barrier which PFD fit to 0.01 (SIL2) .



Thank you for your attention



7th Chemical Process Safety Sharing (CPSS)
7th May 2021, Thailand

