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Incident Investigation and ORM

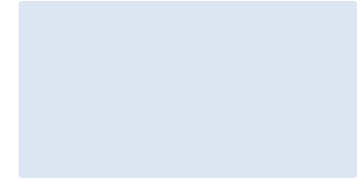
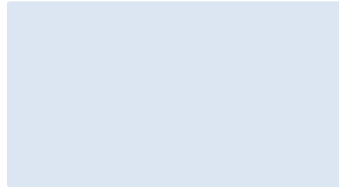
Major Field: Chemical Engineering



Mr. PATTARA TEPNU
Safety Engineer

Incident Investigation and ORM

Major Field: Control & Instrument Engineering



Digitalize PSE & Operating Window Collaboration Project



AGENDA



- GC OVERVIEW
- PROCESS SAFETY EVENT (PSE)
- DIGITALIZE SOLUTION
- COLLABORATION PROJECT
- BENEFIT
- ANALYSIS AND IMPROVEMENT

GC Overview



PTTGC by the numbers

11 Million ton of petrochemical capacity

280 KBD of Petroleum Refining Capacity

1 The largest ethane cracker in Thailand

8 Business units with Fully integrated petrochemical and refinery operations



GC Overview



Thailand's Largest Petrochemical Player

280 (Thousand Barrels per Day)

Petroleum Distillation Capacity ⁱⁿ

11.08 (Million Tons per Annum)

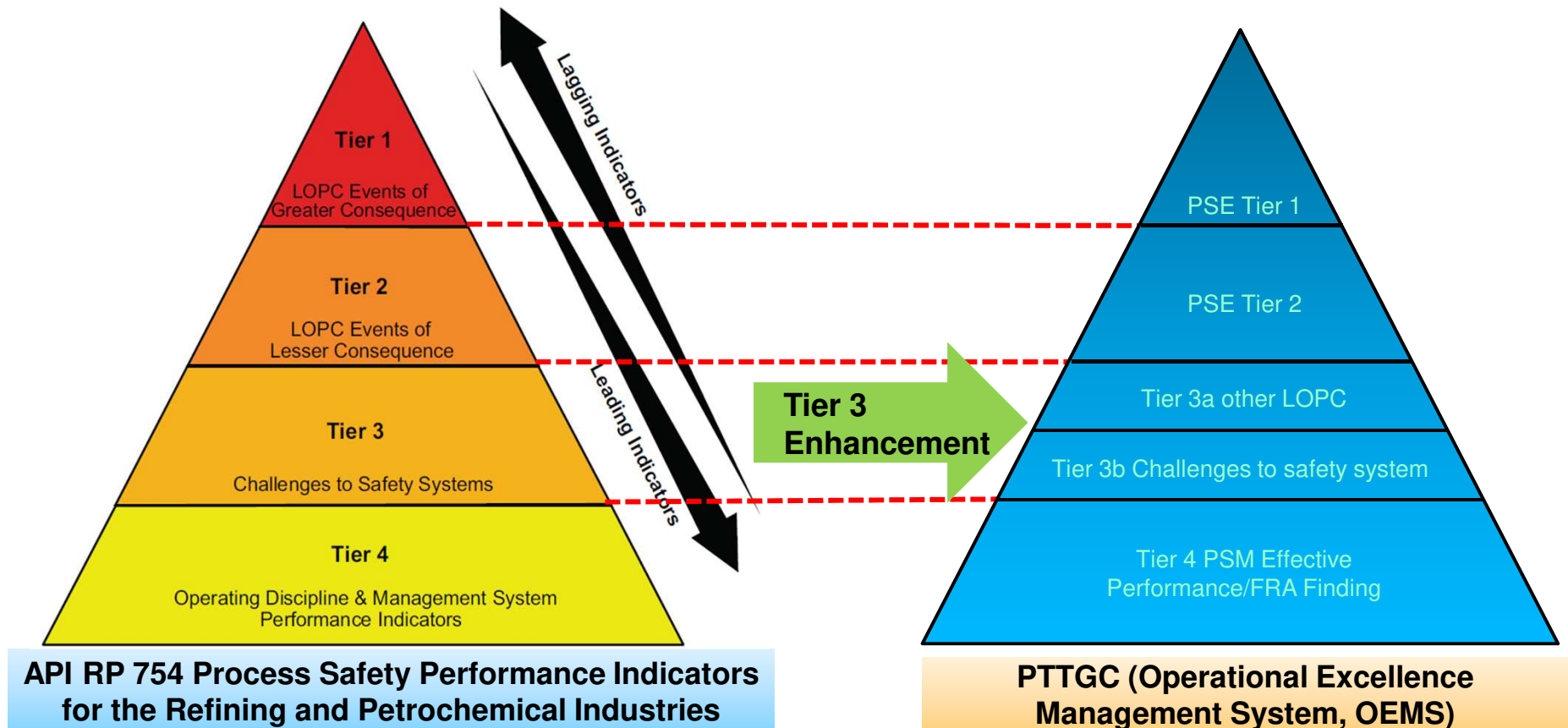
Petrochemical Capacity

	Refinery 280 KBD		Aromatics 2,419 KTA		Olefins 2,988 KTA		Polymers 3,236 KTA		EO-Based Performance 473 KTA		Green Chemicals 759 KTA		PC 250 KTA		Phenol 954 KTA
<ul style="list-style-type: none"> • LPG • Light Naphtha • Reformate • Jet A1 • Diesel • Fuel Oil 	<ul style="list-style-type: none"> • Benzene • Toluene • Paraxylene • Orthoxylene • Mixed Xylenes • Cyclohexane 	<ul style="list-style-type: none"> • Ethylene • Propylene • Mixed C4 • Pyrolysis Gasoline • Butadiene • Butene-1 	<ul style="list-style-type: none"> • HDPE • LLDPE • LDPE • Polystyrene • Polypropylene • mLLDPE • Hexene-1 • PTA • PET 	<ul style="list-style-type: none"> • Ethylene Oxide • Ethylene Glycol • Ethanolamines 	<ul style="list-style-type: none"> • Methyl Ester • Fatty Acid • Fatty Alcohol • Ethoxylate • Glycerin • Specialty Oleochemicals • Bioplastics 	<ul style="list-style-type: none"> • Dilsocyanate • Hexamethylene Diisocyanate and Derivatives • Acrylonitrile • Methyl Methacrylate 	<ul style="list-style-type: none"> • Phenol • Bisphenol A • Acetone 								

Process Safety Event (What is PSE?)



PSE (Process Safety Event) is an unplanned or uncontrolled release of any material from a process, or an undesired condition, that could have resulted in a release of material.



Process Safety Event (Tier 1)



Tier 1 LOPC Events of Greater Consequence

Tier 1 is an **unplanned** release of material from the process that result in the consequences listed below;

- “Days way from work” injury or fatality
- A hospital admission
- A fire or explosion damage greater than or equal to \$100,000 of direct cost.
- An officially declared community evacuation or community shelter-in-place
- Release amount of material greater than or equal to table 1



Table 1—Tier 1 Material Release Threshold Quantities

Threshold Release Category	Material Hazard Classification ^{a,c,d,e,f}	Threshold Quantity (outdoor release)	Threshold Quantity (indoor ^g release)
T1-1	TIH Zone A Materials	≥5 kg (11 lb)	≥0.5 kg (1.1 lb)
T1-2	TIH Zone B Materials	≥25 kg (55 lb)	≥2.5 kg (5.5 lb)
T1-3	TIH Zone C Materials	≥100 kg (220 lb)	≥10 kg (22 lb)
T1-4	TIH Zone D Materials	≥200 kg (440 lb)	≥20 kg (44 lb)
T1-5	Flammable Gases Hydrogen, LPG or Liquids with Normal Boiling Point ≤35 °C (95 °F) and Flash Point <23 °C (73 °F) or Other Packing Group I Materials (excluding acids/bases)	≥500 kg (1100 lb)	≥50 kg (110 lb)
T1-6	Liquids with Normal Boiling Point >35 °C (95 °F) and Flash Point <23 °C (73 °F) or Benzene, Ethanol Other Packing Group II Materials (excluding acids/bases)	≥1000 kg (2200 lb) or ≥7 bbl	≥100 kg (220 lb) or ≥0.7 bbl
T1-7	Liquids with Flash Point ≥23 °C (73 °F) and ≤60 °C (140 °F) or Liquids with Flash Point >60 °C (140 °F) released at a temperature at or above Flash Point or Strong acids/bases see definition 3.1.2) pH < 1 , pH > 12.5 or UNDG Class 2, Division 2.2 (non-flammable, non-toxic gases) excluding air or Other Packing Group III Materials	≥2000 kg (4400 lb) or ≥14 bbl	≥200 kg (440 lb) or ≥1.4 bbl

Process Safety Event (Tier 2)



Tier 2 LOPC Events of Lesser Consequence

Tier 2 is an **unplanned** release of material which is lesser in consequence from the process that result in the consequences listed below ;

- **Recordable injury**
- **A fire or explosion** damage greater than or equal to **\$2500** of direct cost.
- **Release** amount of material greater than or equal to table 2

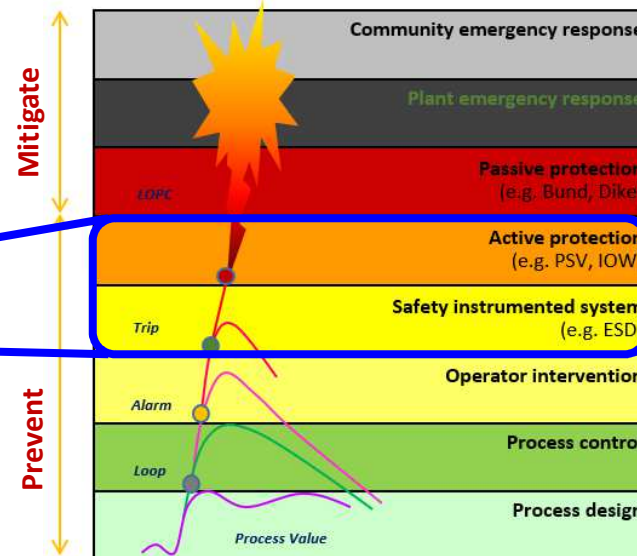
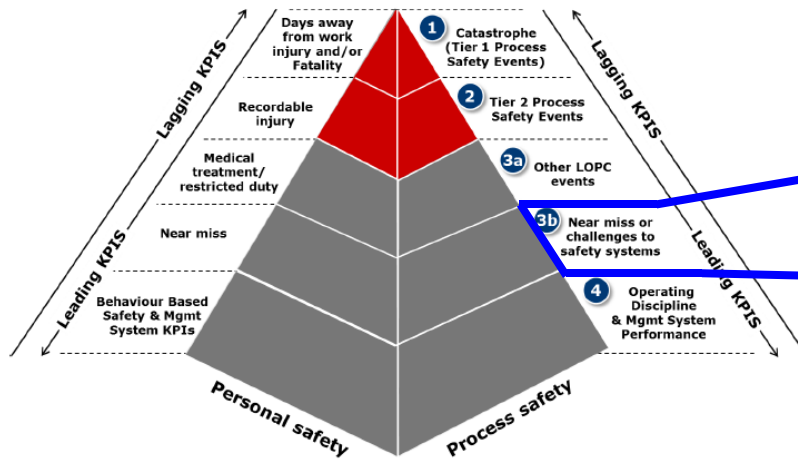
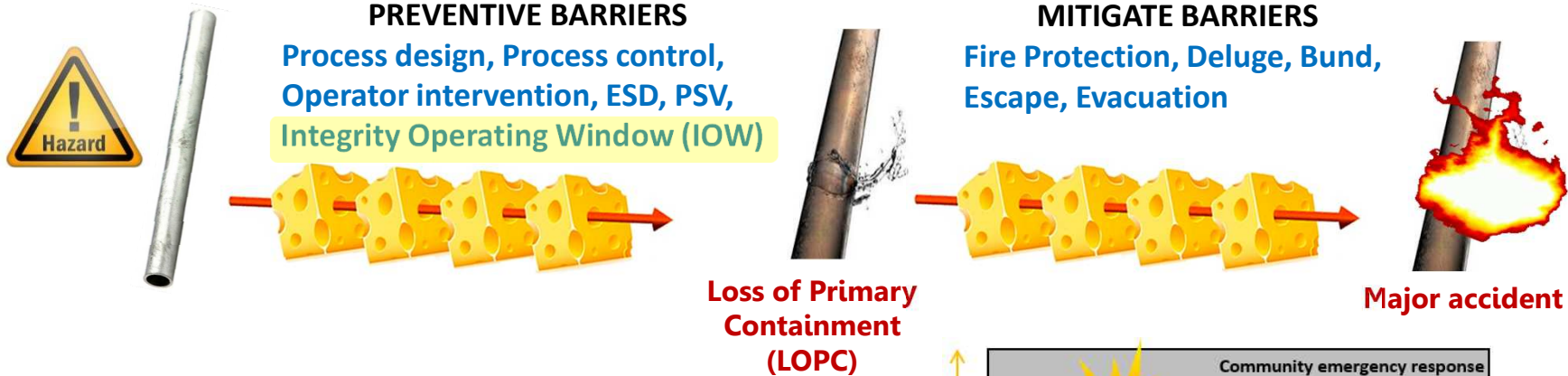


Table 2—Tier 2 Material Release Threshold Quantities

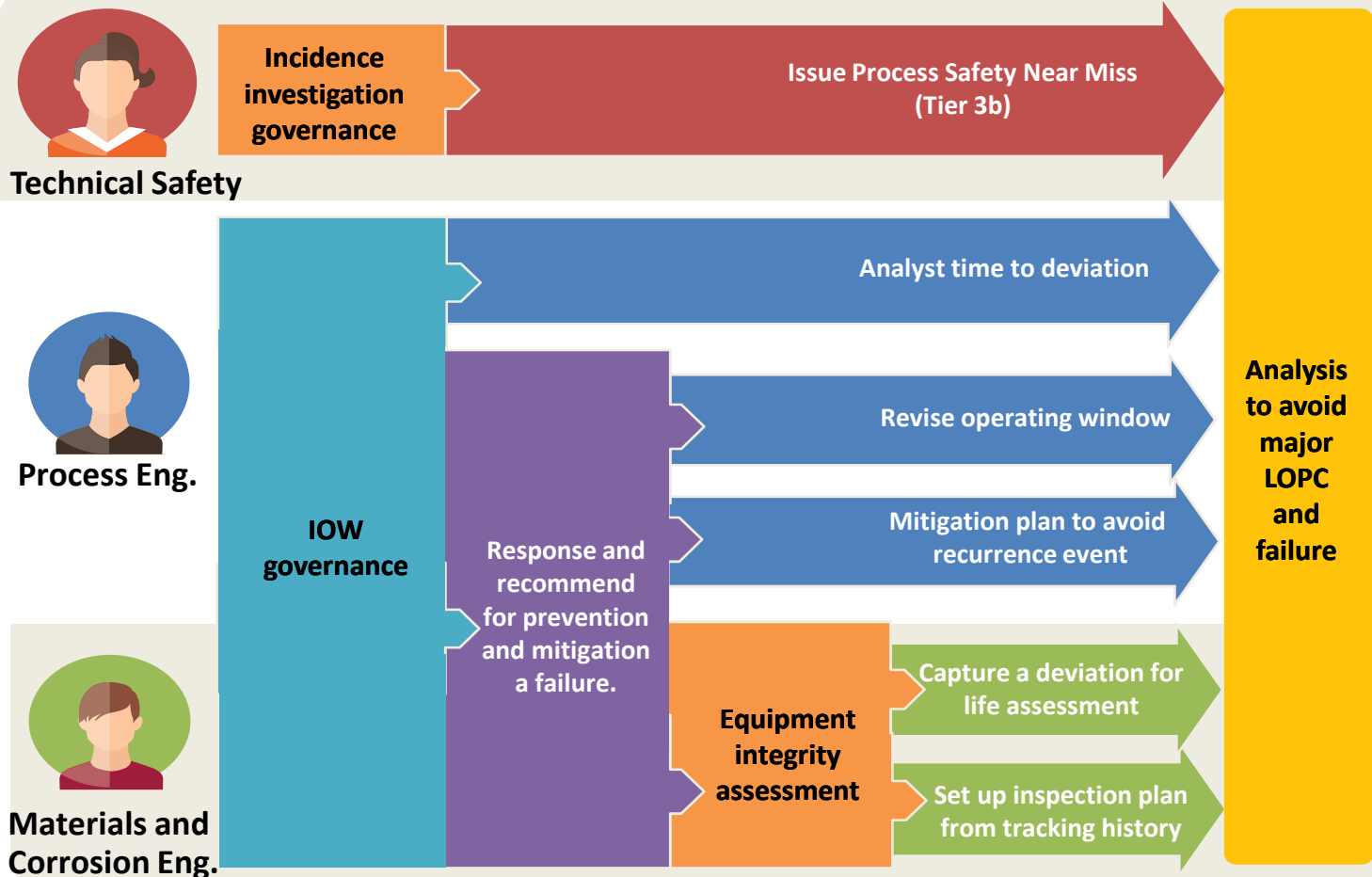
Threshold Release Category	Material Hazard Classification ^{a,c,d,e,f}	Threshold Quantity (outdoor release)	Threshold Quantity (indoor ^b release)
T2-1	TIH Zone A Materials	≥0.5 kg (1.1 lb)	≥0.25 kg (0.55 lb)
T2-2	TIH Zone B Materials	≥2.5 kg (5.5 lb)	≥1.25 kg (2.75 lb)
T2-3	TIH Zone C Materials	≥10 kg (22 lb)	≥5 kg (11 lb)
T2-4	TIH Zone D Materials	≥20 kg (44 lb)	≥10 kg (22 lb)
T2-5	Flammable Gases or Liquids with Normal Boiling Point ≤35 °C (95 °F) and Flash Point <23 °C (73 °F) or Other Packing Group I Materials (excluding acids/bases)	≥50 kg (110 lb)	≥25 kg (55 lb)
T2-6	Liquids with Normal Boiling Point >35 °C (95 °F) and Flash Point <23 °C (73 °F) or Other Packing Group II Materials (excluding acids/bases)	≥100 kg (220 lb) or ≥0.7 bbl	≥50 kg (110 lb) or ≥0.35 bbl
T2-7	Liquids with Flash Point ≥23 °C (73 °F) and ≤60 °C (140 °F) or Liquids with Flash Point >60 °C (140 °F) released at a temperature at or above Flash Point or Strong acids/bases (see definition 3.1.2) or UNDG Class 2, Division 2.2 (non-flammable, non-toxic gases) excluding air or Other Packing Group III Materials	≥200 kg (440 lb) or ≥1.4 bbl	≥100 kg (220 lb) or ≥0.7 bbl
T2-8	Liquids with Flash Point >60 °C (140 °F) and ≤93 °C (200 °F) released at a temperature below Flash Point or Moderate acids/bases (see definition 3.1.1)	≥1000 kg (2200 lb) or ≥7 bbl	≥500 kg (1100 lb) or ≥3.5 bbl

1 ≤ pH < 2 , 11.5 < pH ≤ 12.5

Process Safety Event (Integrity Operating Window)



COLLABORATION PROJECT



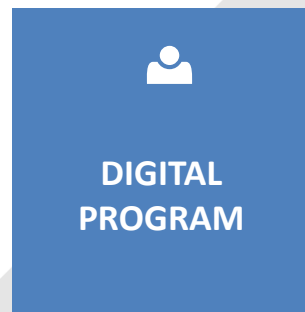
Operation Risk Management (ORM)



BENEFIT



- ❑ Real time record and keep in **Historical data**
- ❑ Prompt **notification**
- ❑ **Accurate** tracking

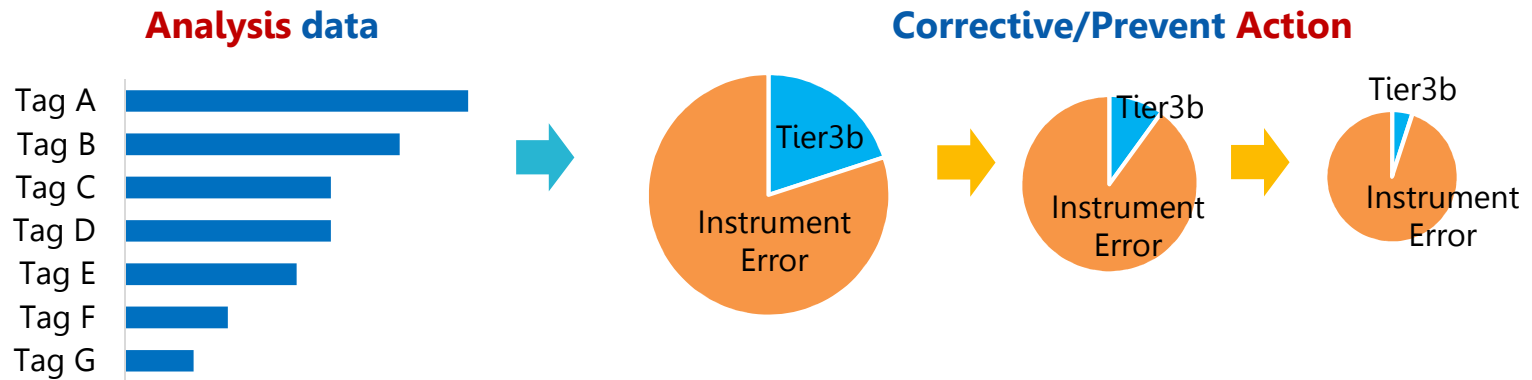


- ❑ Out of IOW event record (**Tier 3b**)
- ❑ Process safety analytic to identify **RISK** and avoid **major LOPC**

- ❑ Capture a **deviation for life assessment**
- ❑ Set up **inspection plan** from tracking history
- ❑ Possible to **monitor** whatever PI tags

- ❑ **Analyst** time to deviation
- ❑ **Review** operating window
- ❑ **Mitigation plan** to **avoid recurrence event**

Analysis and Improvement



Improvement

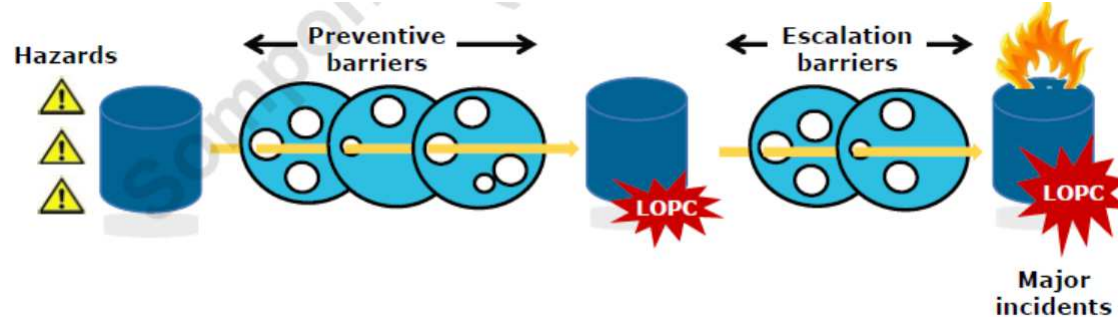
- **Improve operating conditions (short term and long term)**
- **Technical review OPW to proper set point**
- **Re-visit all OPW operameters (whole plant)**
- **Repair and Replace instrument**
- **Increase Awareness to Process Safety**

Thank you

Back up

Process Safety (OEMS)

Process Safety is a disciplined framework for managing the integrity of hazardous operating systems and processes. It applies **good design principles**, **engineering**, and **operating** and **maintenance practices**.



To ensure consistent and discipline

- **Design integrity** – Facilities design and construction that ensures risks are **ALARP**.
- **Technical integrity** – Systematic maintenance of equipment that enables operations to **meet their original design intent** and **hardware limits**.
- **Operations integrity** – Operating principles that ensure the **safe operating window of the equipment is not exceeded**. The demands that operations are executed by the right people, at the right place, with the right information, and the right time.