Ms. SUPIN TAOPUTSHONG
Senior Safety Engineer
Incident Investigation and ORM

Major Field: Chemical Engineering
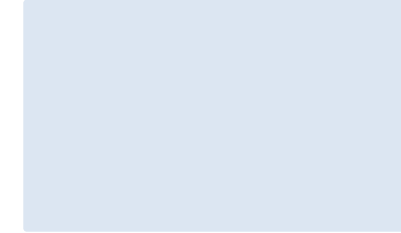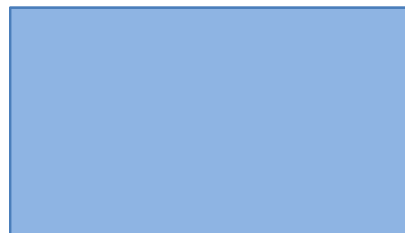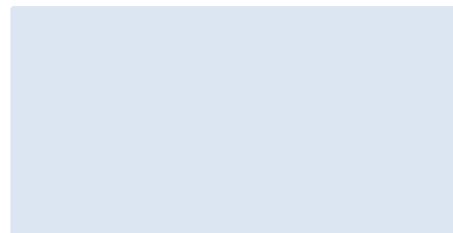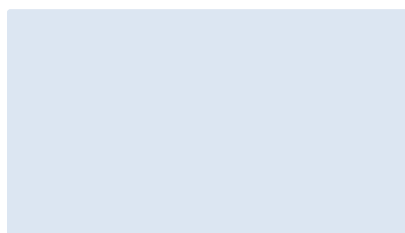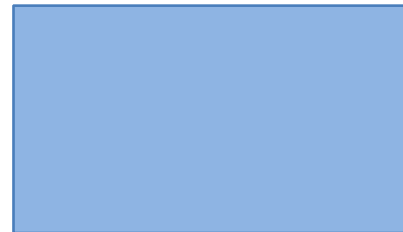

Mr. PATTARA TEPNU
Safety Engineer
Incident Investigation and ORM

Major Field: Control & Instrument Engineering

Digitalize PSE & Operating Window Collaboration Project

GC
SPIRIT
The way we work together

GC
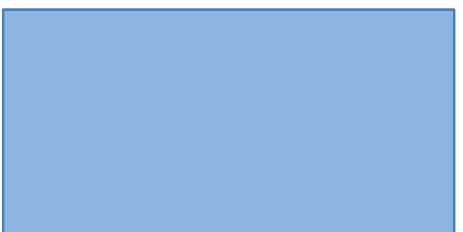
- GC OVERVIEW
- PROCESS SAFETY EVENT (PSE)
- DIGITALIZE SOLUTION
- COLLABORATION PROJECT
- BENEFIT
- ROOT CAUSE ANALYSIS

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

8 Business Units

REFINERY AROMATICS OLEFINS POLYMERS

EO BASED GREEN PERFORMANCE PHENOL

Thailand's Largest Petrochemical Player

280 (Thousand Barrels per Day)
Petroleum Distillation Capacity (1)

11.08 (Million Tons per Annum)
Petrochemical Capacity

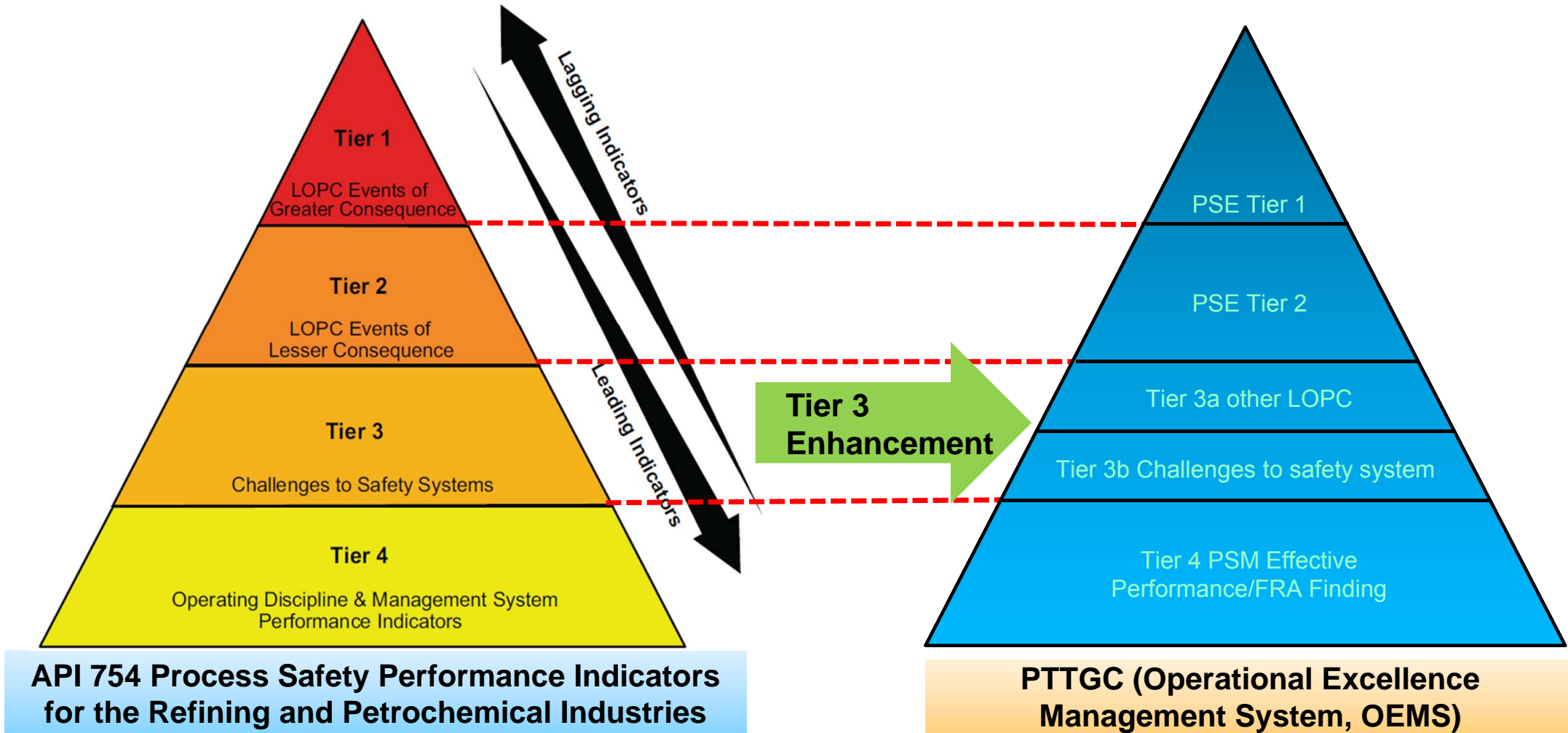| **Refinery** 280 KBD	**Aromatics** 2,419 KTA	**Olefins** 2,988 KTA	**Polymers** 3,236 KTA	**EO-Based Performance** 473 KTA	**Green Chemicals** 759 KTA	**PC** 250 KTA	**Phenol** 954 KTA
• LPG • Light Naphtha • Reformate • Jet A1 • Diesel • Fuel Oil	• Benzene • Toluene • Paraxylene • Orthoxylene • Mixed Xylenes • Cyclohexane	• Ethylene • Propylene • Mixed C4 • Pyrolysis Gasoline • Butadiene • Butene-1	• HDPE • LLDPE • LDPE • Polystyrene • Polypropylene • mLLDPE • Hexene-1 • PTA • PET	• Ethylene Oxide • Ethylene Glycol • Ethanolamines	• Methyl Ester • Fatty Acid • Fatty Alcohol Ethoxylate • Grycerin • Specialty Oleochemicals • Bioplastics	• Diisocyanate • Hexamethylene Diisocynate and Derivatives • Acrylonitrile • Methyl Methacrylate	• Phenol • Bisphenol A • Acetone

What is PSE (Process Safety Event)

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.

API 754 Process Safety Performance Indicators for the Refining and Petrochemical Industries

PTTGC (Operational Excellence Management System, OEMS)

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[b] 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) [Benzene, Ethanol] or 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) [Butanol, o-Xylene] 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 < pH ≤ 12.5

Tier 3a : Other LOPC events

LOPC incidents with a consequence less than Tier 2 PSEs

Tier 3b : Challenges to Safety Systems (Near miss)
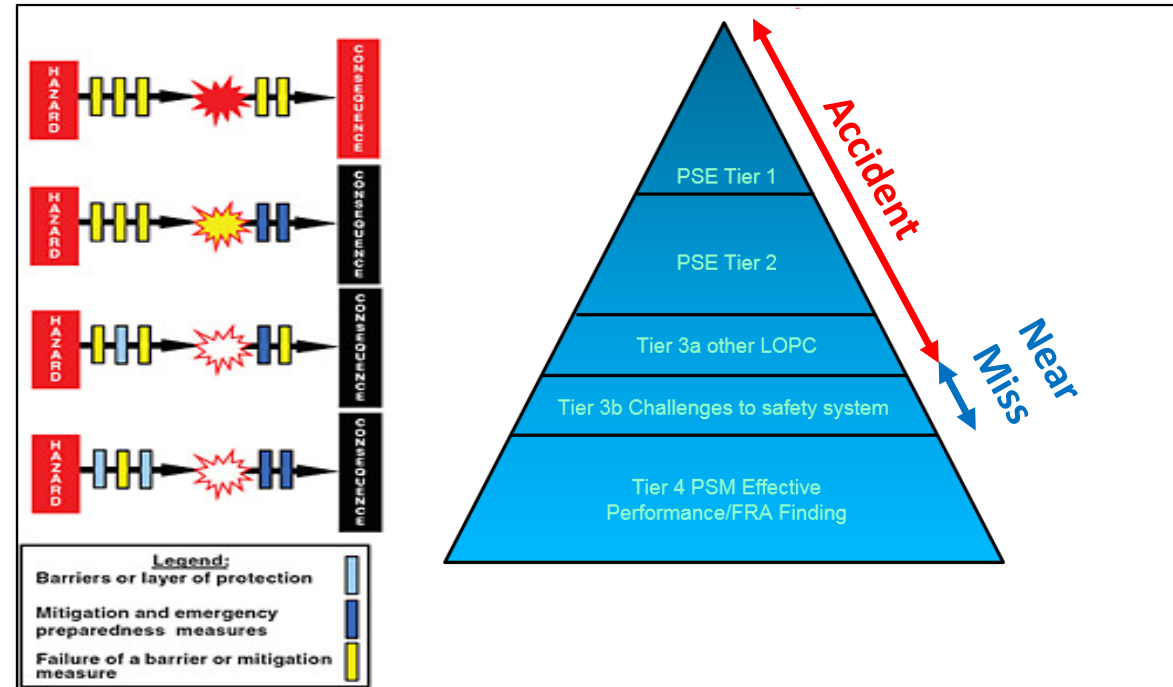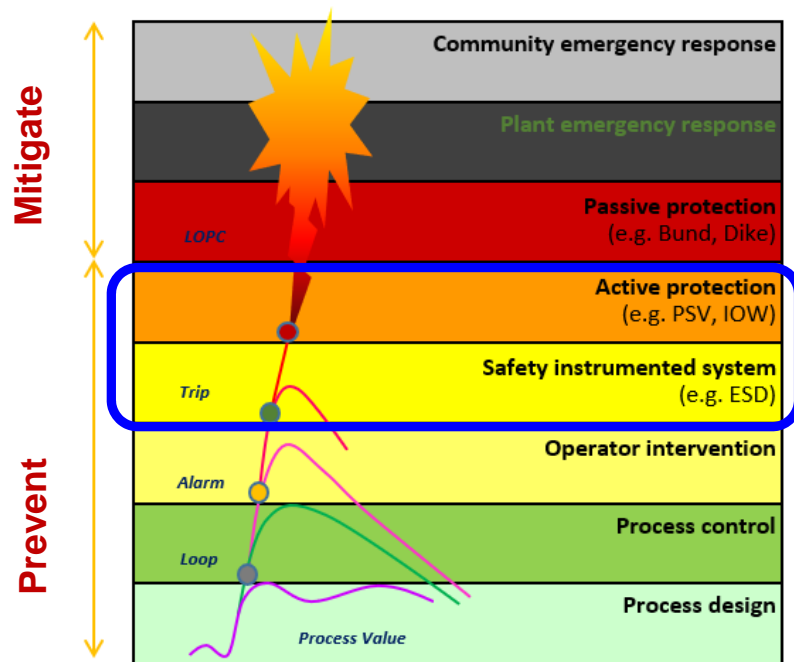
- Safe operation limit (Integrity Operating Window, IOW) excursions
- Pipe as SCE Equipment is Thickness don't meet the allowance Thickness
- Demands on safety systems;

  Activation of a safety instrumented system (ESD)

  Activation of a Pressure Relief Device (PRD)

A demand resulting from intentional activation is excluded.

PROCESS SAFETY (Integrity Operating Window)

PREVENTIVE BARRIERS
Process design, Process control, Operator intervention, ESD, PSV, Integrity Operating Window (IOW)

MITIGATE BARRIERS
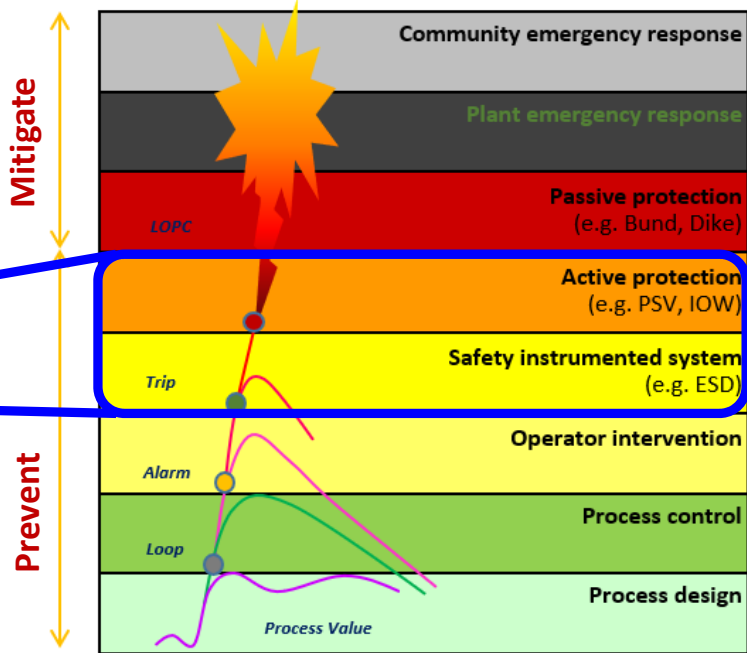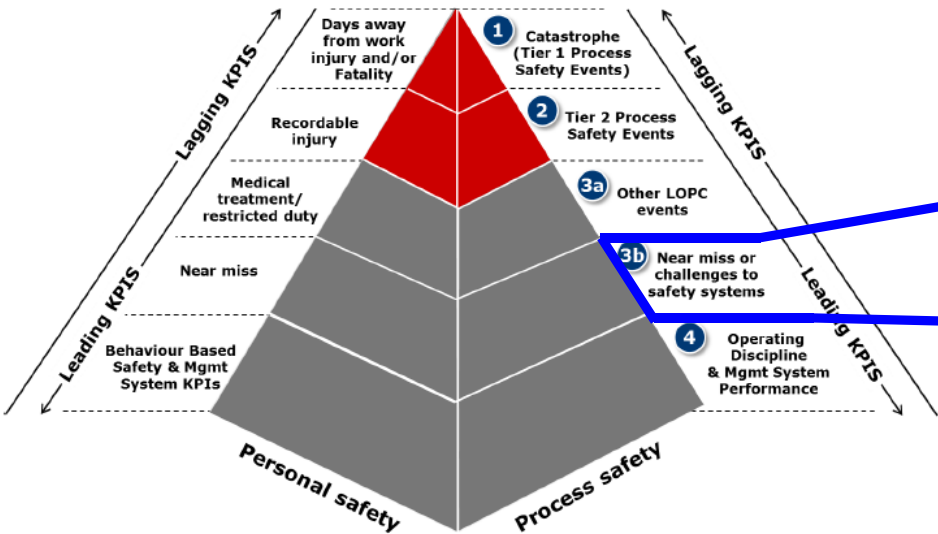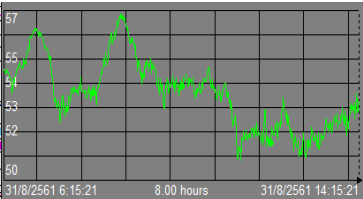Fire Protection, Deluge, Bund, Escape, Evacuation

Hazard

Loss of Primary Containment (LOPC)

Major accident

Days away from work injury and/or Fatality — 1 Catastrophe (Tier 1 Process Safety Events)

Recordable injury — 2 Tier 2 Process Safety Events

Medical treatment/ restricted duty — 3a Other LOPC events

Near miss — 3b Near miss or challenges to safety systems

Behaviour Based Safety & Mgmt System KPIs — 4 Operating Discipline & Mgmt System Performance

Lagging KPIS

Leading KPIS

Personal safety

Process safety

Mitigate

Community emergency response

Plant emergency response

Passive protection (e.g. Bund, Dike)

LOPC

Active protection (e.g. PSV, IOW)

Safety instrumented system (e.g. ESD)

Trip

Operator intervention

Alarm

Process control

Loop

Process design

Process Value

Prevent

DIGITALIZE SOLUTION

PI System

Historical record event

Automatic notify e-mail

Statistic summarization

Export data
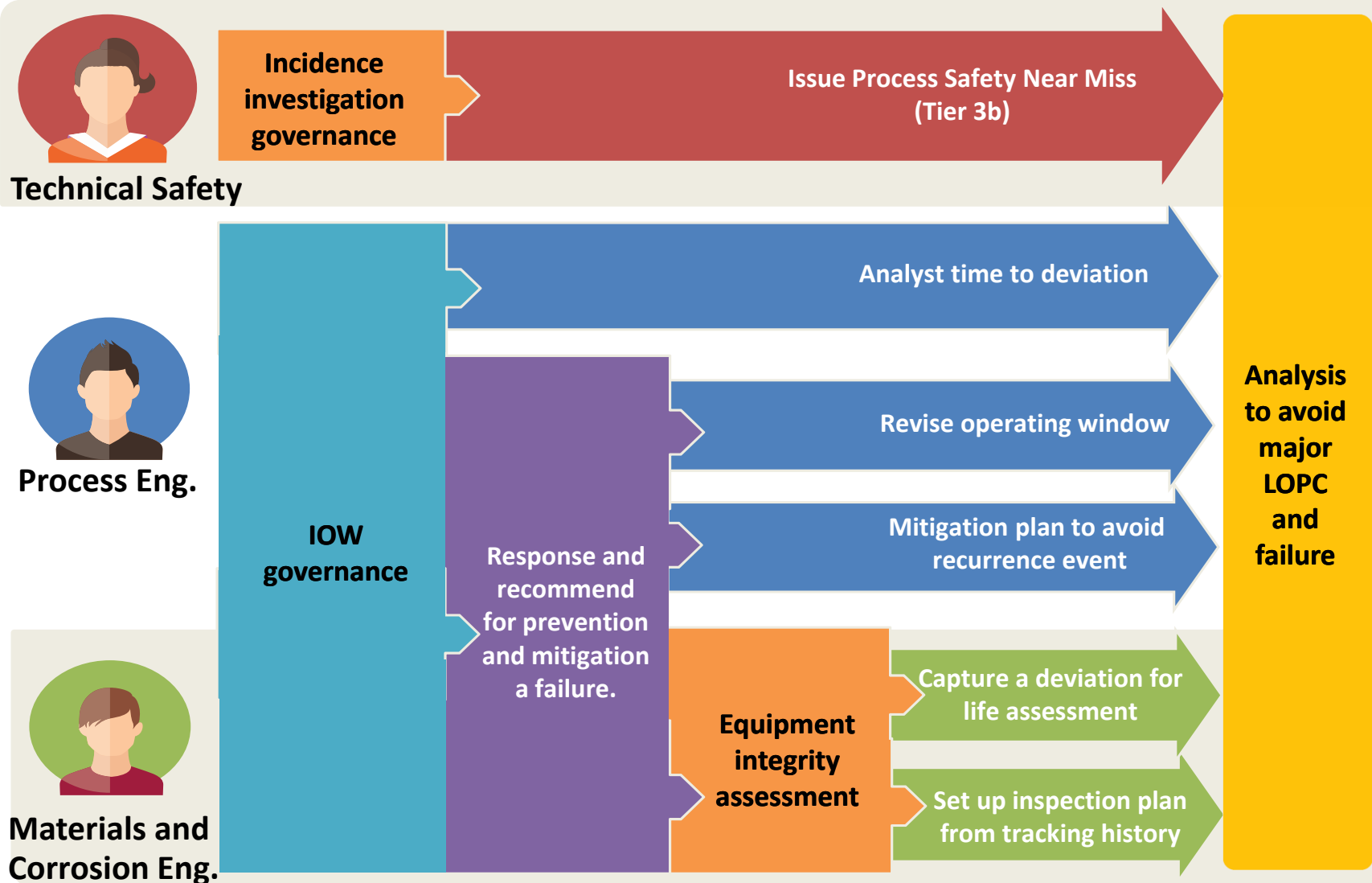
☐ **Real time record and keep in Historical data**

☐ **Prompt notification**

☐ **Accurate tracking**
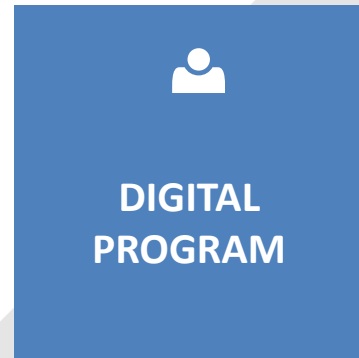
☐ **Out of IOW event record (Tier 3b)**

☐ **Process safety analytic to identify RISK and avoid major LOPC**

DIGITAL PROGRAM

STRENGTHEN PROCESS SAFETY

RELIABILITY PROACTIVE

TECHNICAL PROACTIVE

☐ **Analyst time to deviation**

☐ **Review operating window**

☐ **Mitigation plan to avoid recurrence event**

☐ **Capture a deviation for life assessment**

☐ **Set up inspection plan from tracking history**

☐ **Possible to monitor whatever PI tags**

Root Cause Analysis

Thank you