

# 11<sup>th</sup> Chemical Process Safety Sharing (CPSS)



**Topic: Emergency relates to Process Area, Tank farm & Jetty  
and Utilities**

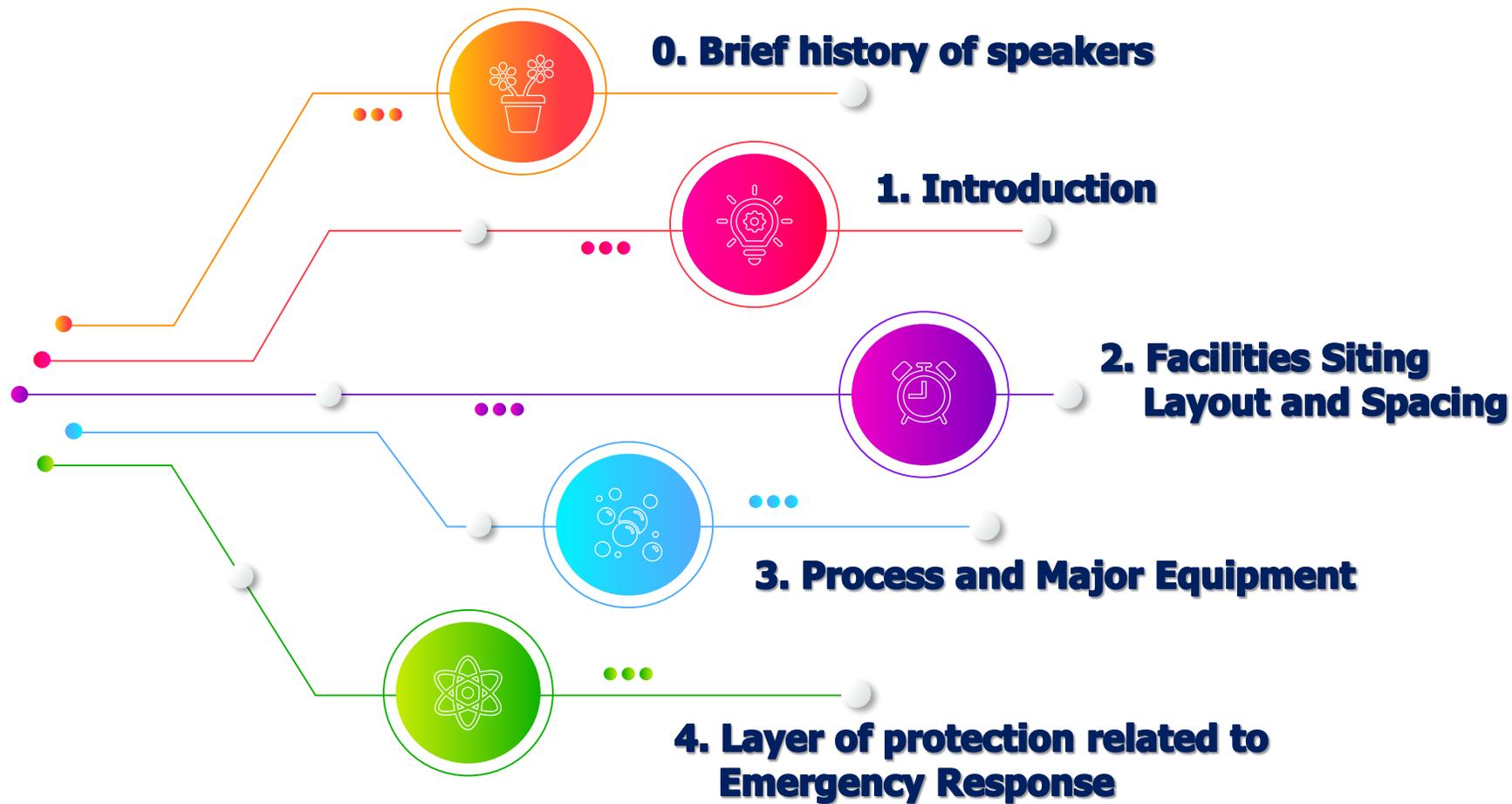
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**Mobile: 081-578-1315**

**Company : PTT Global Chemical Public Company Limited**







## 0. Brief history of speakers

### WORK EXPERIENCE

#### Petroleum, Petrochemical and Chemical in 1988 - CURRENT

- Instrument Mechanical Maintenance : TPI
- Operations : NPC
- Operations Support : NPC
- Maintenance Services : NPC
- Engineering and Project Management : NPC
- Maintenance Planning : NPC
- Process Safety Management : PTTCHEM
- Technical Safety Services: GC

### EDUCATION

- Diploma Certificate in Automotive technicians : Sisaket Technical College
- Higher Vocational Certificate in Automotive technicians : Ubon Ratchathani Technical College
- B.Sc. In Production Technology : Chachoengsao Teachers College
- B.Eng. in Mechanical Engineering : SWU
- M.Eng. in Mechanical Engineering : SWU
- Ph.D. in Mechanical Engineering : SWU

### RESOLUTION

Take care of every life so that they can live up to the terms that the heavens preside over

### CIRTIIFICATES

- Certificate in Constructionism-Chemical Engineering Practice School (C-ChEPS - 4th) : KMUTT
- Certificate in Fire Protection Engineering : KU
- Certificate in Process Safety Management Implement & Audits : Prima Tech & PI-II



## 1910.119 (n) Emergency planning and response.

- The employer shall establish and implement an emergency action plan for the entire plant in accordance with the provisions of 29 CFR 1910.38. In addition, the emergency action plan shall include **procedures** for handling small releases. **Employers** covered under this standard may also be subject to the hazardous waste and emergency response provisions contained in 29 CFR 1910.120 (a), (p) and (q).
- **TYPES OF EMERGENCY PLANS**
  - **On-site plan** : This will be the responsibility of the works management to formulate it. Plan must therefore be specific to the site.
  - **Off-site plan** : This will be the responsibility of district emergency authority to integrate plans. Plan must therefore be specific to the area.

## OBJECTIVES OF EMERGENCY PLANS

- To localize the emergency, and if possible, to eliminate it.
- To minimize the effects on people, property and environment.
- Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and prompt communication to people living nearby

## Causes of emergency

- **NATURE** : earthquake, droughts, floods, etc.
  - **VIOLENCE** : war, armed conflict, sabotage, etc.
  - **DETERIORATION** : environment degradation, etc.
  - **FAILURES**: equipment, plant, fire, leakage, etc.
- **This will result in fire ,explosion or toxic release.**



## FACTORS TO BE CONSIDERED

Three factors have to be taken into consideration in formulating the plan either for On-site or Off-site. This can be termed as safety continuum. The three factors are:

### 1. Prevention

- ✓ Anticipation
- ✓ Analysis
- ✓ Scenarios
- ✓ Engineering and Design.

### 2. Preparedness

- ✓ Policy
- ✓ Procedures
- ✓ Performance
- ✓ Practice.

### 3. Response

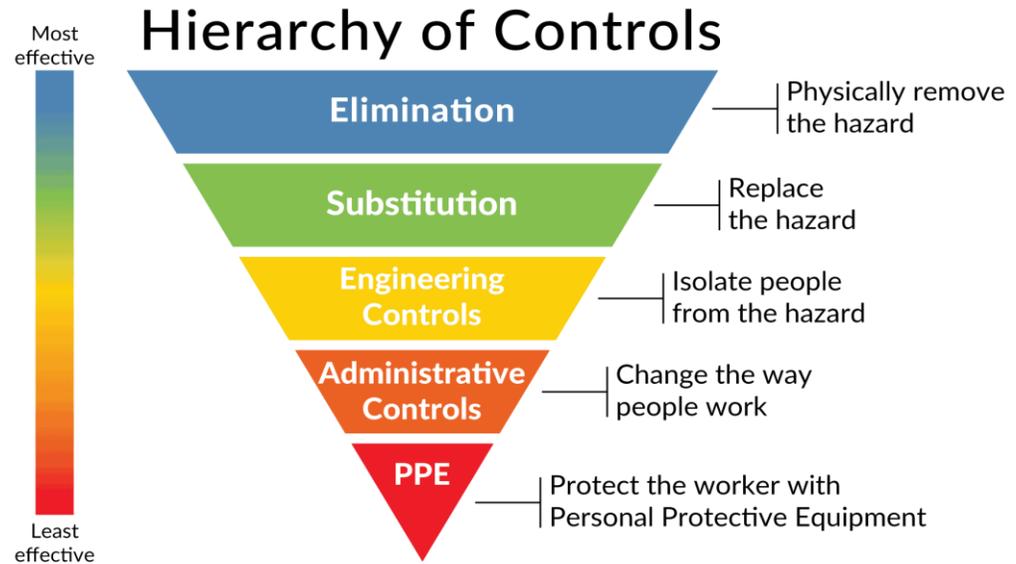
- ✓ Reaction to an incident
- ✓ Critique of incident



## OSHA Hierarchy of controls and Risk Controls

- **Risk Elimination**
  - Includes avoidance by design
- **Risk Reduction**
  - Reduce to exposure
  - Substitution
  - Engineering
- **Risk Isolation**
  - Separation/Segregation
- **Risk Control**
  - Physical
  - System
  - Human

The hazard controls in the hierarchy are, in order of decreasing effectiveness:



Credit of [www.ohswa.or.th](http://www.ohswa.or.th)

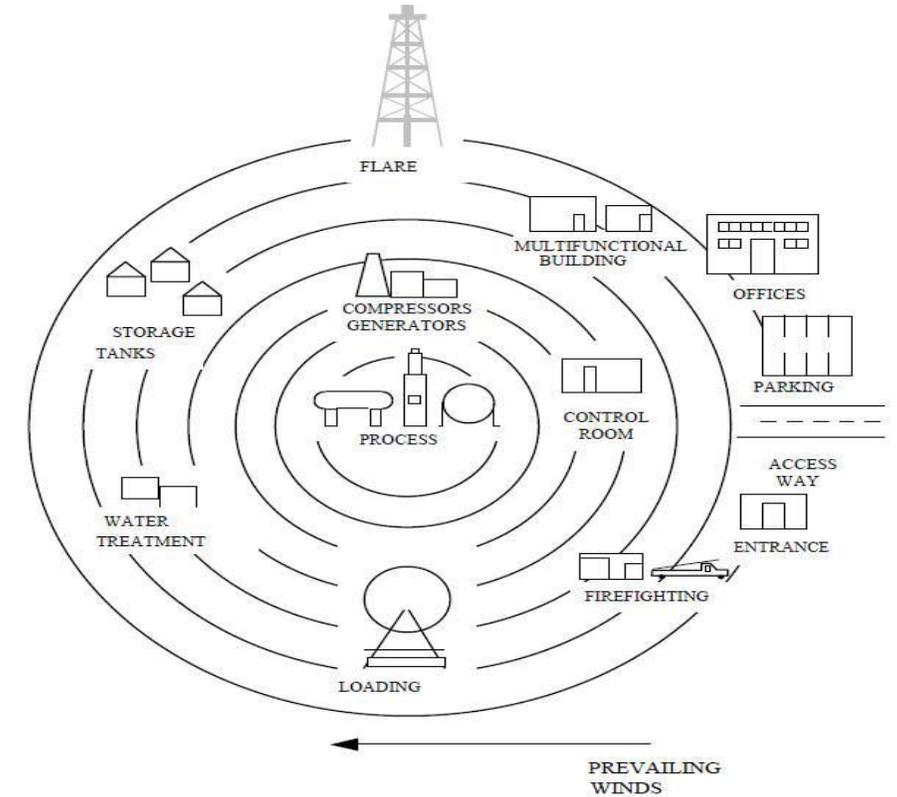


## 2. Facilities Siting Layout and Spacing (1/7)

### Hazardous classification of each unit

- **Moderate hazard:** This category includes processes, operations, or materials with limited explosion and moderate fire hazards.
- **Intermediate hazard:** This category includes processes, operations, or materials with an appreciable explosion and moderate fire hazard.
- **High hazard:** This category includes processes, operations, or materials with high explosion and moderates to heavy fire hazards.

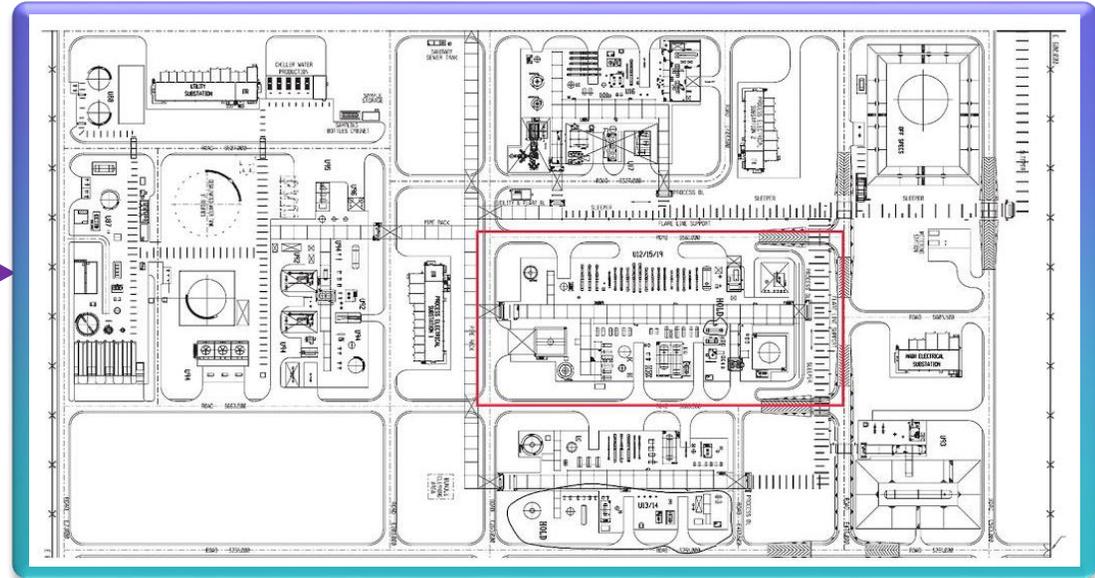
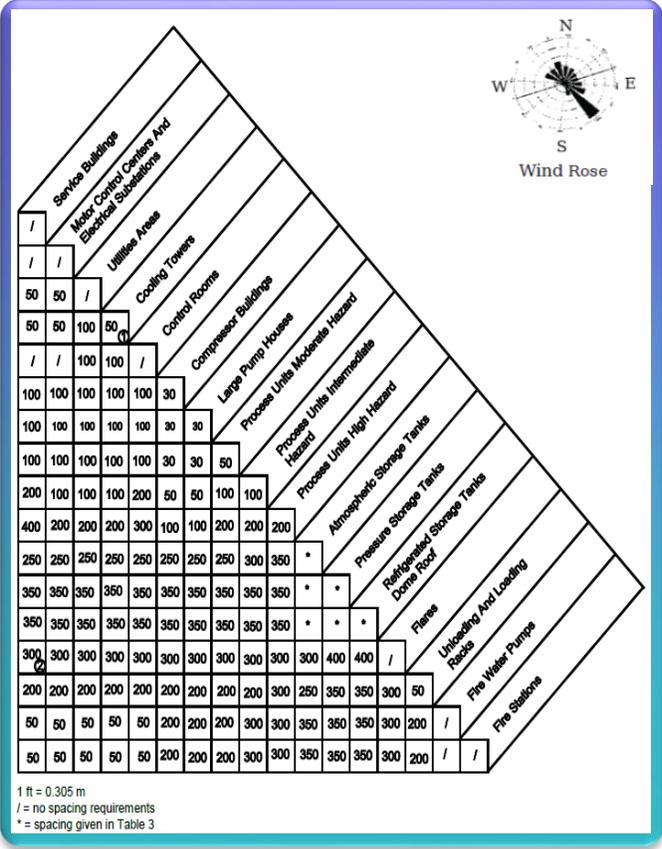
### Plant layout arrangement.



Credited with the GAP Guidelines



# 2. Facilities Siting Layout and Spacing (3/7)

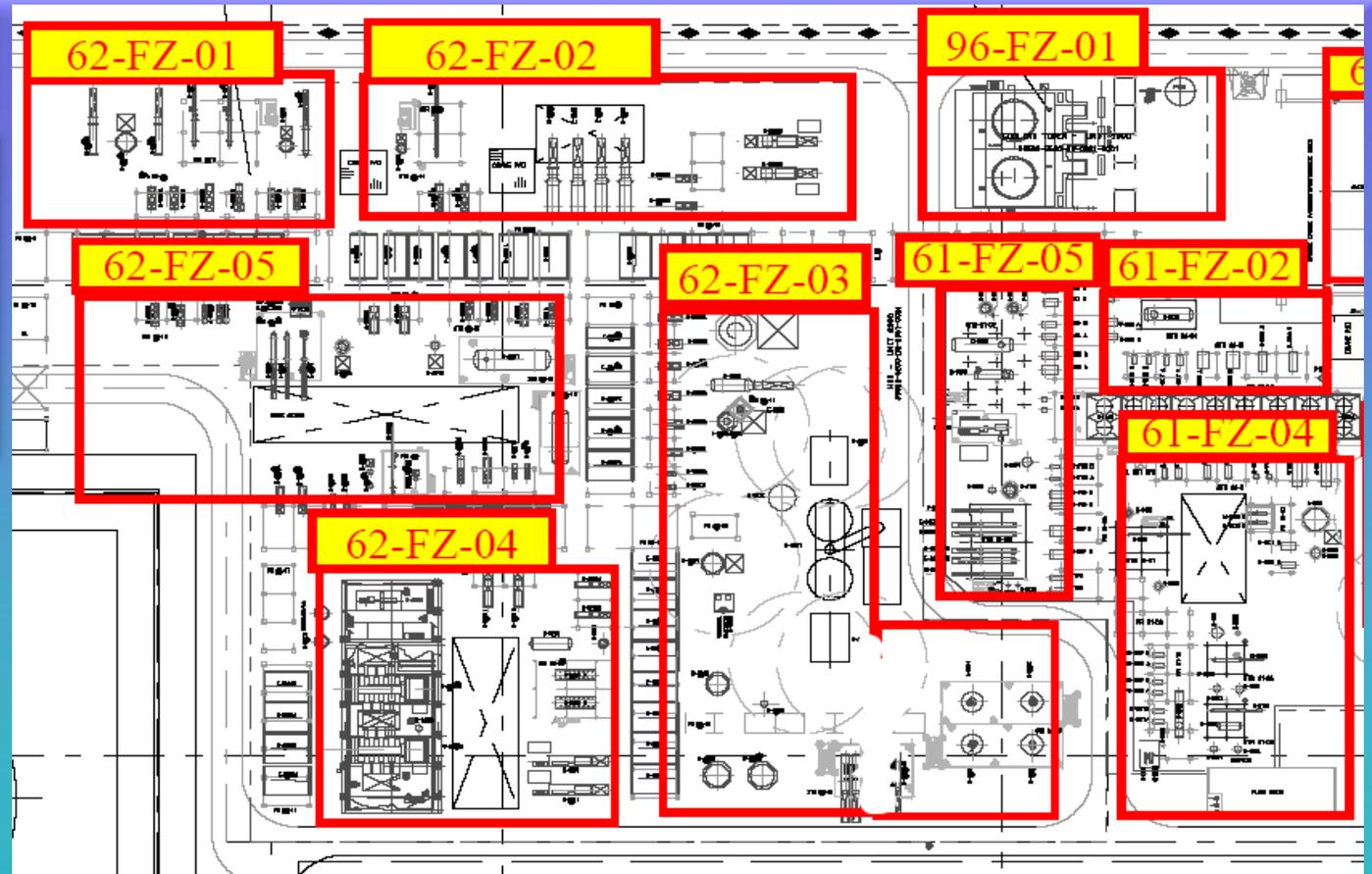




## 2. Facilities Siting Layout and Spacing (4/7)

### Fire Water System Development

1. Facilities Siting Layout and Spacing
2. Fire Zones
3. Fire Scenarios
4. Fire Water Duration
5. Fire Water Demand



## 2. Facilities Siting Layout and Spacing (5/7)



### ❖ FIRE PROTECTION PHILOSOPHY

#### 2.1. Concerns Party in the design of fire protection systems

##### ❖ Government Regulations

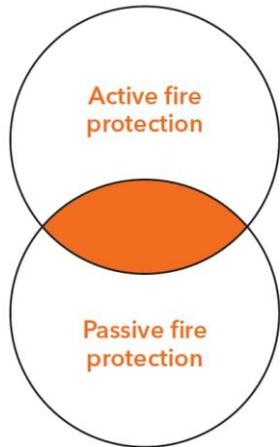
- The Fire Protection System shall be designed and installed in accordance with Government legislated regulations and specifically.
  - Ministry of Industry Act
  - Ministry of Energy Act
  - Ministry of Labor Act
  - The Authorities Having Jurisdiction (AHJ) are governmental or non-governmental entities responsible for enforcing building codes, fire codes, and other regulations in a given jurisdiction.
  - The International Building Code (IBC)

##### ❖ Insurer

- In addition to the requirements of the statutory authority the Fire and Safety System design shall comply with the requirements of the Owners Insurance Provider.
- All fire protection equipment shall be either UL (Underwriters' Laboratories) listed and/or FM (Factory Mutual) approved for its intended use.



## 2. Facilities Siting Layout and Spacing (6/7)



### ❖ FIRE PROTECTION PHILOSOPHY

#### 2.2. General

- The primary role of the Fire and Safety system is to provide fire detection, protection and mitigation capacity to the entire Petroleum, Petrochemical and Chemical Complex and shall include both active and passive fire measures.
- Personnel safety and equipment protection shall be the primary consideration in planning and layout of the Petroleum, Petrochemical and Chemical Complex. Process facilities shall be designed and equipped to:

- Minimize the effects of fire in order to preclude hazard progression.
- Conduct effective fire fighting operations without exposure to extreme danger.



## 2. Facilities Siting Layout and Spacing (7/7)

### ❖ FIRE PROTECTION PHILOSOPHY

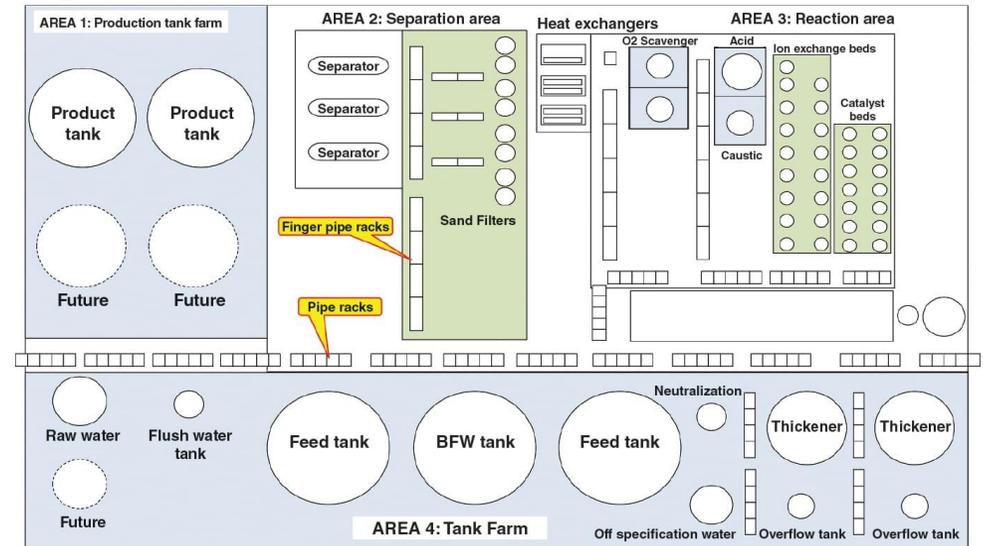
#### 2.3. Operation Philosophy

The philosophy of protection assumes that:

- The Petroleum, Petrochemical and Chemical Complex cannot depend on assistance in emergency situations from outside sources and, therefore, must be independent and self-reliant.
- A fire can occur in any area of the Petroleum, Petrochemical and Chemical Complex, in varying degrees of magnitude, and from a variety of sources.

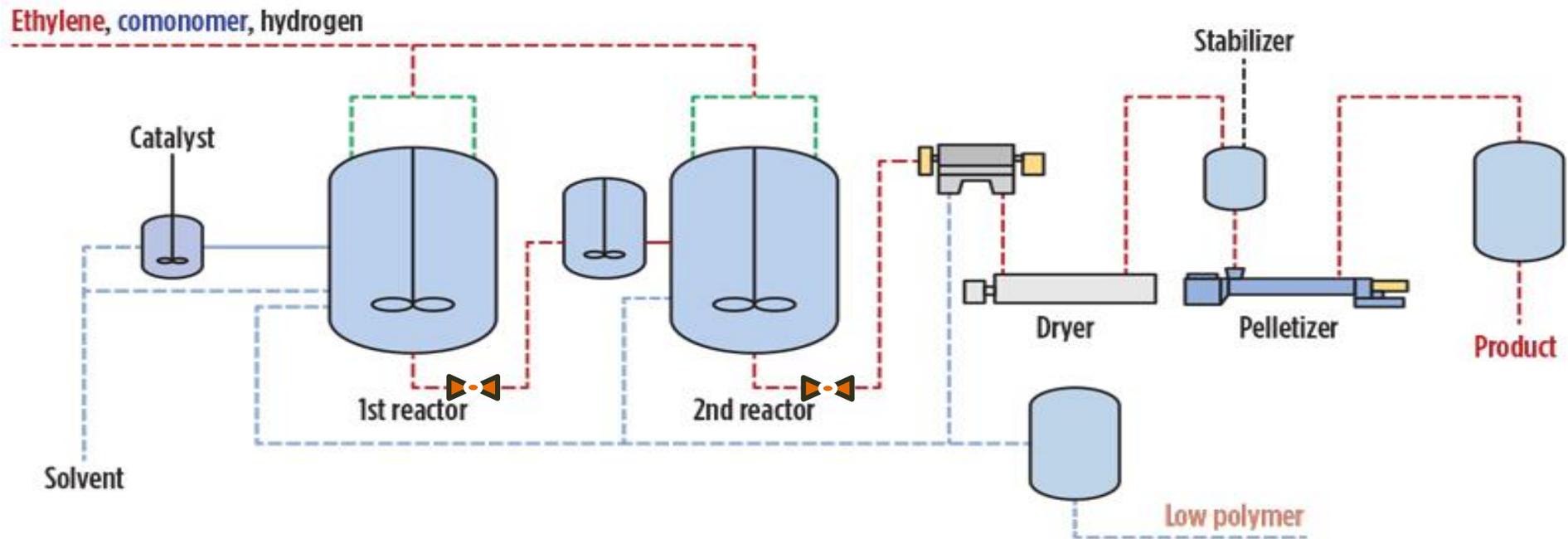


Plot plan



### 3. Process and Major Equipment Design (1/6)

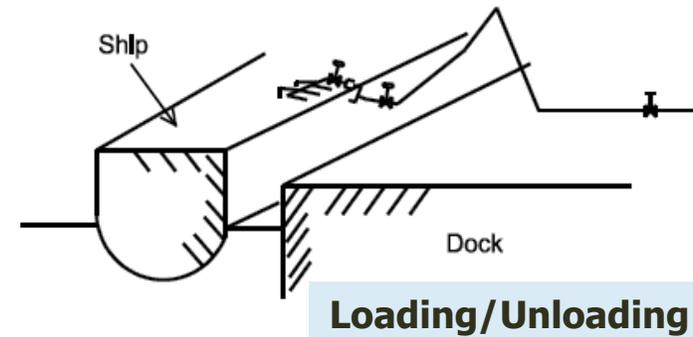
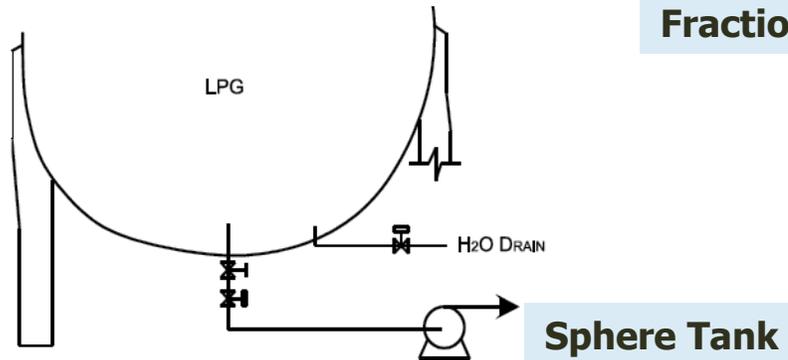
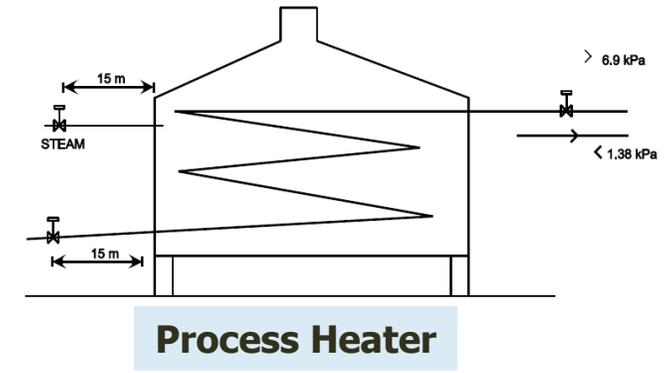
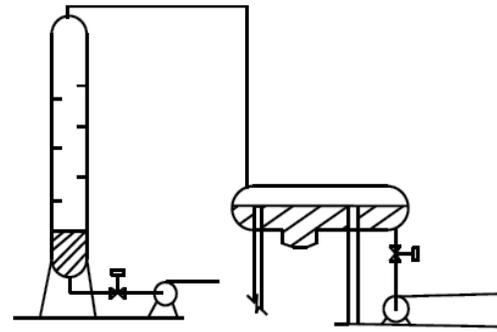
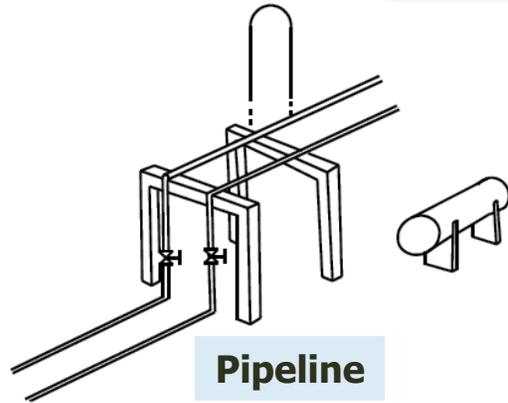
## Process isolation design



Credited with [https://jp.mitsuichemicals.com/en/techno/license/pdf/cx\\_process.pdf](https://jp.mitsuichemicals.com/en/techno/license/pdf/cx_process.pdf)

# 3. Process and Major Equipment Design (2/6)

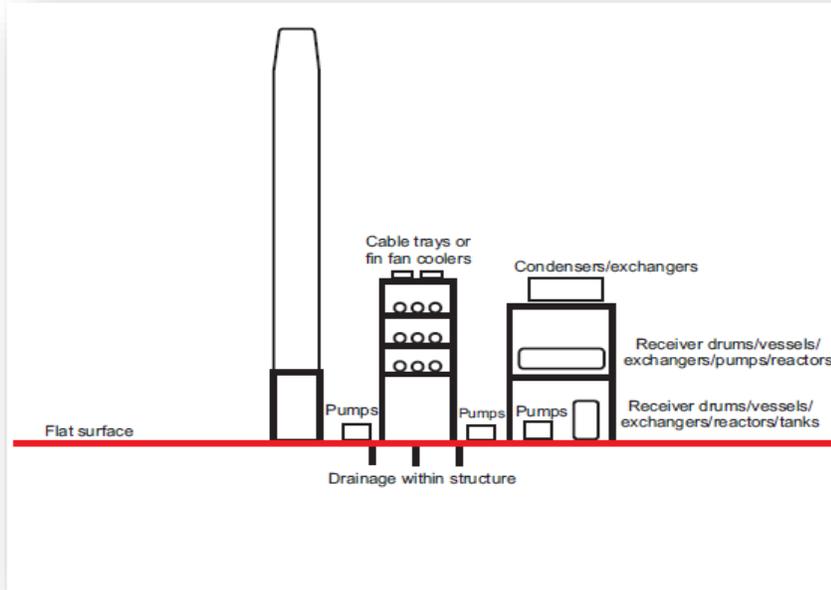
## Process isolation design



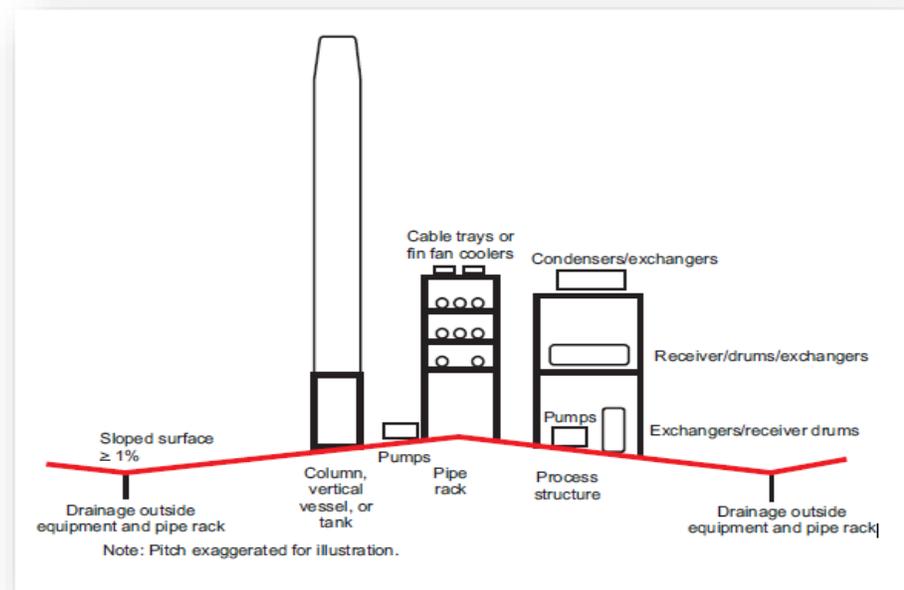
Credited with <https://www.fmglobal.com/research-and-resources/fm-global-data-sheets>

# 3. Process and Major Equipment Design (3/6)

## Process drainage design



**Example of less-desirable emergency drainage design**



**Example of desirable emergency drainage design**

Credited with <https://www.fmglobal.com/research-and-resources/fm-global-data-sheets>



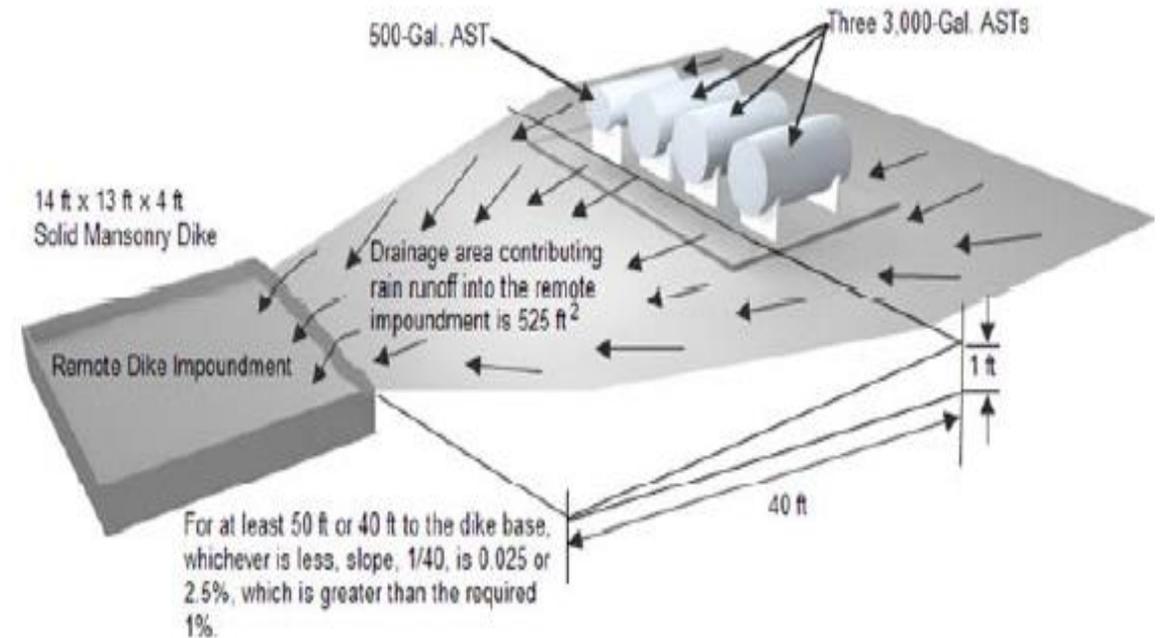
# 3. Process and Major Equipment Design (4/6)



## Major Equipment Design: Spill Control



Dike and Drain



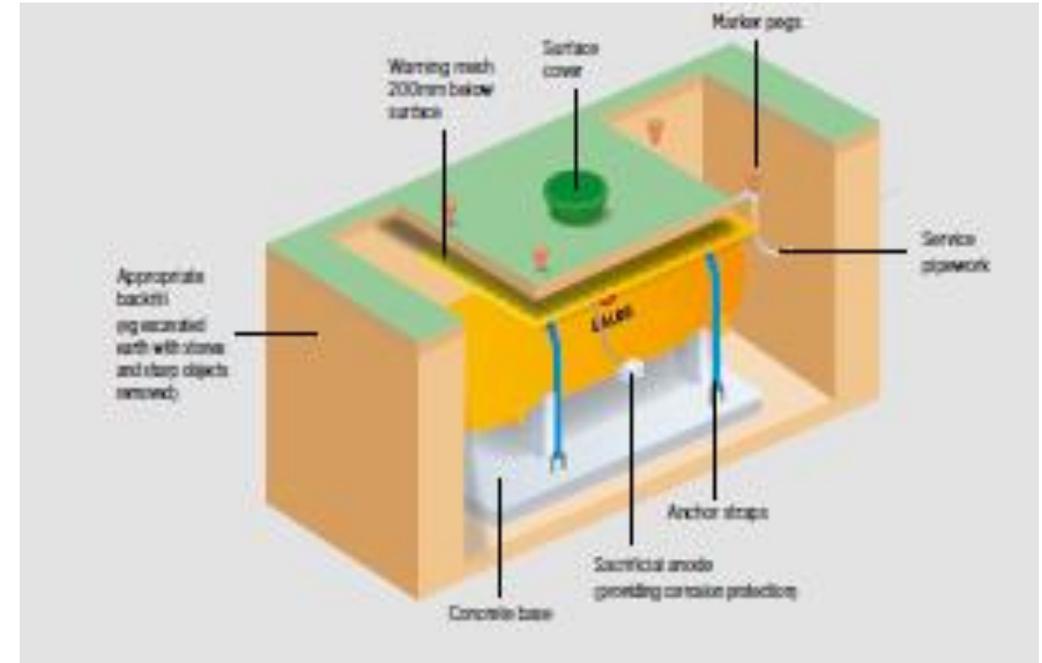
Remote Dike impoundment



## Major Equipment Design: Spill Control



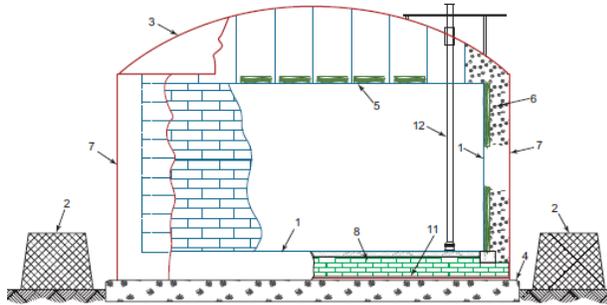
Semi-Underground



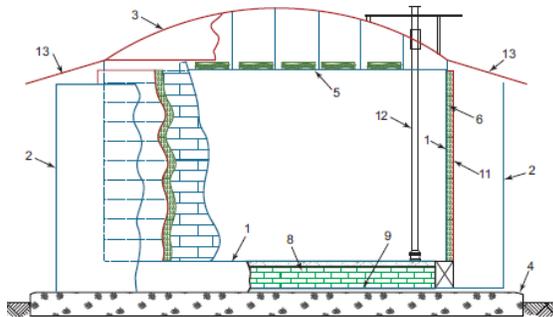
Underground

# 3. Process and Major Equipment Design (6/6)

## Major Equipment Design: Spill Control



Single Containment Tank System



Double Containment Tank System



Remote Dike impoundment



## 4. Layer of protection related to Emergency Response (1/7)

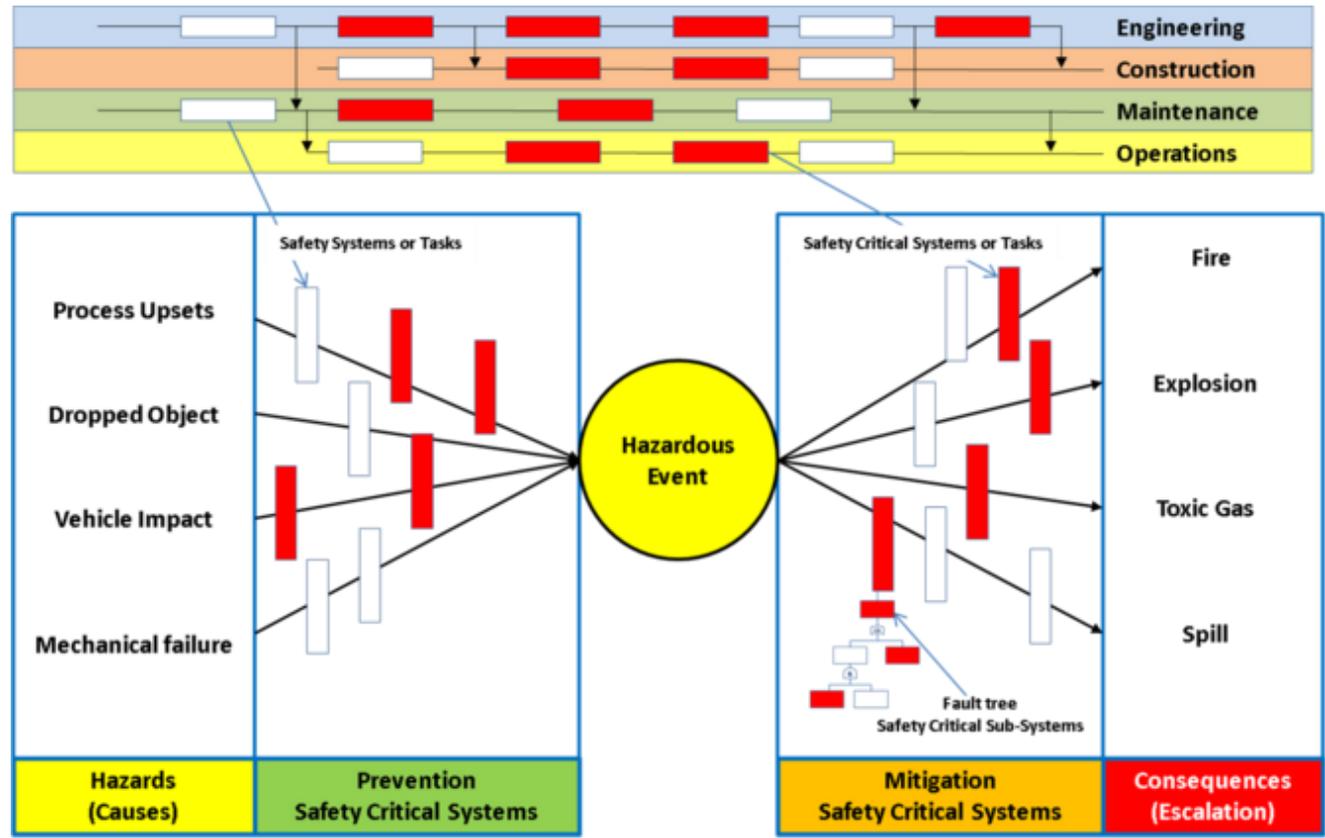
### Bowtie schematic





# 4. Layer of protection related to Emergency Response (2/7)

## Bowtie schematic



Escalating Consequences Of SCE failure

Credited with <http://www.epc365.com/safety-1.html>

# 4. Layer of protection related to Emergency Response (3/7)



## Typical risk reduction methods found in process plants

**Layer 1:** Process Design (e.g. inherently safer designs);

**Layer 2:** Basic controls, process alarms, and operator supervision;

**Layer 3:** Critical alarms, operator supervision, and manual intervention;

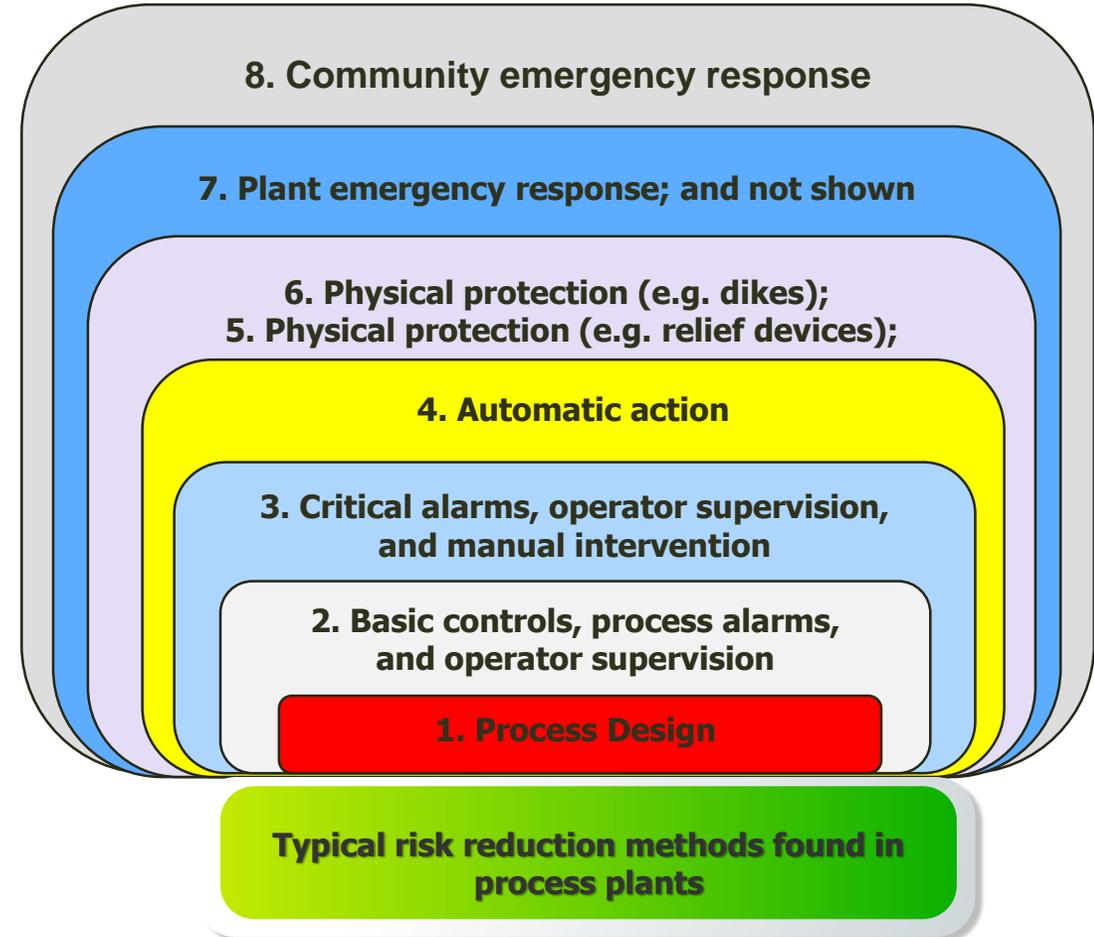
**Layer 4:** Automatic action (e.g. SIS or ESD);

**Layer 5:** Physical protection (e.g. relief devices);

**Layer 6:** Physical protection (e.g. dikes);

**Layer 7:** Plant emergency response; and not shown

**Layer 8:** Community emergency response



## 4. Layer of protection related to Emergency Response (4/7)

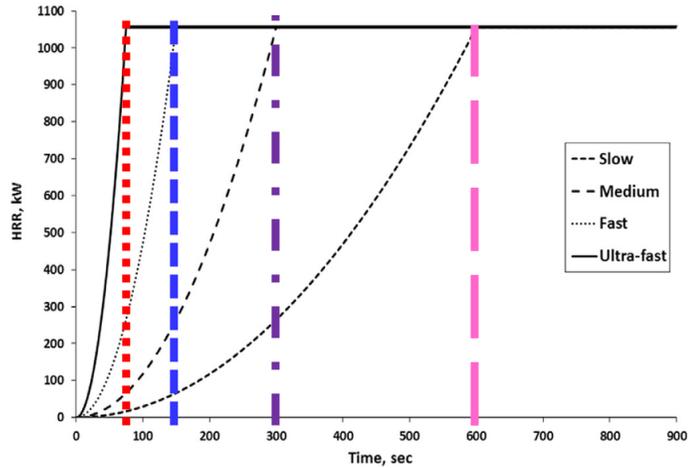
- Fire in the Petroleum, Petrochemical and Chemical industries
  - Pool fire
  - Flash fire
  - Jet fire
  - Fire ball



# 4. Layer of protection related to Emergency Response (5/7)



## Fire growth curve



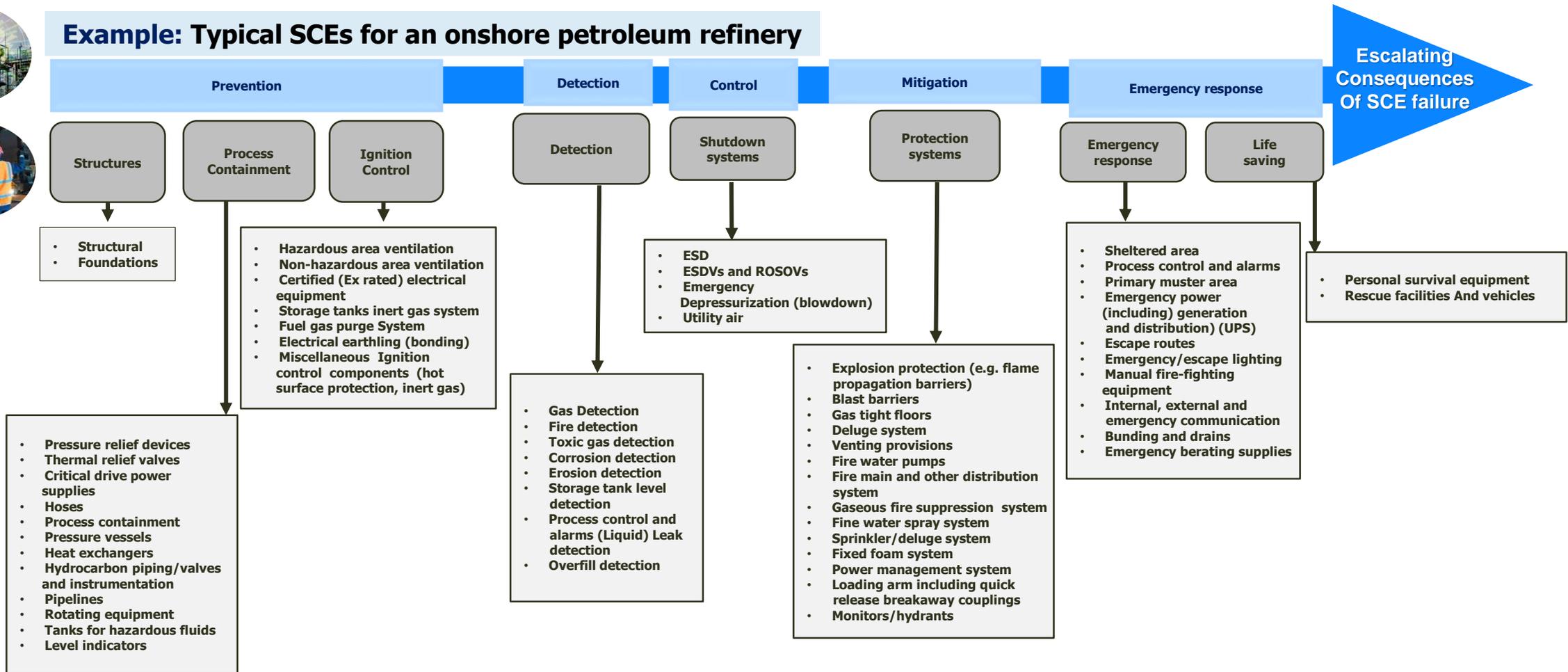
## Summary of t<sup>2</sup> Fire Parameters

Class of Fire Growth	Intensity Constant a (kW/sec)	Growth Time t <sub>g</sub> (sec)
Slow	0.00293	600
Medium	0.01172	300
Fast	0.0469	150
Ultra-Fast	0.1876	75



# 4. Layer of protection related to Emergency Response (6/7)

## Example: Typical SCEs for an onshore petroleum refinery



Credited with EGPC and Egyptian Oil and Gas Holding Companies <https://egyptoil-gas.com/tag/egpc/>

## 4. Layer of protection related to Emergency Response (7/7)

➤ To localize the emergency, and if possible, to eliminate it.

➤ To minimize the effects on people, property and environment.

➤ Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and prompt communication to people living nearby.



Credit of [www.csb.gov/investigations](http://www.csb.gov/investigations)



Credit of <https://fire.relyonnutec.com>



# Thank you for your attention





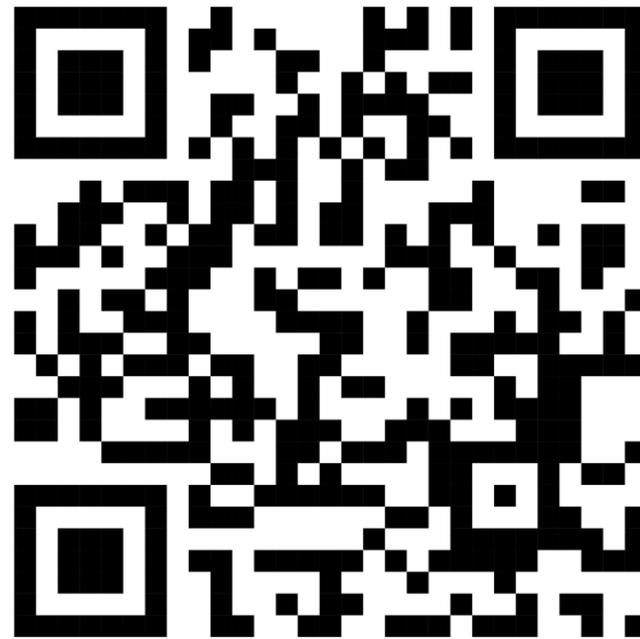
# Q & A



**Emergency relates to Process Area, Tank farm & Jetty  
and Utilities**



# Rating the session



Emergency relates to Process Area, Tank farm & Jetty  
and Utilities