9th Chemical Process Safety Sharing (CPSS)

Facility Siting Implementation for temporary and permanent building

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Contents

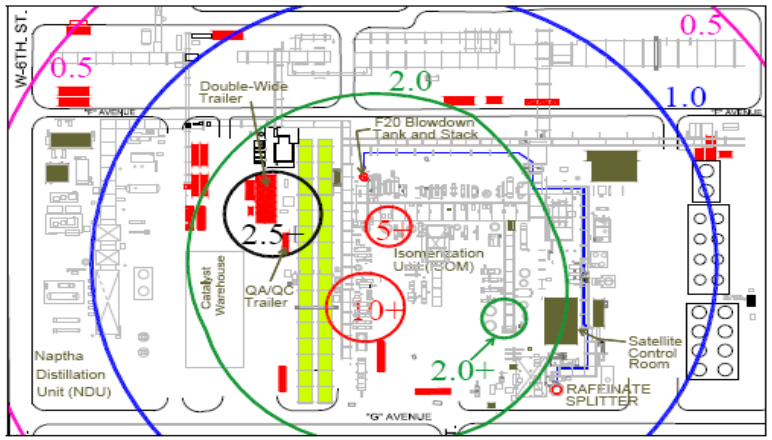
- Background for safe siting of occupied building
- Reference code and standard
- Ex: Facilities siting

Safe Siting of Occupied Portable Buildings

Learning from Incident:

- BP Texas Isomerization Unit Explosion, March 23, 2005
- 15 People died, 180 others were injured
- Many of the victims were in or around work trailers located near an atmospheric vent stack.

Explosion leading to multiple fatalities and major asset damage



Blast Overpressure Map in PSI for Texas Incident

Reference Code and Standard

Code & Standard :

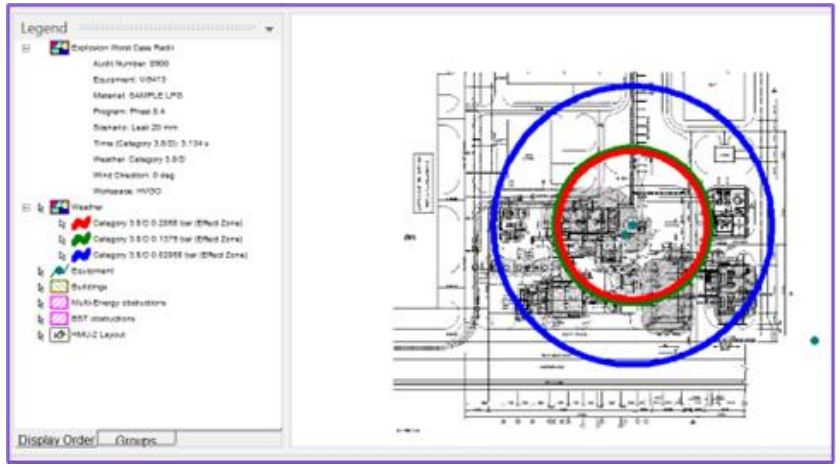
- Thai Oil Standard Specification TOSS-09-001 Equipment Spacing (Applicable Standard and Guides) from Institute of Petroleum Model Code of Safe Practice Part.)
- DEP 80.00.10.11 Layout of Onshore Facilities
- DEP 34.17.10.35 Siting of Onshore Occupied Portable Buildings
- DEP 34.17.10.33 Portable Blast-resistant Modules
- Design and Engineering Manual – Process safety Basic requirements (Safe Siting of Occupied Portable Buildings)
- API RP 753 Management of Hazards Associated with Location of Process Plant Portable Buildings
- API RP 756 Management of Hazards Associated with Location of Process Plant Tents
- NFPA 850 NFPA 850, Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations

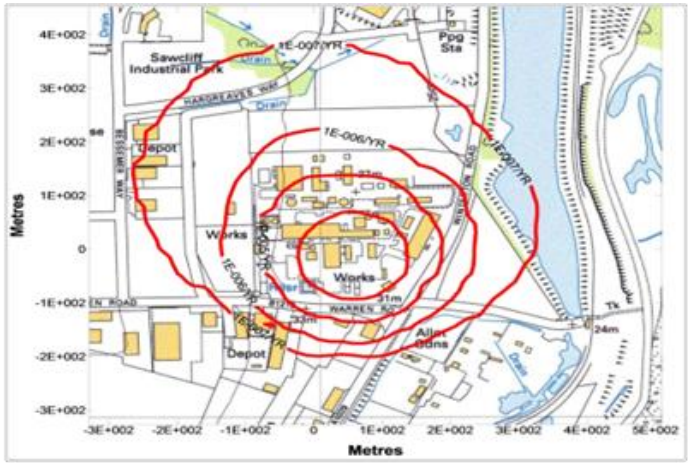
Note: Apply to all facilities siting in the TOP Group

Safe Siting of Occupied Portable Buildings

Methodology

- ❑ Consequence modeling
- ❑ Risk based approach
- ❑ Safety distance approach





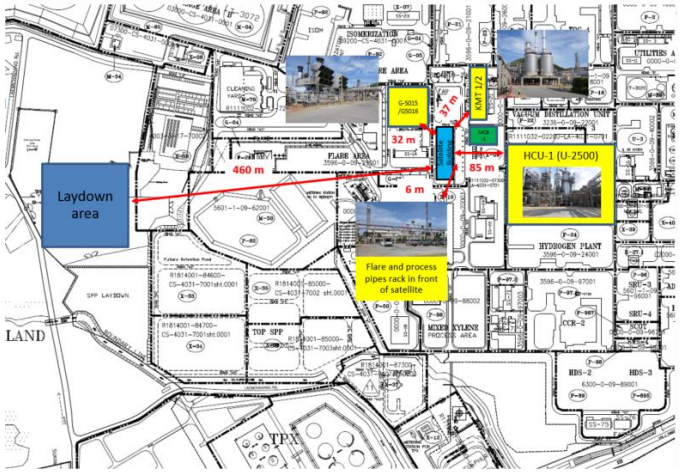
Example Facilities Siting

1. New satellite building (permanent)
2. Caravans for Turnaround (temporary)

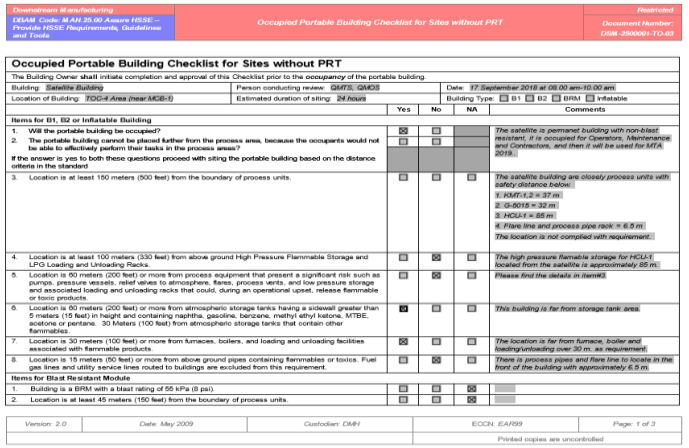
Ex 1 New Satellite Building (Permanent)

Background

The current satellite building uses for meeting, operation & maintenance shifts and lunch break during normal operation. The building is a normal concrete building (non blast proof construction). It was perceived that the risk for the occupied building may be high, it may not be safe to house people in the building should there be a release of vapour cloud (included Toxic gases) or explosion.



Satellite building – Distance from process unit and overhead piping



Downstream Manufacturing | Restricted

DEAM Code: M.AN.25.00 Assure HSSE – Provide HSSE Requirements, Guidelines and Tools | Occupied Portable Building Checklist for Sites without PRT | Document Number: DSM-250001-TO-03

Occupied Portable Building Checklist for Sites without PRT

The Building Owner shall initiate completion and approval of this Checklist prior to the occupancy of the portable building.

Building: Satellite Building | Person conducting review: GMTS, GMOS | Date: 7/ September 2018 at 08:00 am-10:00 am

Location of Building: TOC=# Area (near MCB-1) | Estimated duration of siting: 24 hours | Building Type: ☐ B1 ☐ B2 ☐ BRM ☐ Inflatable

	Yes	No	NA	Comments
Items for B1, B2 or Inflatable Building				
1. Will the portable building be occupied?	☒	☐		The satellite is permanet building with non-blast resistant. It is occupied for Operators, Maintenance and Contractors, and then it will be used for MTA 2019.
2. The portable building cannot be placed further from the process area, because the occupants would not be able to effectively perform their tasks in the process areas?	☐	☐		
If the answer is yes to both these questions proceed with siting the portable building based on the distance criteria in the standard				
3. Location is at least 150 meters (500 feet) from the boundary of process units.	☐	☐	☐	The satellite building are closely process units with safety distance below: 1. KMT-1,2 = 37 m 2. G-5015 = 32 m 3. HCU-1 = 85 m 4. Flare line and process pipe rack = 6.5 m The location is not complied with requirement.
4. Location is at least 100 meters (330 feet) from above ground High Pressure Flammable Storage and LPG Loading and Unloading Packs.	☐	☒	☐	The high pressure flamable storage for HCU-I located from the satellite is approximately 85 m.
5. Location is 60 meters (200 feet) or more from process equipment that present a significant risk such as pumps, pressure vessels, relief valves to atmosphere, flares, process vents, and low pressure storage and associated loading and unloading racks that could, during an operational upset, release flammable or toxic products.	☐	☒	☐	Please find the details in item#3.
6. Location is 60 meters (200 feet) or more from atmospheric storage tanks having a sidewall greater than 5 meters (15 feet) in height and containing naphtha, gasoline, benzene, methyl ethyl ketone, MTBE, acetone or pentane. 30 Meters (100 feet) from atmospheric storage tanks that contain other flammables.	☒	☐	☐	This building is far from storage tank area.
7. Location is 30 meters (100 feet) or more from furnaces, boilers, and loading and unloading facilities associated with flammable products.	☒	☐	☐	The location is far from furnace, boiler and loading/unloading over 30 m. as requirement.
8. Location is 15 meters (50 feet) or more from above ground pipes containing flammables or toxics. Fuel gas lines and utility service lines routed to buildings are excluded from this requirement.	☐	☒	☐	There is process pipes and flare line to locate in the front of the building with approximately 6.5 m.
Items for Blast Resistant Module				
1. Building is a BRM with a blast rating of 55 kPa (8 psi).	☐	☐	☒	
2. Location is at least 45 meters (150 feet) from the boundary of process units.	☐	☐	☒	

Version: 2.0 | Date: May 2009 | Custodian: DMH | ECCN: EAR99 | Page: 1 of 3

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Reference – Shell standard on temporary occupied buildings

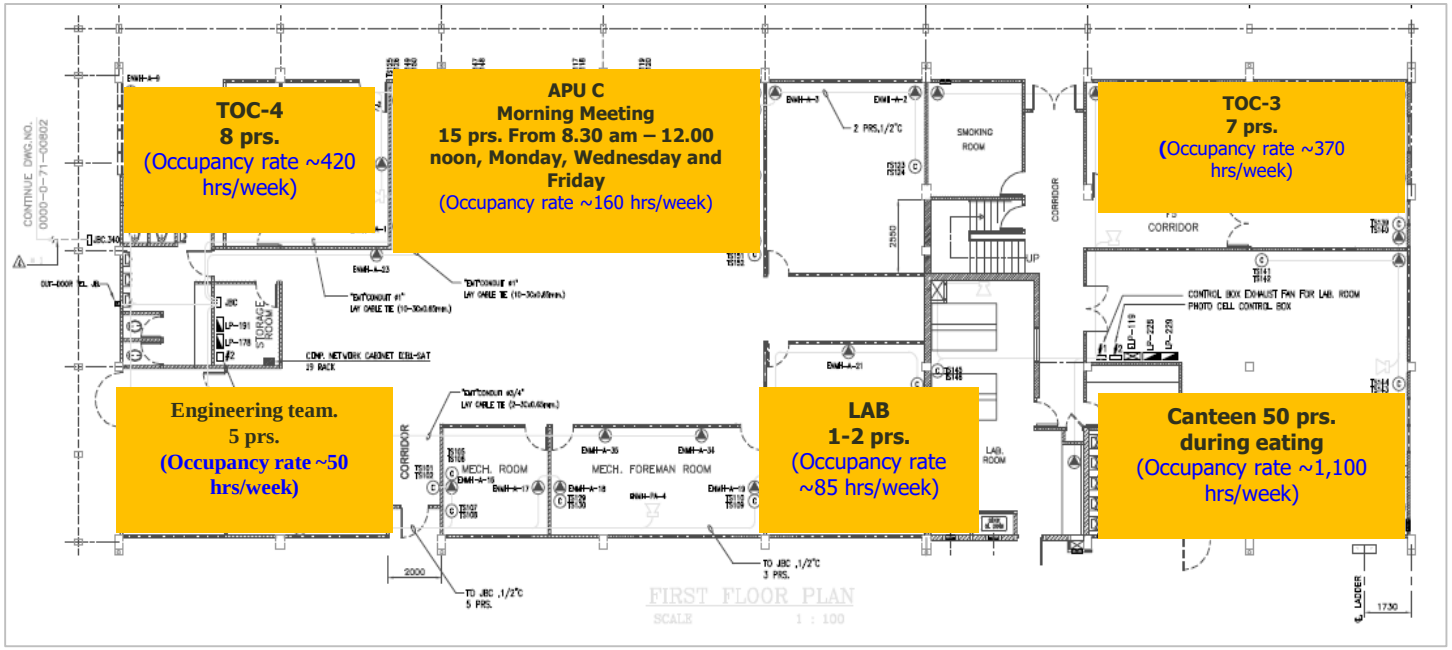
Results of Assessment of Satellite Building

Distance from the process boundary to Satellite office building:

Building	Process Unit / Above ground piping	Distance (m)	Shell Standard (m)
Satellite Office Building	Kerosene Merox Treating Unit (KMT-1/2, U2300/U2350)	37 m	100
	Generators G-5015 / 5016	32 m	100
	Hydrocracker Unit -1 (U2500)	85 m	100
	Flare and process pipe rack	6 m	15

Based on the above assessment it was concluded that the satellite office does not conform to the distance requirements specified in Shell Standard. It is recommended not to use Satellite office building as an occupied building for normal operation.

Ex 1 New Satellite Building (Permanent)



Total Occupancy Rate:

- Operations (Unit operators) - around 3,000 exposure hour per week / 400 exposure hour per day
- Operation (Process LAB) – around 85 hour per week / 12 exposure hour per day
- Engineering team – around 110 hour per week / 15 exposure hour per day

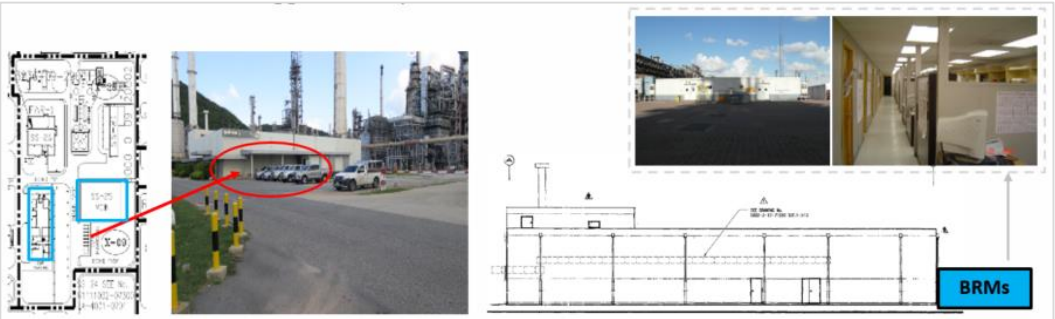
Total – 3,195 hrs. per week / 460 hrs. per day

Ex 1 New Satellite Building (Permanent)

Option 1
Extension of MCB-1 with multiple BRMs joined together

Provide 5 x BRMs which are connected to MCB-1, the location is proposed as figure below.
SIZE of individual BRM - 12000 x 3000 x 2690mm (LxWxH)
Total area of 5 x BRMs connected together 180 m2
Proposed occupancy;

- Field Operator TOC4, Utility and TOC3 – 15 Operators
- Canteen for operation – 50 prs.
- APU-C Meeting room – 15 prs,



Side view of MCB-1

Not accepted. Concern evacuating in case of gas cloud release.

Example of BRM's installed

- Single BRM

- Multiple BRMs joined together

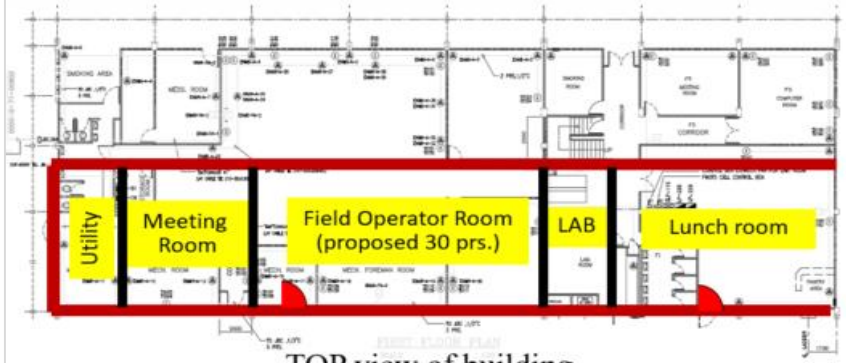
Inflatable blast resistant shelters (withstand 10 psi for 100 ms)

Ex 1 New Satellite Building (Permanent)

Option 2
Upgrading of existing satellite building

Provide separate blast proof wall with 3 sides (single storey), a roof and 2 doors as following figures.
SIZE of building – 9 m x 48 m x 6 m (LxWxH)
Total area is 430 m2
Proposed occupancy;

- Field Operator TOC4, Utility and TOC3 – 15 Operators
- Canteen for operation – 50 prs.
- APU-C Meeting room – 15 prs,



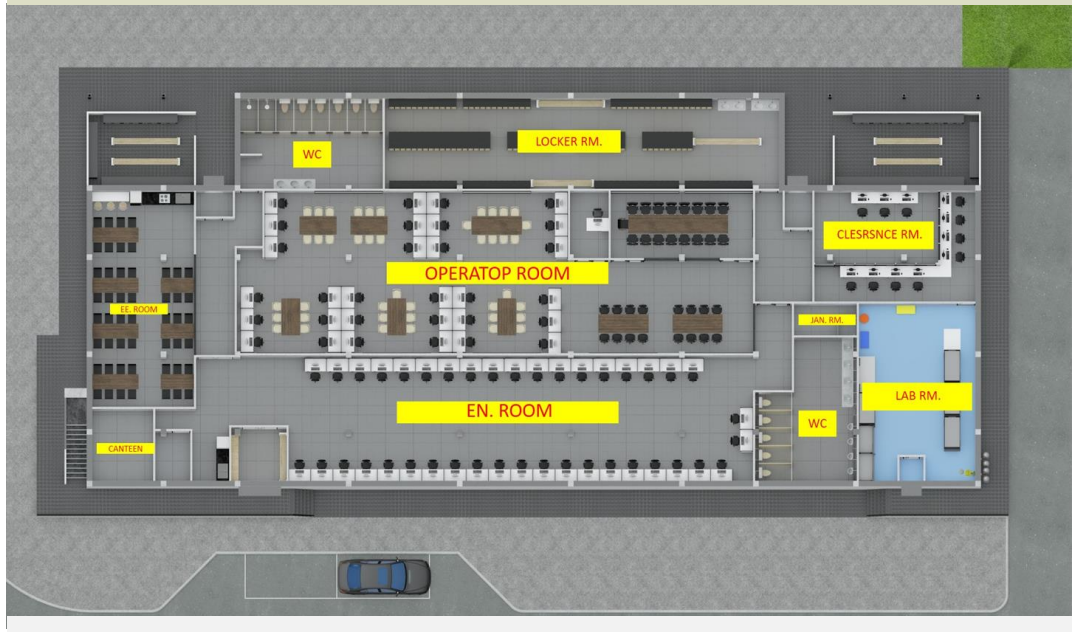
TOP view of building


Side view of building

Not accepted. Concern design for blast building structure.

Ex 1 New Satellite Building (Permanent)

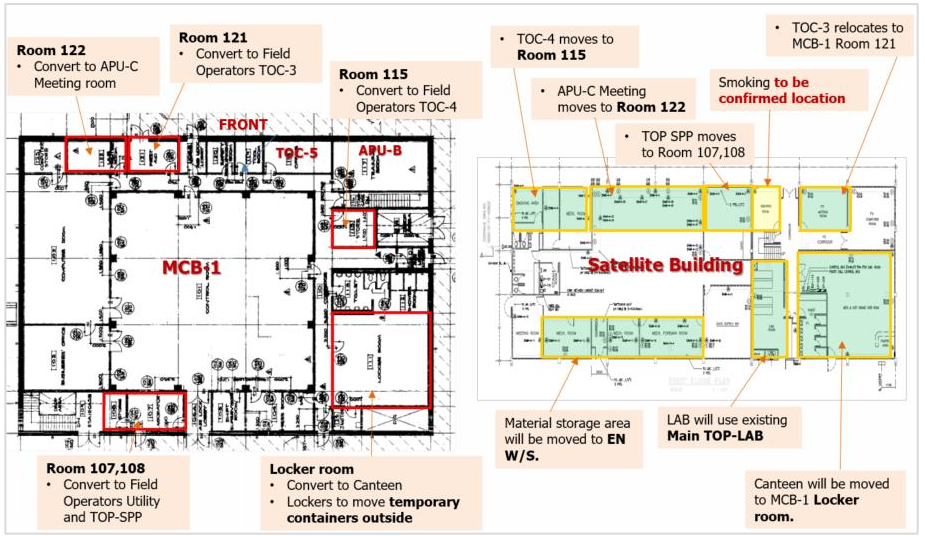
Option 3 New Satellite Building



System requirements:

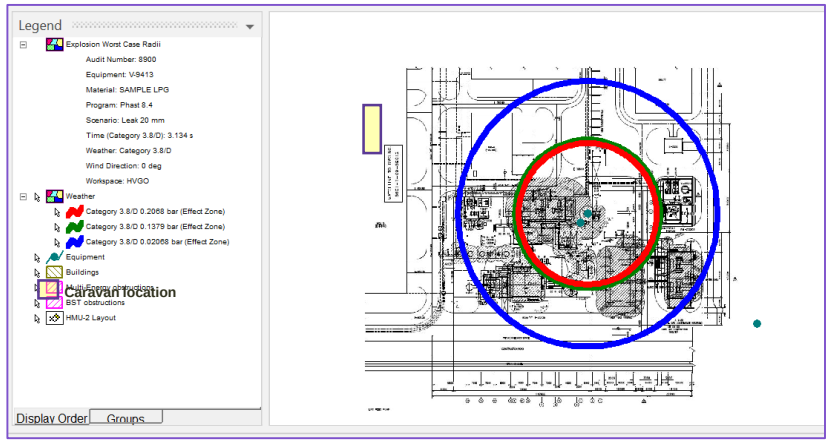
- Blast building
- HVAC System
- Fire & Gas detection system
- Electrical system
- Water supply
- Firefighting equipment
- Drainage system
- Etc.

Interim mitigation plan

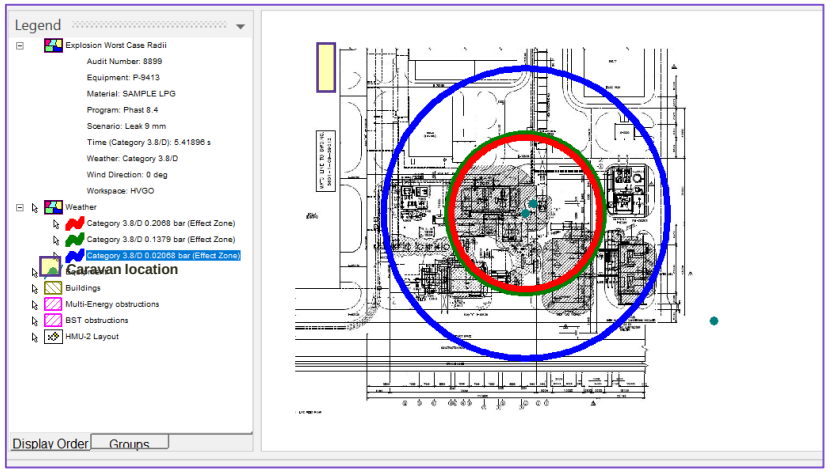


Ex 2 Caravans for Turnaround (Temporary)- PHAST Calculation Model

V-9413 (LPG Vessel, release 20 mm)



P-9413A (LPG pump, release 9 mm)



Summary of calculation

1. Model calculation base on DEP 80.47.10.30 with release hole size recommendation
2. Calculation with worst 2 cases for V-9413 (LPG Vessel) and P-9413A (LPG Pump)
3. Result of calculation as following
   - Safety distance at 0.3 psi or 0.0268 bar (blue line)
   - V-9413, max safety distance 66 m
   - P-9413A, max safe distance 68 m

Recommendation

- The proposed location is caravan beside of FAR-4. As per calculation model demonstrated that the explosion contour may impact to Caravan location. Suggest to relocate the caravan beside of Substation 73, as classified is safe location.

Ex 2 Caravans for Turnaround (Temporary)- PHAST Calculation Model

1. All portable buildings shall evaluate whether the portable/permanent building are occupied or unoccupied and then conduct a risk analysis for occupied portable buildings using the appropriate Building Checklist or other methodology to ensure that all risks have been addressed.
2. Permanent / Portable buildings defined as "occupied" shall be sited using the criteria and design as per standards.
3. The siting of occupied portable buildings shall be incorporated into the Management of Change (MOC) Process used at the manufacturing site. Then it requires for reviewing and approving by Technical authority persons.
4. In case of deviation from standards, the process shall be escalated to upper levels to review and approve.
5. The site's process shall have administrative control put in place to prevent unoccupied portable buildings from becoming occupied.

Chemical Process Safety Sharing

Thank you for your attention