

# Facility Siting – Concepts Unlocked

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# Disclaimer

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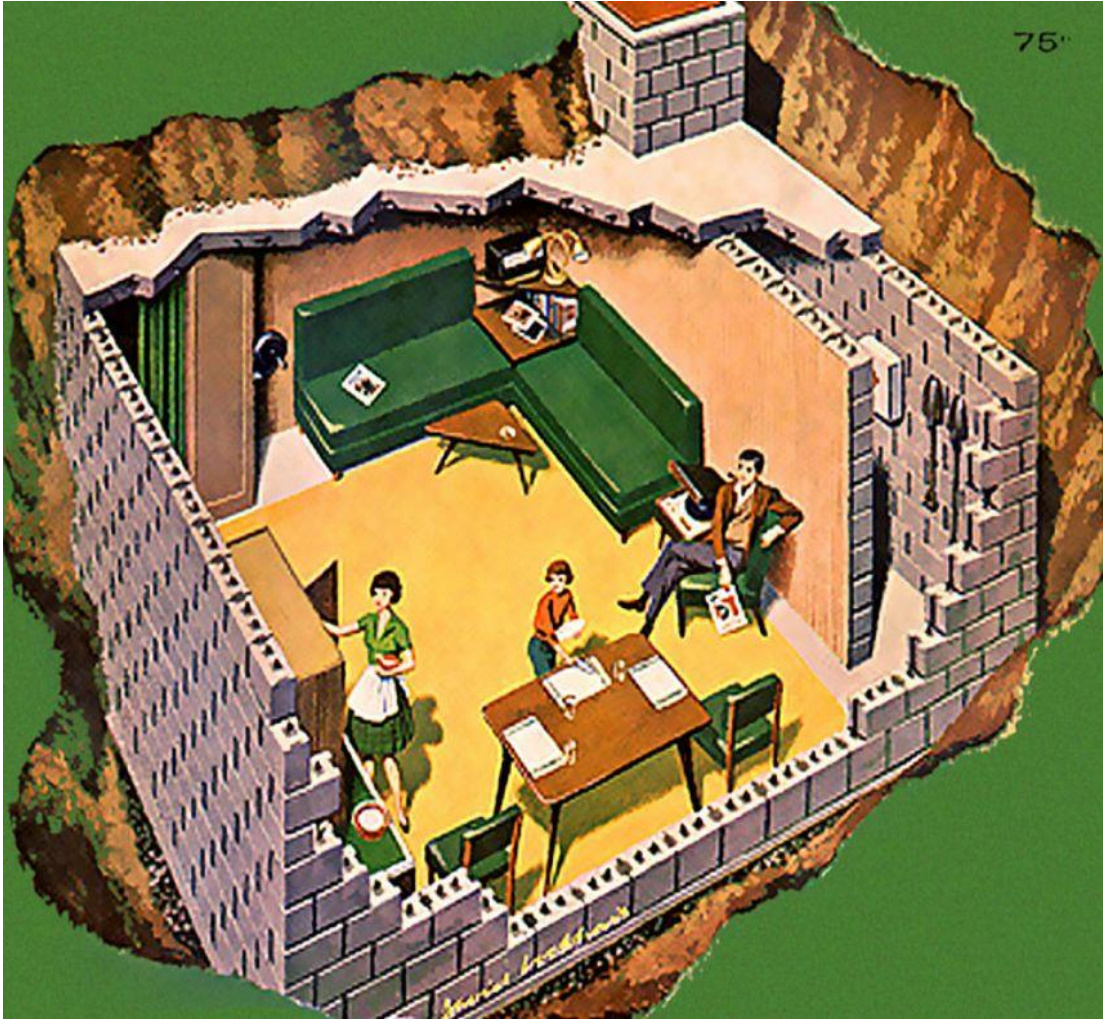
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# Facility Siting and OBRA

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- **Facility Siting** has a broad application domain
  - Refers to managing the risks to the **onsite** occupied buildings, **offsite** areas or to a **specific unit/location** within a process plant
- The **primary/current focus** of Facility Siting within the process industries is to manage the risks to the **onsite building occupants** due to potential explosion, toxic exposure, flashfires and thermal radiation hazards
- In Singapore, Facility Siting is commonly referred as **Occupied Building Risk Assessment (OBRA)**

# OBRA Objective



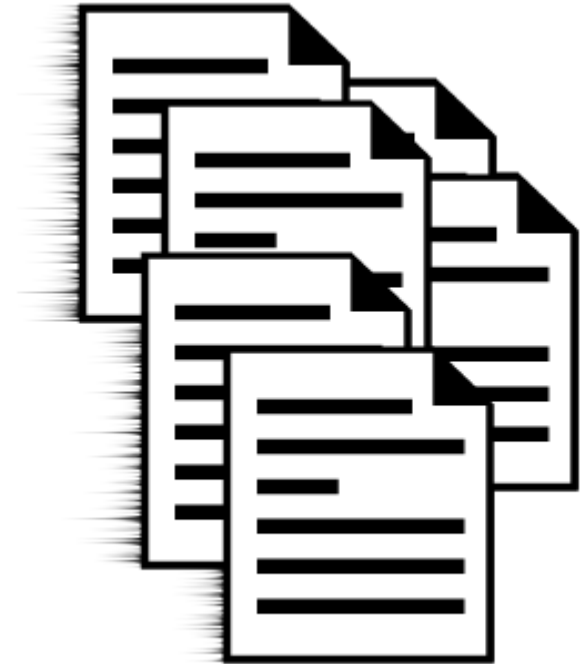
# OBRA Objective

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- The objective is to **assess** the risks to the onsite building occupants and **reduce** the risks to as low as reasonably practicable
- The purpose is to ensure **personnel located in the occupied buildings are not placed at a greater risk** by virtue of their location in comparison to personnel who are outside the buildings
- In other words, the **buildings and the building components** should not create additional risks to personnel located in the buildings

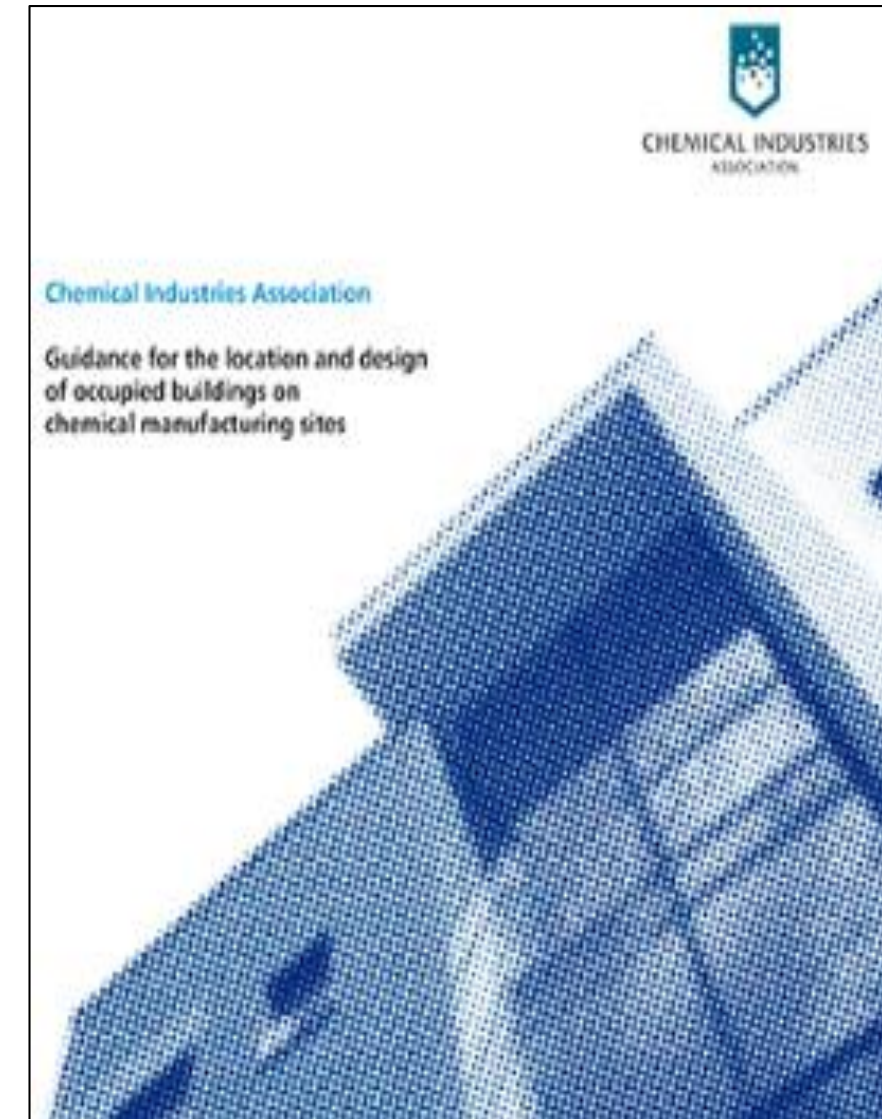
# Singapore Acts and Regulations Related to OBRA

- **Workplace Safety and Health Act (WSHA)**
  - Requires the duty holders to take so far as is reasonably practicable measures as necessary to ensure the safety and health of persons at work
- **Acts & Regulations on Quantitative Risk Assessment (QRA)**
  - OBRA is an explicit requirement in the QRA studies since 2016
- **WSHA (Major Hazard Installations) Regulations 2017**
  - Require the occupier of a major hazard installation (MHI) or deemed MHI to take all measures necessary to reduce the risk of major accidents to as low as is reasonably practicable
  - **Safety Case Technical Guide**
    - The MHIs should identify and describe the control measures that are in place to manage the risks which includes the analysis through **OBRAs**



# Basis and Reference

- This topic covers some of the critical aspects of the OBRA in reference to the **UK Chemical Industries Association (CIA)** guidance [Reference 1]
- The practitioners are recommended to **refer to the listed references** and make an informed decision prior to embarking on their OBRA journey



Source: [cia.org.uk](http://cia.org.uk)

# Scope of Buildings



- Buildings **intended for occupancy** (e.g. control room, portable cabins) irrespective whether they are **permanent or temporary** should be included
- Buildings **not intended** for occupancy are typically not included (e.g. electrical substations)
  - May be included to address business impact concerns
- **Site-specific criteria** may need to be developed for the buildings with the shorter occupancy duration (e.g. 15 minutes occupancy in a 24-hour period)





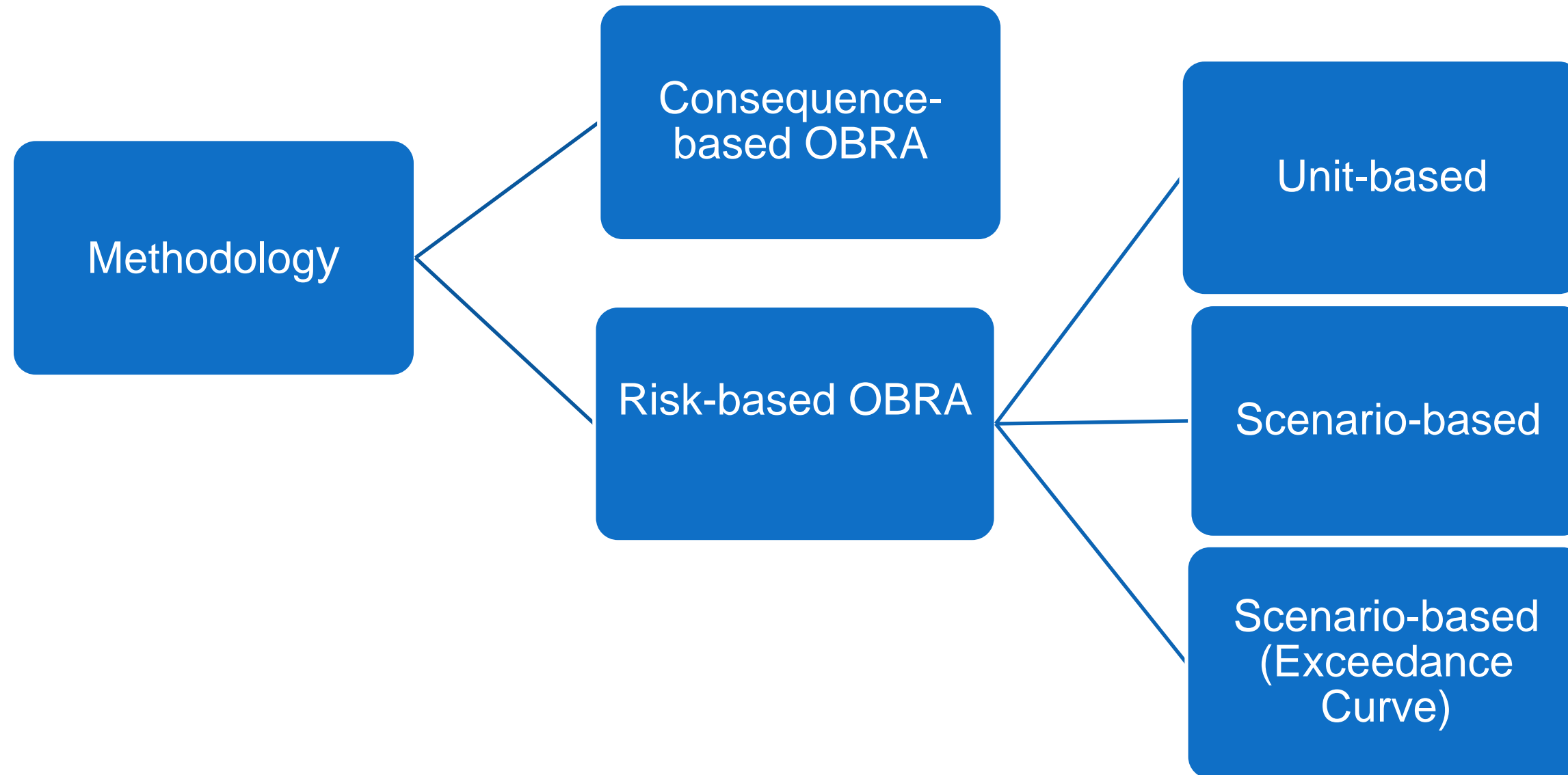
# Hazards

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- **Explosion**
  - Vapor Cloud Explosion - VCE
  - Dust explosion (considered case by case)
  - Boiling Liquid Expanding Vapor Explosion - BLEVE (considered case by case)
- **Toxic gas exposure**
- **Flashfire**
- **Thermal radiation**
  - Poolfire
  - Jetfire
  - Fireball
- **Others**
  - Exothermic reaction (considered case by case)
  - Pressure vessel burst (considered case by case)
  - Smoke exposure (considered case by case)

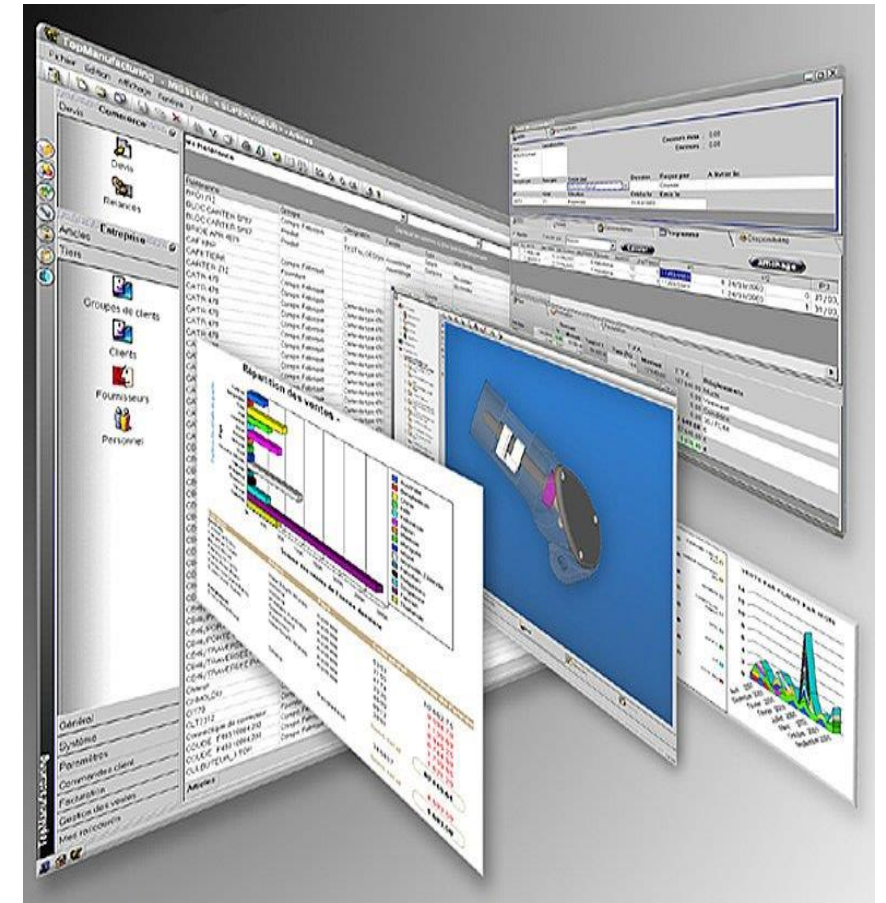
# Methodology

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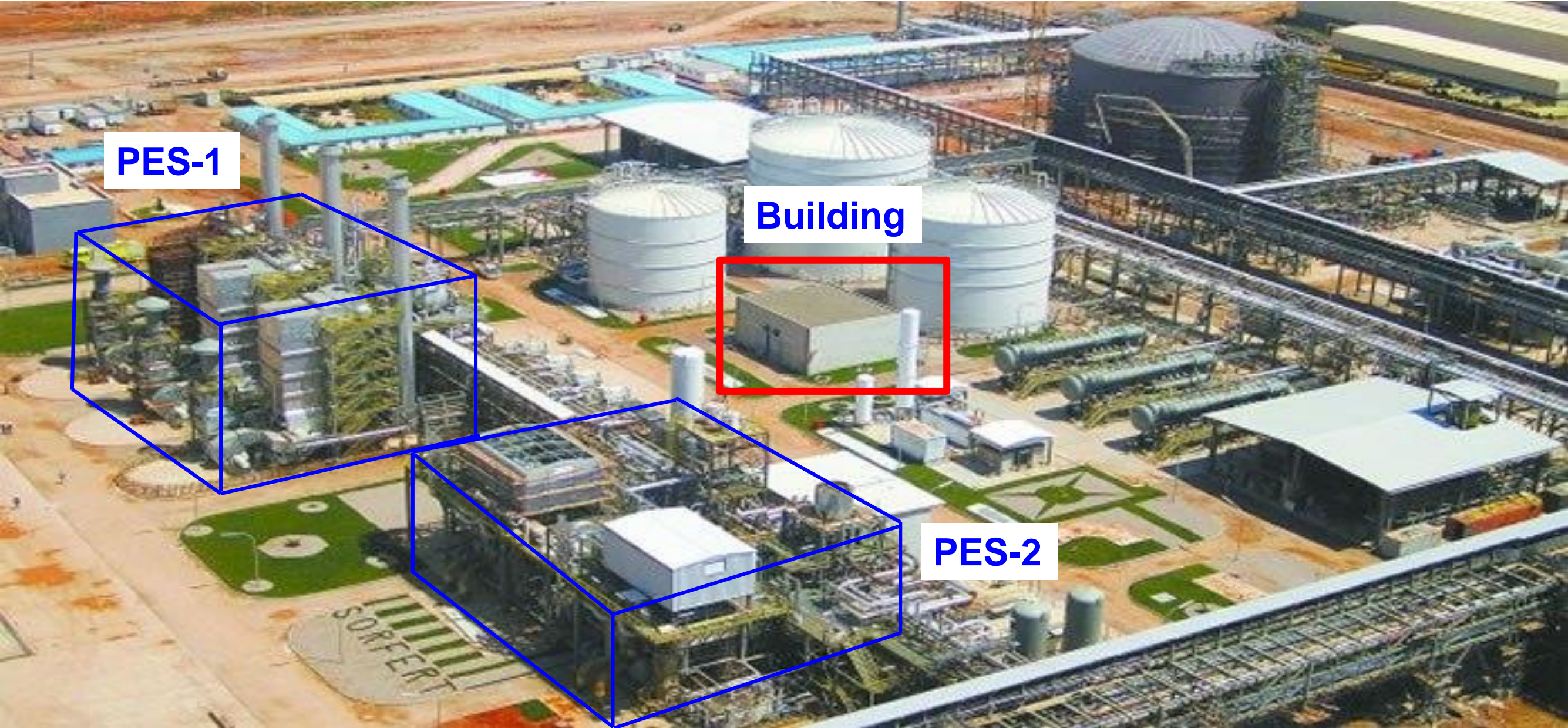


# VCE Analysis – The devil is in the detail

- Let us look at how the **blast overpressure impact** to the occupied buildings is estimated for a **VCE**
- **Consequence analysis software/tools** are used to estimate
- Some of the critical input parameters are
  - Definition of the **Potential Explosion Site (PES)**
  - **Distance** between the PES and the buildings
  - **Volume** of the PES
  - Level of **congestion and confinement** in the PES
  - **Process material** that is assumed to undergo the explosion



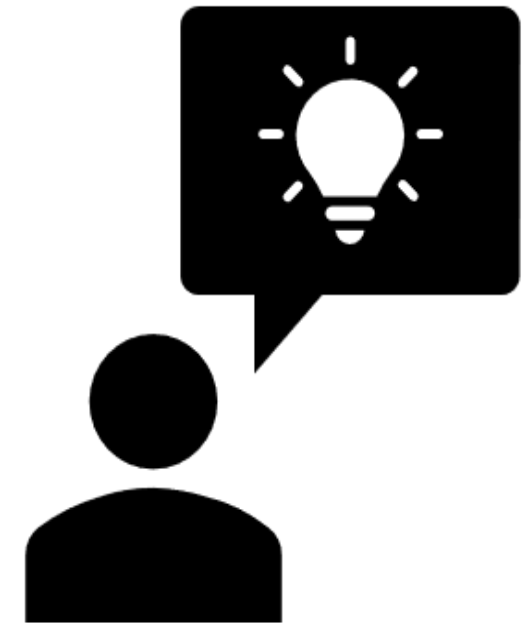
# Potential Explosion Site - Example



# Potential Opportunities

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- Though there is a wealth of guidance in the standards and publications, a clear and consistent technical basis is unavailable
  - **Varying basis and assumptions** are applied along with some rationale
- No **two organizations would apply a similar basis** and there is a potential to get different results even for the facilities with a similar design
- There is an opportunity to **streamline and develop an effective approach** for the analysis
  - Technologies like **Augmented Reality (AR)** may be applied and the analysis can be automated



# Observations Based on the Actual OBRAs

- Some of the existing buildings are built with **weaker building components** (e.g. sliding glass windows, glass doors)
- **Low-cost control measures** such as glass filming, glass door replacement should be considered while waiting for the permanent control measures

- The general understanding on the need for **In Place Protection (IPP)** and its design requirements is less than adequate
- Existing IPP procedures and the IPP design capabilities **require improvements**

- In the past, the fire hazards were managed based on building **Fire Code** requirements, **Spacing** requirements and **Emergency Response Plans**
- The OBRA which applies the consequence modelling results **identifies gaps**
- Implementation of **good industry practices** would address some of the concerns

# Summary

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- Prior to embarking on the OBRA journey, understand the various methodologies and choose **the most appropriate methodology** for the facility
- Completing the OBRA is the first-step, but the important step is to **implement** the OBRA recommendations and **reduce** the risks to as low as reasonably practicable
- The **Management of Change** process should be strengthened so that any future changes in the plant/facilities do not create new risks
- The **Portable Occupied Buildings** require a special attention and their movement/introduction should be managed properly (e.g. through a management system)

# Acknowledgements

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- Thanks to all my friends, colleagues, ex-colleagues, client representatives and the **OBRA practitioners** with whom I had great interactions for the past 11 years when conducting the OBRA studies
- Thanks to **Creative Commons** for making the pictures (used in this presentation) available for public use



Thanks for your time

Q & A

# References

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