

# DIY OBRA

Do it yourself Occupied building risk assessment

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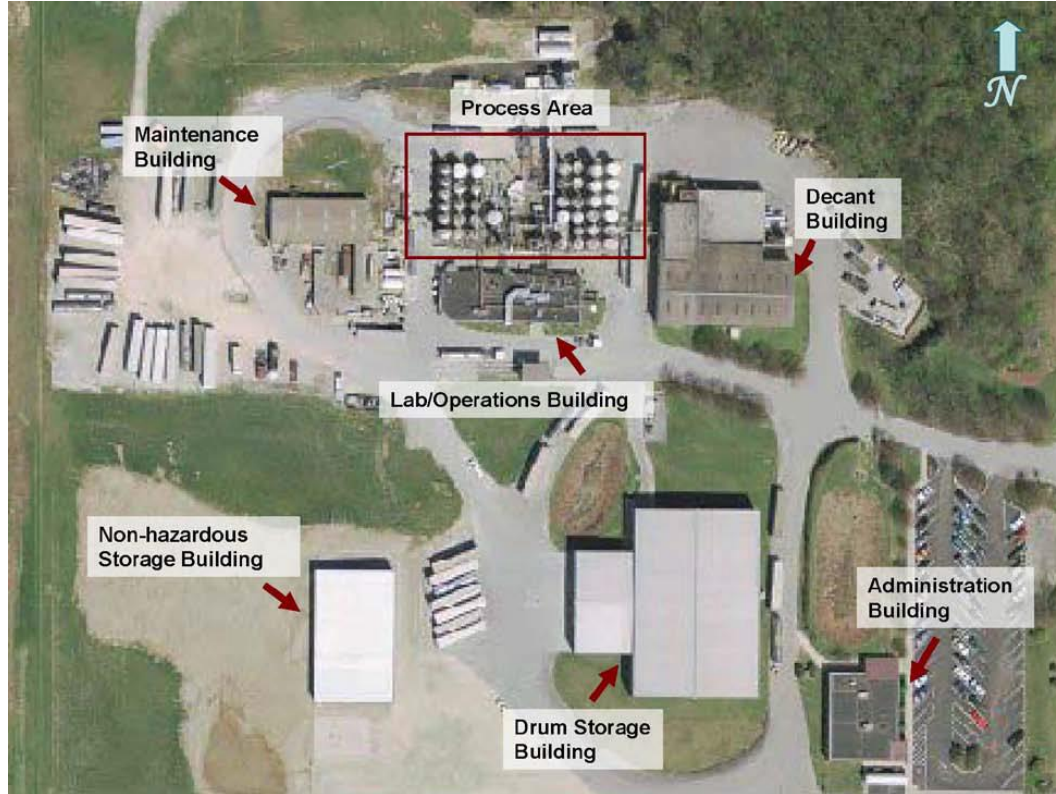
Global Senior Process Safety Expert

DSM Operations & Responsible Care

1 October 2021, Dordrecht NL, PS congress



# WHAT WOULD YOU DO DIFFERENT IN THE SITE LAYOUT OF THIS PLANT?





**VEOLIA TECHNICAL  
SOLUTIONS LLC**

**PLANT AFTER VAPOR  
CLOUD EXPLOSION**

**(PICTURES FROM CSB)**



# Occupied Buildings Safety

Protect people in buildings  
against potential  
consequences of major  
process-related incidents



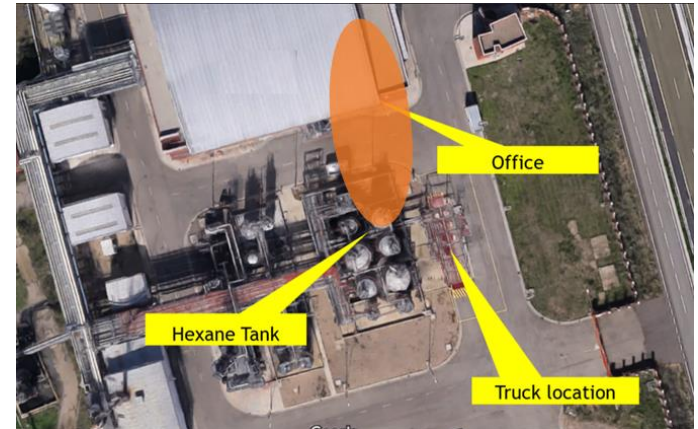
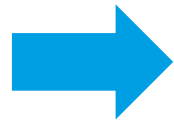
*“Wrong dosing, runaway”*



# DETERMINE THE EFFECT DISTANCES BY USING TOOLS

- Expert software (e.g. PHAST, SafeSite, Effects)
- CHEF (or RAST) Excel tool - Available via CCPS and EPSC

VAPOR DISPERSION INPUT INFORMATION		JET MIXING		SIMPLE VAPOR DISPERSION			
<b>STEP 1 - Select Location, Type of Release, Concentration and Distance of Interest</b> Release Location: <input type="text"/> <small>Release Point or "Cloud" "Tails"</small> Type of Release: <input type="text"/> <small>Vertical, Horizontal, or Other</small> Use Averaging Time Correction for Flammable Releases: <input type="checkbox"/> <small>Yes/No</small> Concentration of Interest: <input type="text"/> ppm Distance of Interest: <input type="text"/> m Release Temperature: <input type="text"/> °C Vapor Molecular Weight: <input type="text"/> g/mol Normal Boiling Point: <input type="text"/> °C		<b>JET MIXING</b> Vapor Density: <input type="text"/> <small>at atmospheric pressure (Equation 3-10)</small> Discharge Velocity: <input type="text"/> m/sec Jet Mixing Transition Distance: <input type="text"/> m Concentration at X: <input type="text"/> ppm Distance Correction for Initial Concentration: Effective Release Elevation: <input type="text"/> m Correction for Release Elevation: Iteration for Release within Enclosed Space: <input type="text"/> ppm		<b>STEP 2 - Enter Chemical Properties (See Select Chemical Name from the List)</b> Chemical Name: <input type="text"/> Low or Flammable Limit (LFL): <input type="text"/> % EFED-2 Concentration: <input type="text"/> ppm Vapor Molecular Weight: <input type="text"/> g/mol Normal Boiling Point: <input type="text"/> °C		<b>STEP 3 - Enter Process Information</b> Release Rate: <input type="text"/> kg/sec Release Temperature: <input type="text"/> °C Total Release Quantity: <input type="text"/> kg Liquid or Two-Phase Release Velocity: <input type="text"/> m/sec Interaction Type: <input type="text"/> <small>Vertical, Horizontal, or Other</small> Equipment and Plant Layout Information: Diameter of Hole or Discharge Piping: <input type="text"/> m Release Elevation: <input type="text"/> m Enclosed Process Area Volume: <input type="text"/> cu m Enclosed Process Area Ventilation Rate: <input type="text"/> /hr	



# DEFINE AFFECTED NUMBER OF PEOPLE

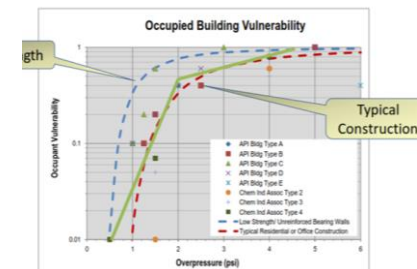
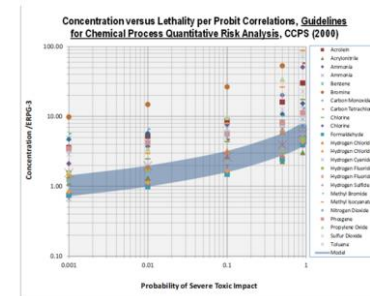
People affected = Occupancy x vulnerability factor

Define vulnerability factor for  
toxic concentration in a building

- ERPG-3 = 0%
- 5 times ERPG-3 = 100%

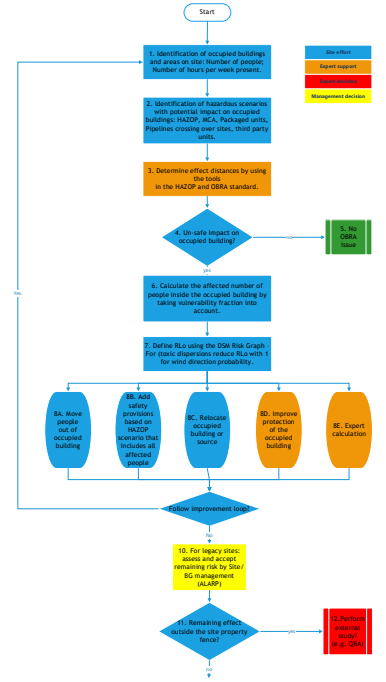
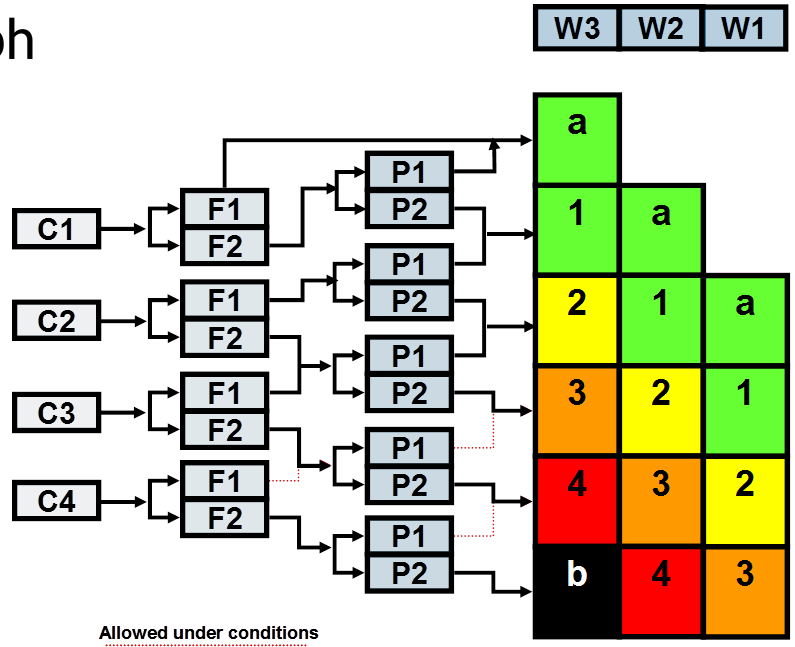
Define vulnerability factor for  
explosion pressure @ building

- 30 mbar = 0 %
- 300 mbar = 100%



# DEFINE THE RISK

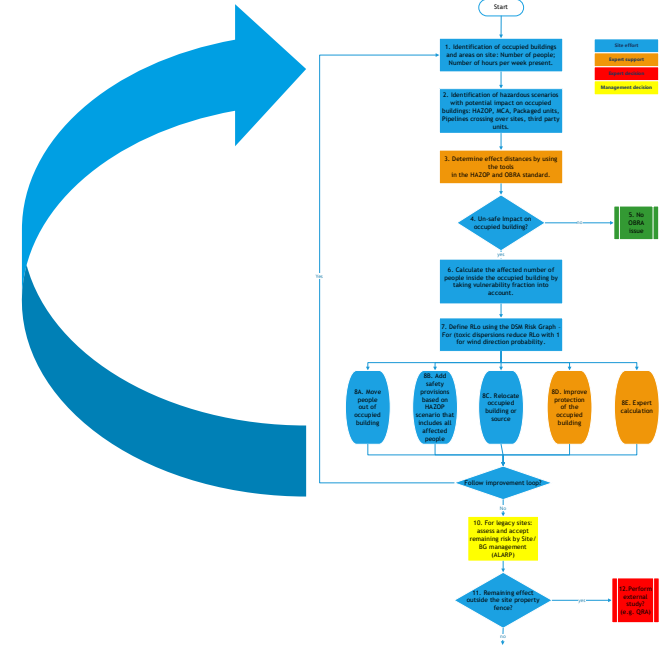
## DSM RiskGraph





# OBRA MEASURES FOR RISK GAP CLOSING

- A. Move people out of occupied buildings
- B. Improve/increase the safeguarding to mitigate the risk
- C. Relocate the occupied building or source of the hazard
- D. Modify occupied buildings



# FLIXBOROUGH, UK - 1974

## OBRA RELATED INCIDENT

- Explosion equivalent to 15 Tonnes TNT
- 1,800 buildings within 1 mile radius damaged
- All 18 people in control room killed
- 500+ would have been killed during a weekday



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