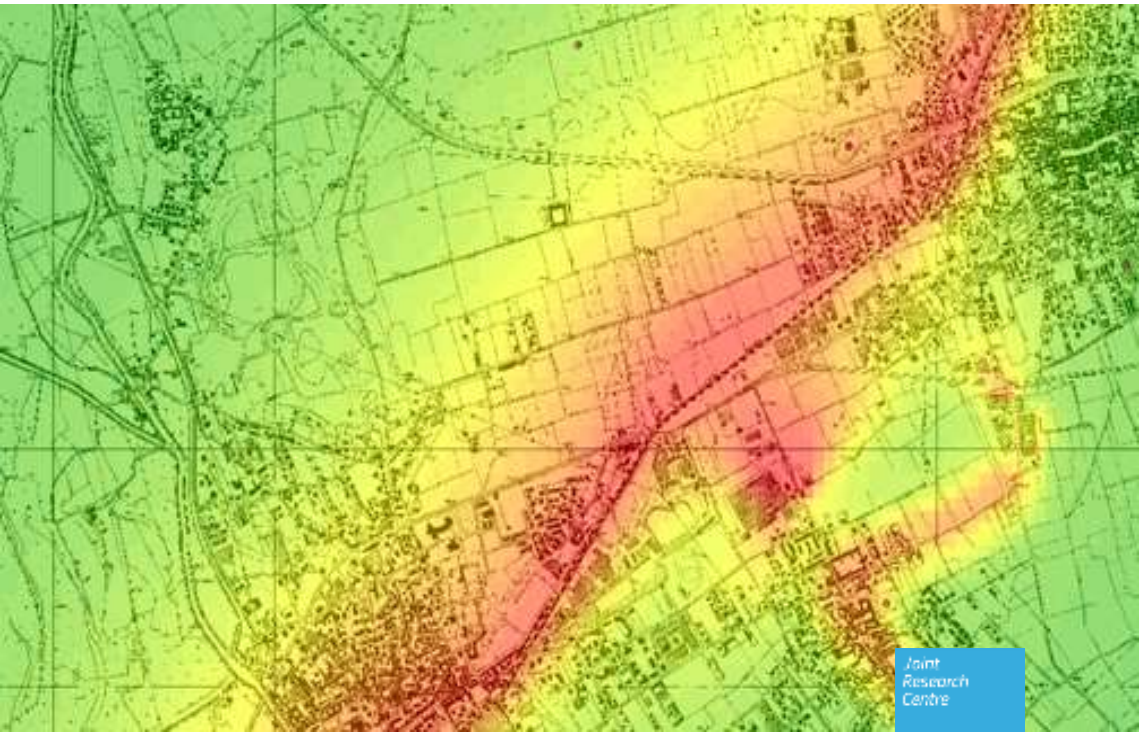
Session 9: Risk acceptance criteria and land use planning

Workshop on Accident Analysis and Risk Assessment

20-22 November 2013, Ispra, Italy



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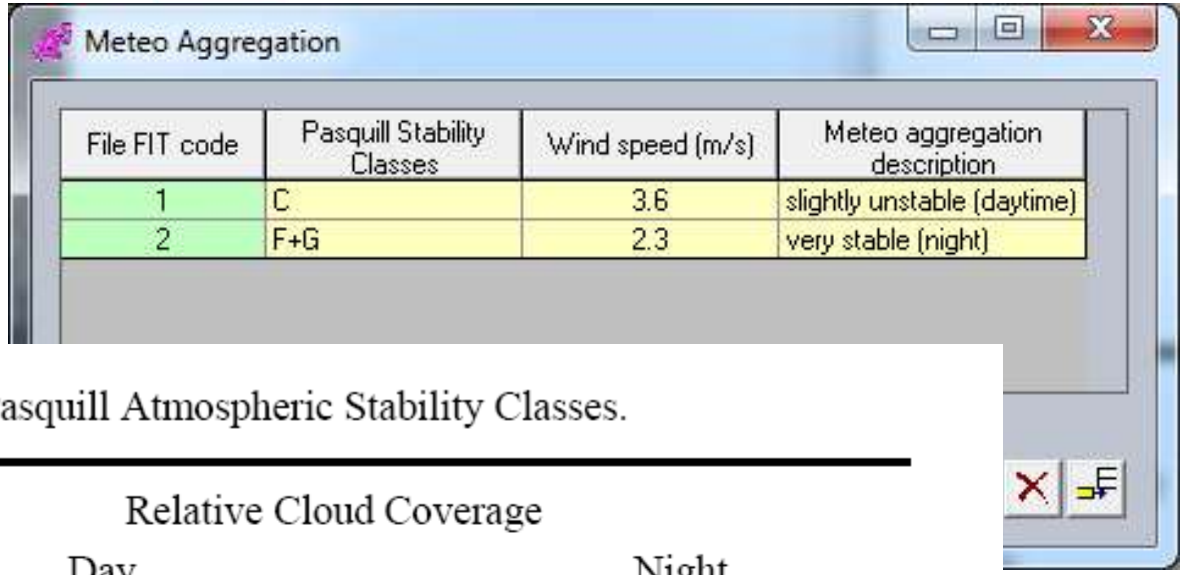
PLANTS

- Petroleum Depo
- Explosive Factory
- Sulfur Dioxide Tank Wagon
- Ammonia Refrigerator unit

Meteo



File FIT code	Pasquill Stability Classes	Wind speed (m/s)	Meteo aggregation description
1	C	3.6	slightly unstable (daytime)
2	F+G	2.3	very stable (night)

Table C5.2. Pasquill Atmospheric Stability Classes.

Surface Wind Speed[a] (m/s)	Relative Cloud Coverage				
	Day			Night	
	0/8 - 2/8	3/8 - 5/8	6/8 - 8/8	< 3/8	> 4/8
< 2	A	A - B	B	F	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	D	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

[a] At a height of 10 m.

Petroleum Depo

2 Gasoline tanks
- h = 11m
- D = 21m
- m= 2735 tons

2 Kerosene (2 Jet A1) tanks
- h = 9.1m
- D = 34 m
- m= 6491 tons

Petroleum Depo: Accident Scenarios

Fire due to roof failure
$f = 10^{-3}\ y^{-1}$

Large release of fuel (overfilling, tank failure)
$f = 10^{-3}\ y^{-1}$

Delayed Ignition ?
$p_G = 0.1$
$P_K = 0.01$

YES

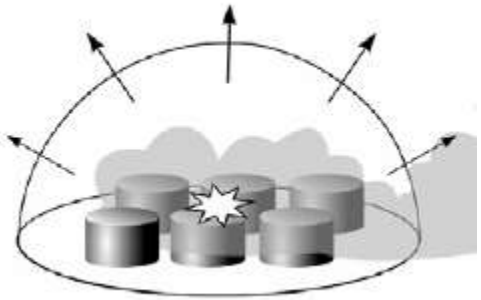
UVCE
$f_G = 10^{-4}\ y^{-1}$
$f_k = 10^{-5}\ y^{-1}$

NO

Pool Fire
$f_G = 9\ 10^{-4}\ y^{-1}$
$f_k = 9.9\ 10^{-5}\ y^{-1}$

Explosive Factory

Cloud, Air-Propane 92000m^3
Propane mass 4770



R = 35m

PEMEX Mexico City
The PEMEX LPG Terminal, of 16,000 m^3 capacity, in Mexico City, was regularly supplied by 3 refineries. At 5:35 am of November 19, 1984, the control room noticed a pressure drop in the pumping station, without however being able to find its cause. An 8-in diameter pipeline between a spherical storage tank and a group of cylindrical vessels was leaking. The leak lasted between 5-10 min, while a 0.4 m/s wind was in the area. A large vapor cloud was formed, followed by a VCE. The resulting casualties included 550 deaths and more than 6,400 wounded.

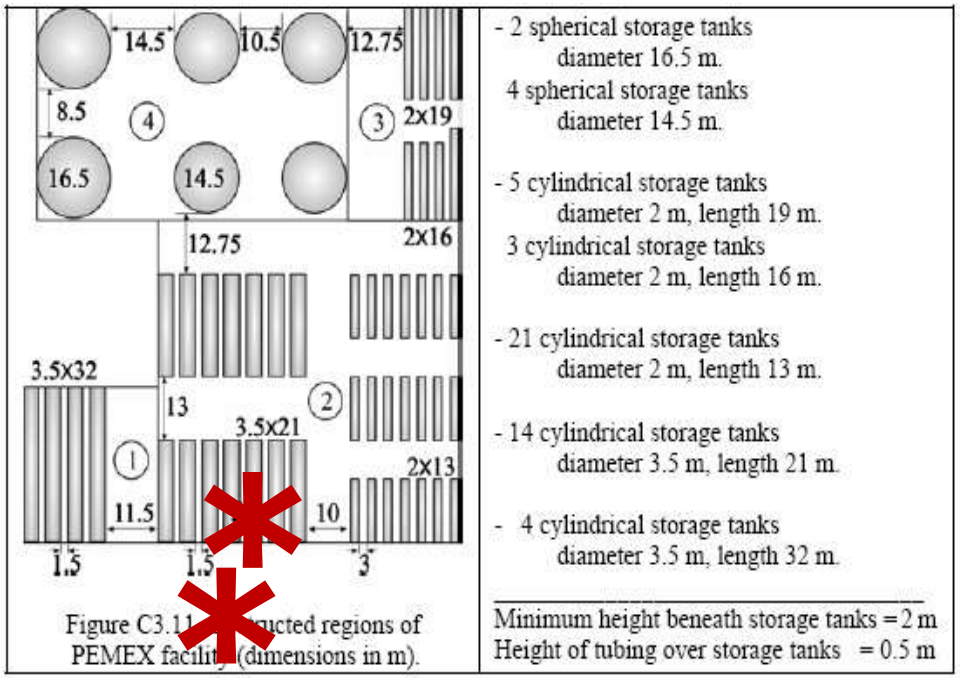


Figure C3.11 ...ucted regions of PEMEX facilit... (dimensions in m).

- 2 spherical storage tanks
  diameter 16.5 m.
  4 spherical storage tanks
  diameter 14.5 m.

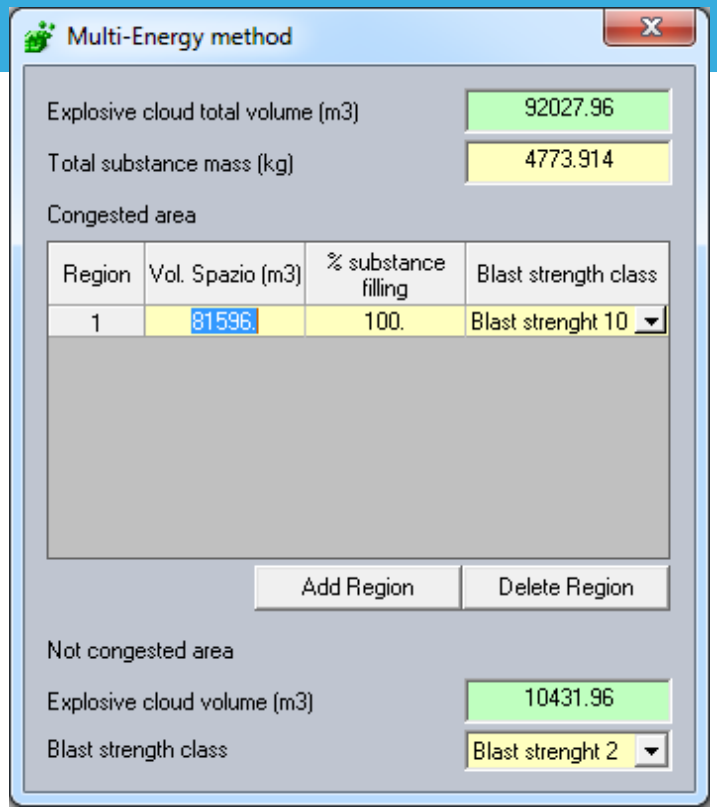
- 5 cylindrical storage tanks
  diameter 2 m, length 19 m.
  3 cylindrical storage tanks
  diameter 2 m, length 16 m.

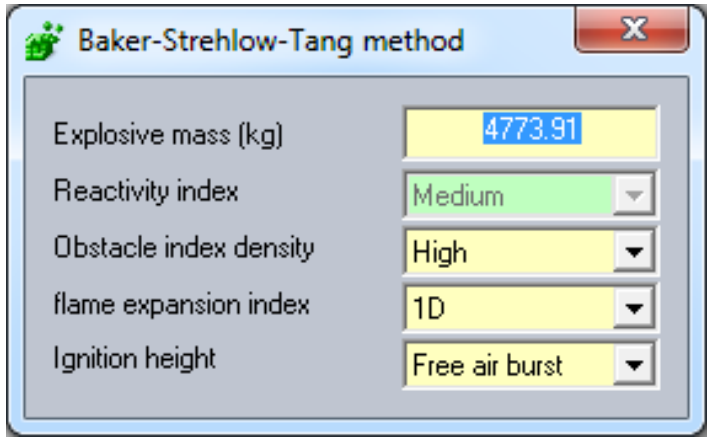
- 21 cylindrical storage tanks
  diameter 2 m, length 13 m.

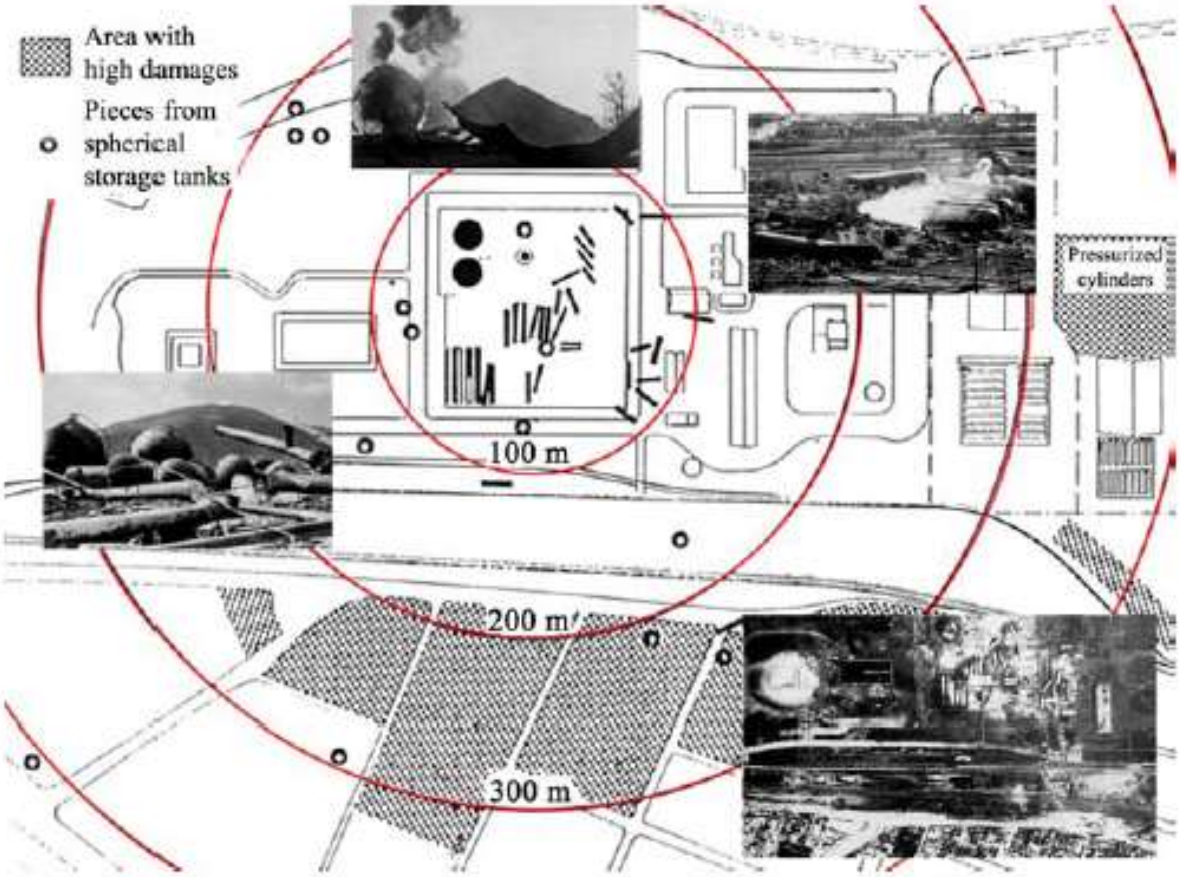
- 14 cylindrical storage tanks
  diameter 3.5 m, length 21 m.

- 4 cylindrical storage tanks
  diameter 3.5 m, length 32 m.

Minimum height beneath storage tanks = 2 m
Height of tubing over storage tanks = 0.5 m







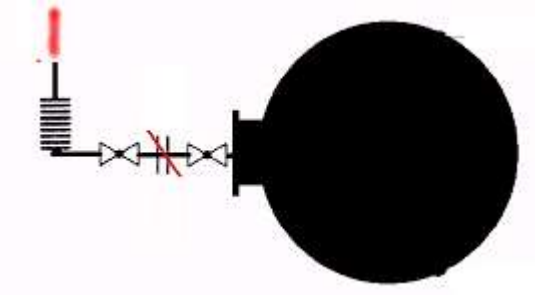
Area layout and photographs after the explosion [Arturson 1987, Lerdo de 1985, Pietersen 1988].

Local observations

P_s over 0.3 bar (within 200m)

Sulfur Dioxide Tank Wagon

S1 Catastrophic failure of tank during tank wagon change f=10^{-7} (**50t**)
S2 Failure of the Flange f=10^{-5} (**20 min release**)
S3 Failure of the Flexble pipe f=10^{-5} (**20 min release**)



Release of ammonia from the refrigeration system

- The scenario estimates release of Ammonia during loading into the refrigeration system. Loading operations take place every 2 years (**fm=1.3710^{-3}**).
- Ammonia is transferred from road tanker into the refrigeration system using a flexible hose18 mm in diameter (**f = 10^{-2}**).
- The scenario assumes hose rupture and release lasting 5 minutes (300 s).