

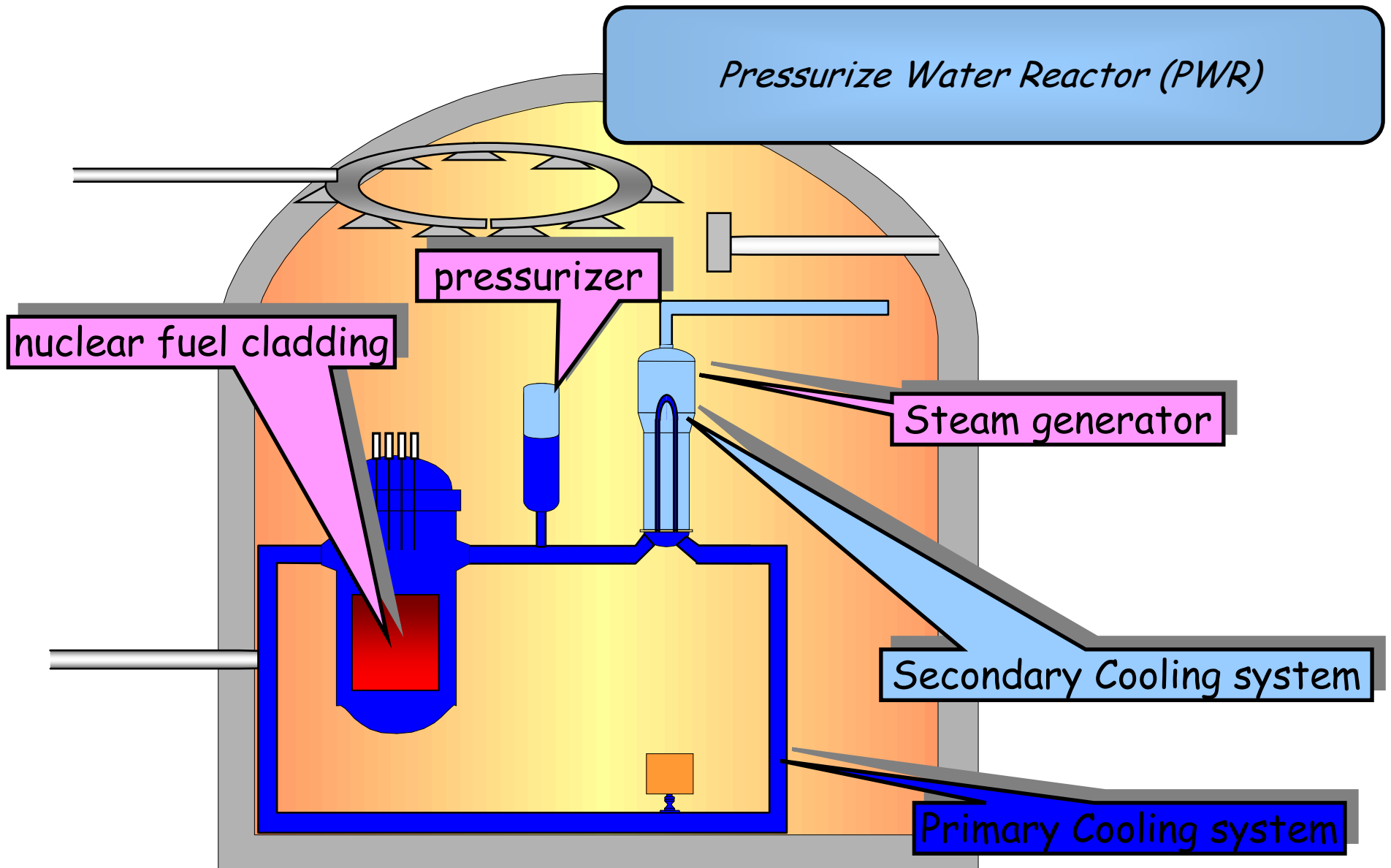
The logo for IRSN, featuring the letters 'IRSN' in a bold, sans-serif font. The 'I', 'R', and 'S' are red, while the 'N' is blue.

INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

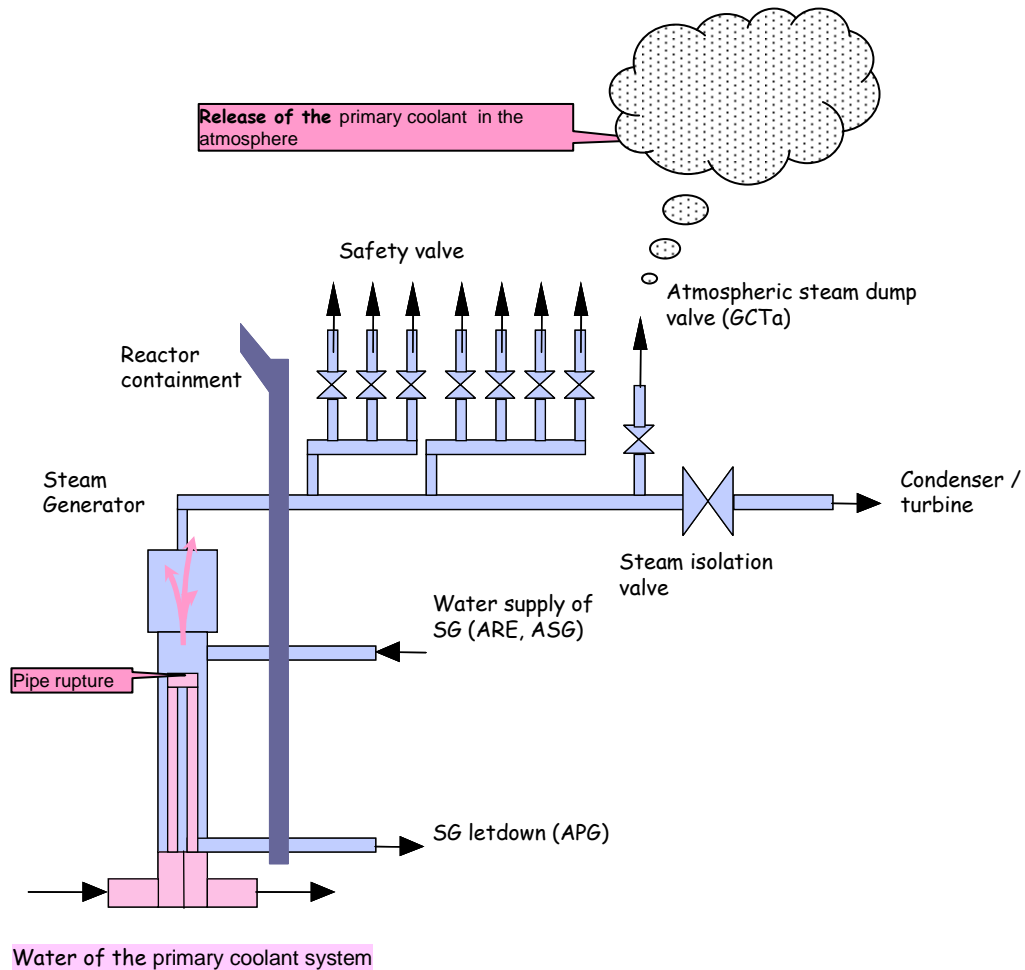
Proposed Scenarios

E. NAVARRO, IRSN

Steam generator tube rupture



Steam generator tube rupture

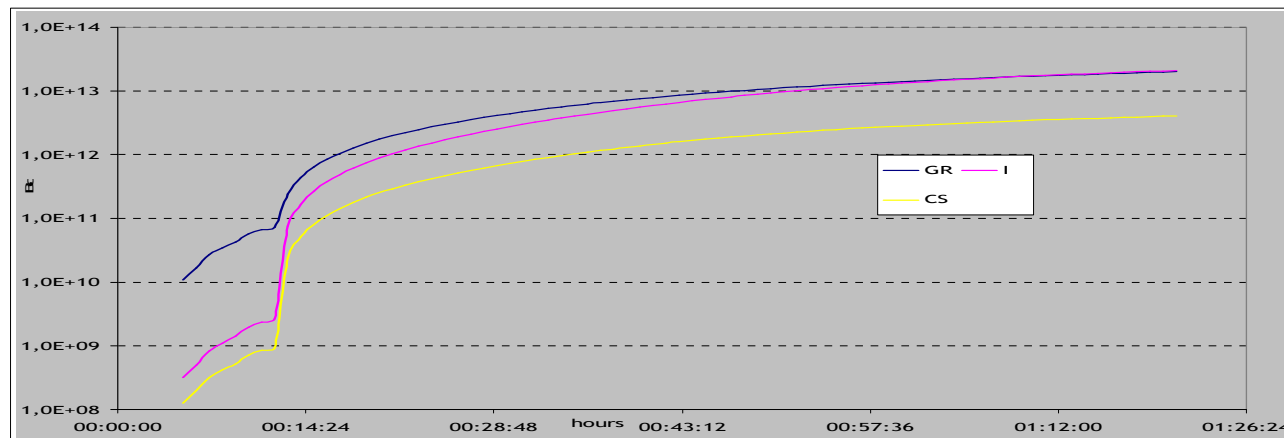
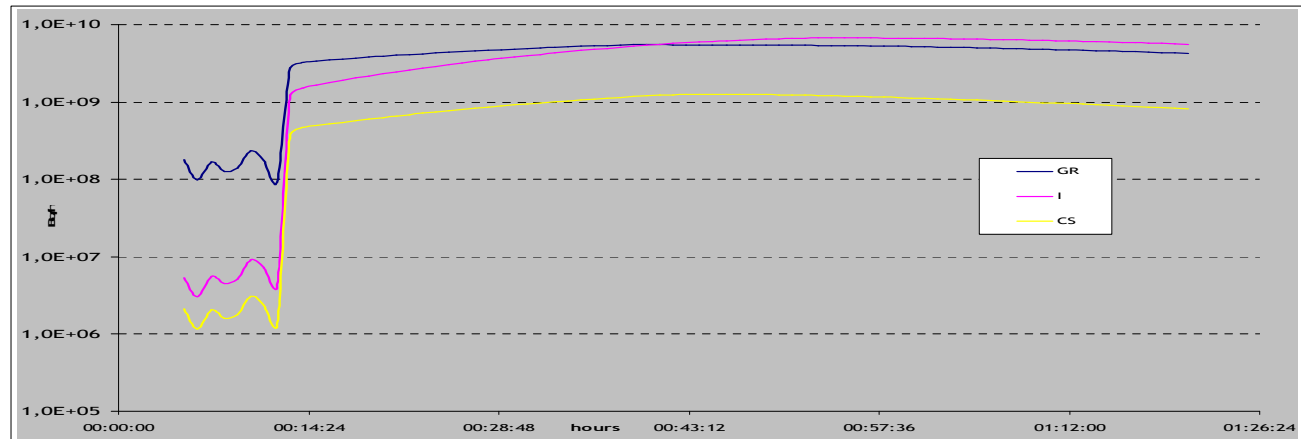


Duration of release = 1 h

<i>Radionuclide</i>	<i>Total Activity released 1 h (Bq)</i>
Noble Gases	2,0.10¹³
Iodine	2,1.10¹³
Caesium	4,0.10¹²

Steam generator tube rupture

Release rate (Bq/h)



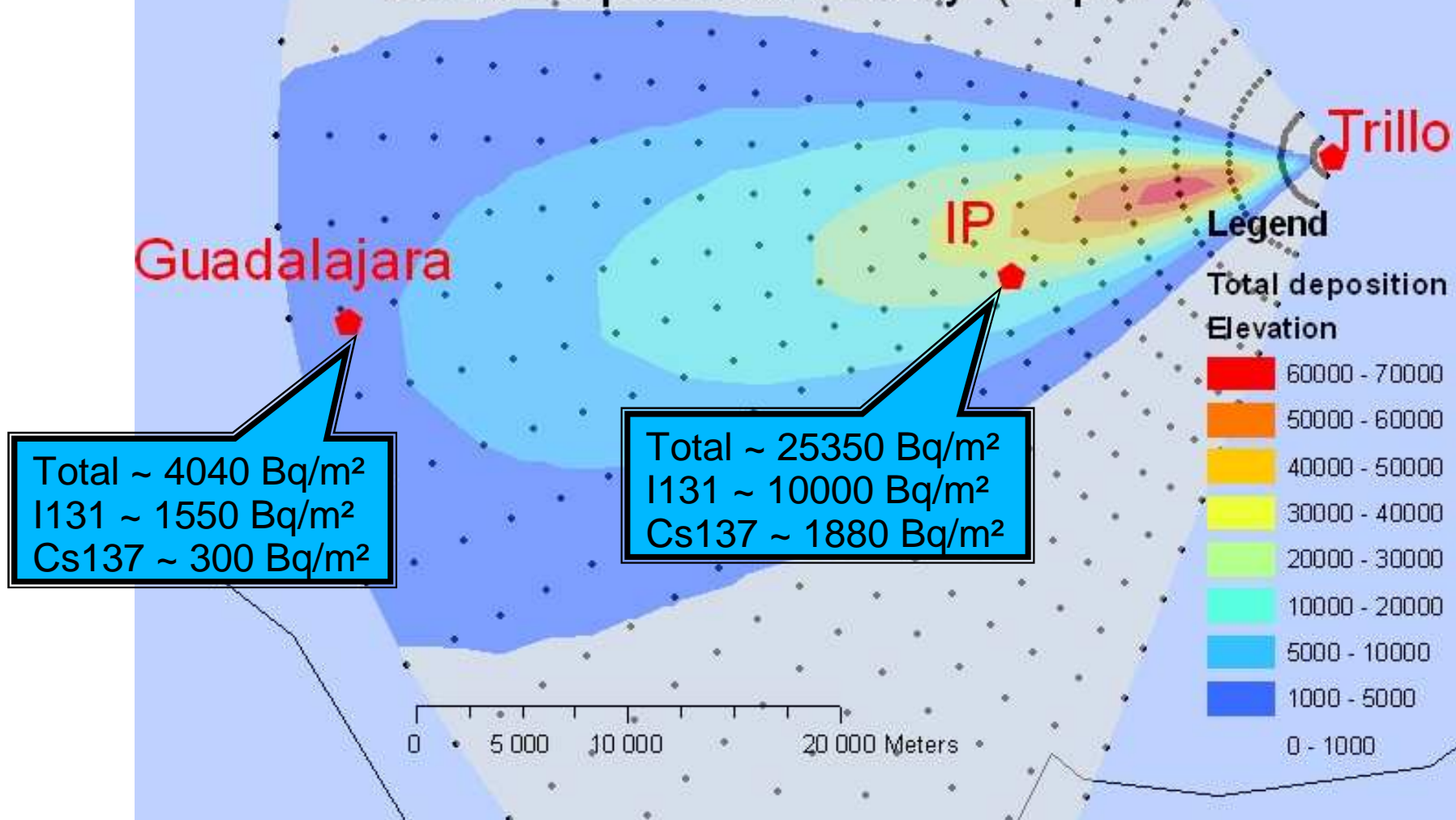
Released activity (Bq)

Steam generator tube rupture - Simplified Approach

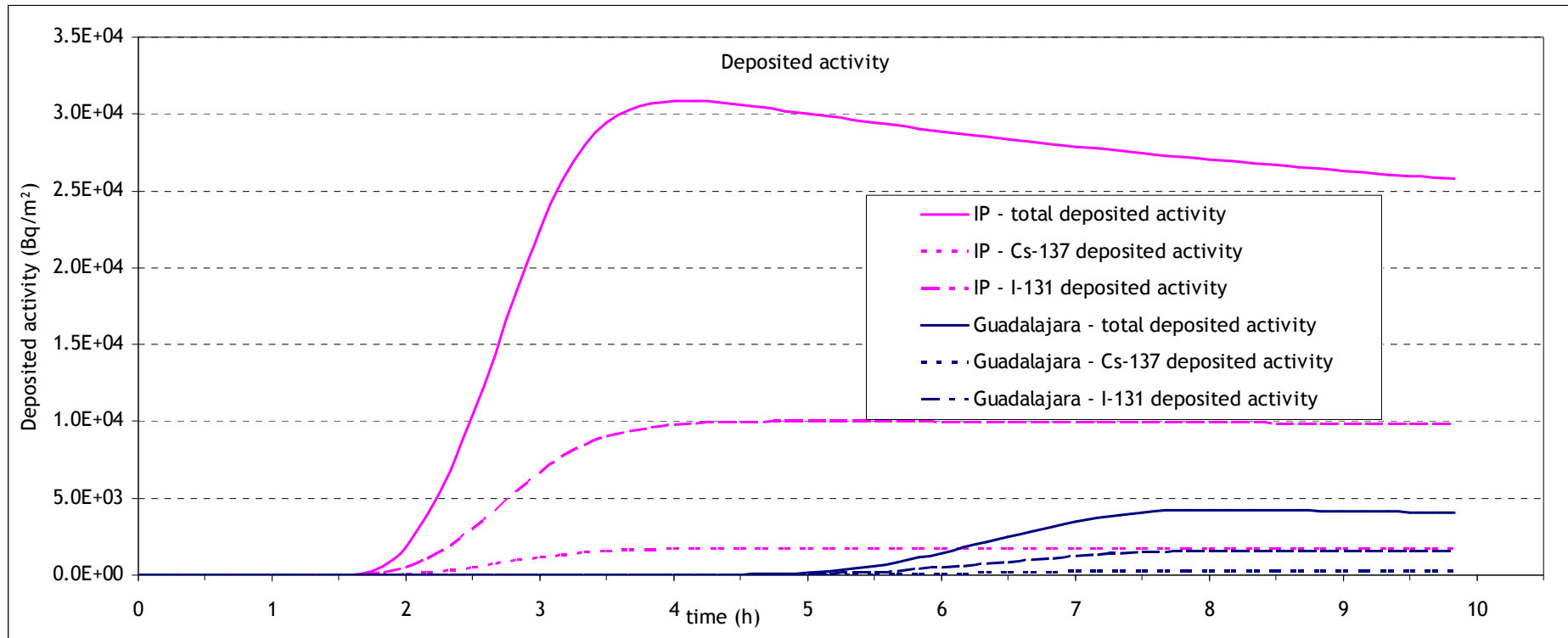
- **Model :**
 - pX (IRSN Puff model) : 1 to 50 km (“short range” modeling)
- **Objective approach: having a maximum contamination → no dispersion effect**
 - flat terrain
 - constant meteorological conditions during dispersion
 - uniform wind field direction
- **Meteorological data:**
 - Mean wind in spatial grid
 - Atmospheric stability : **Stable** - wind speed : **2m/s** - direction **77°**
 - Atmospheric stability : **Neutral** - wind speed : **3.2m/s** - direction **80°**
- **Simulation endpoints**
 - IP
 - Guadalajara

Steam Generator Tube Rupture

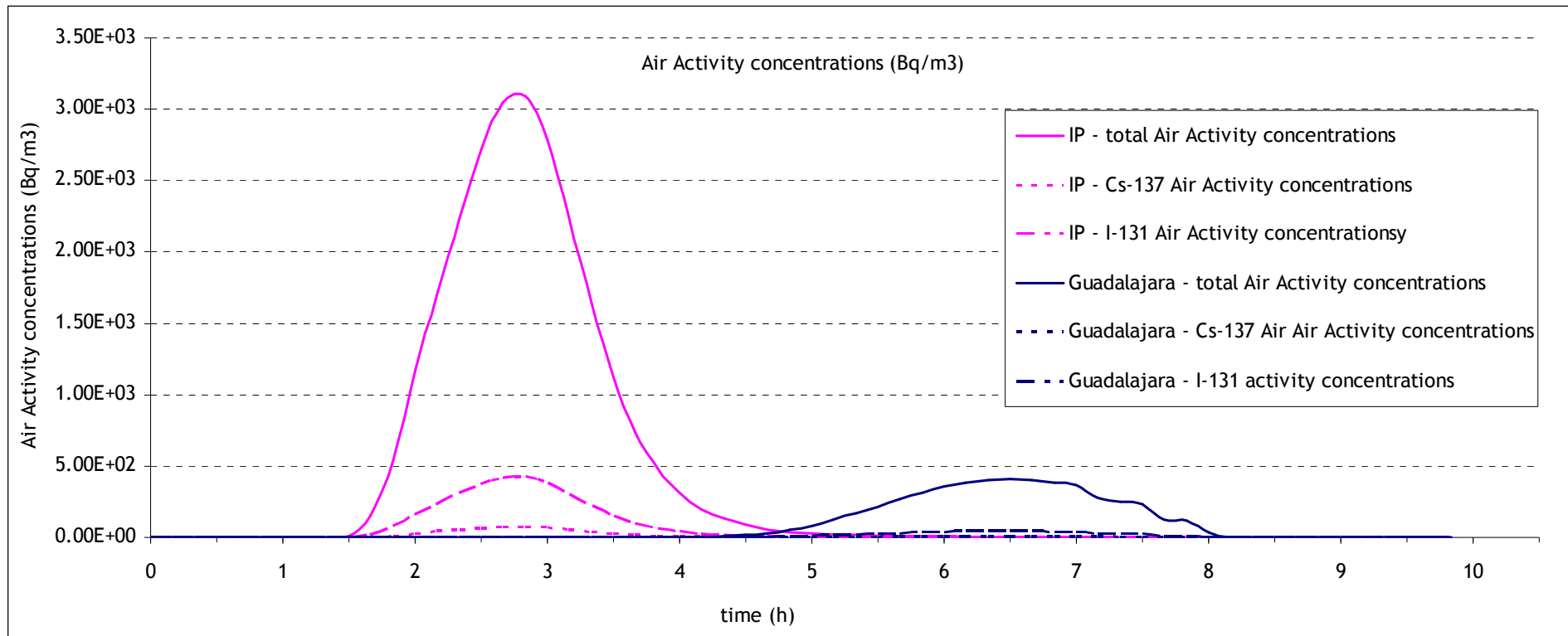
Stable - wind 77° - 2 m/s
Total Deposited Activity (Bq/m²).



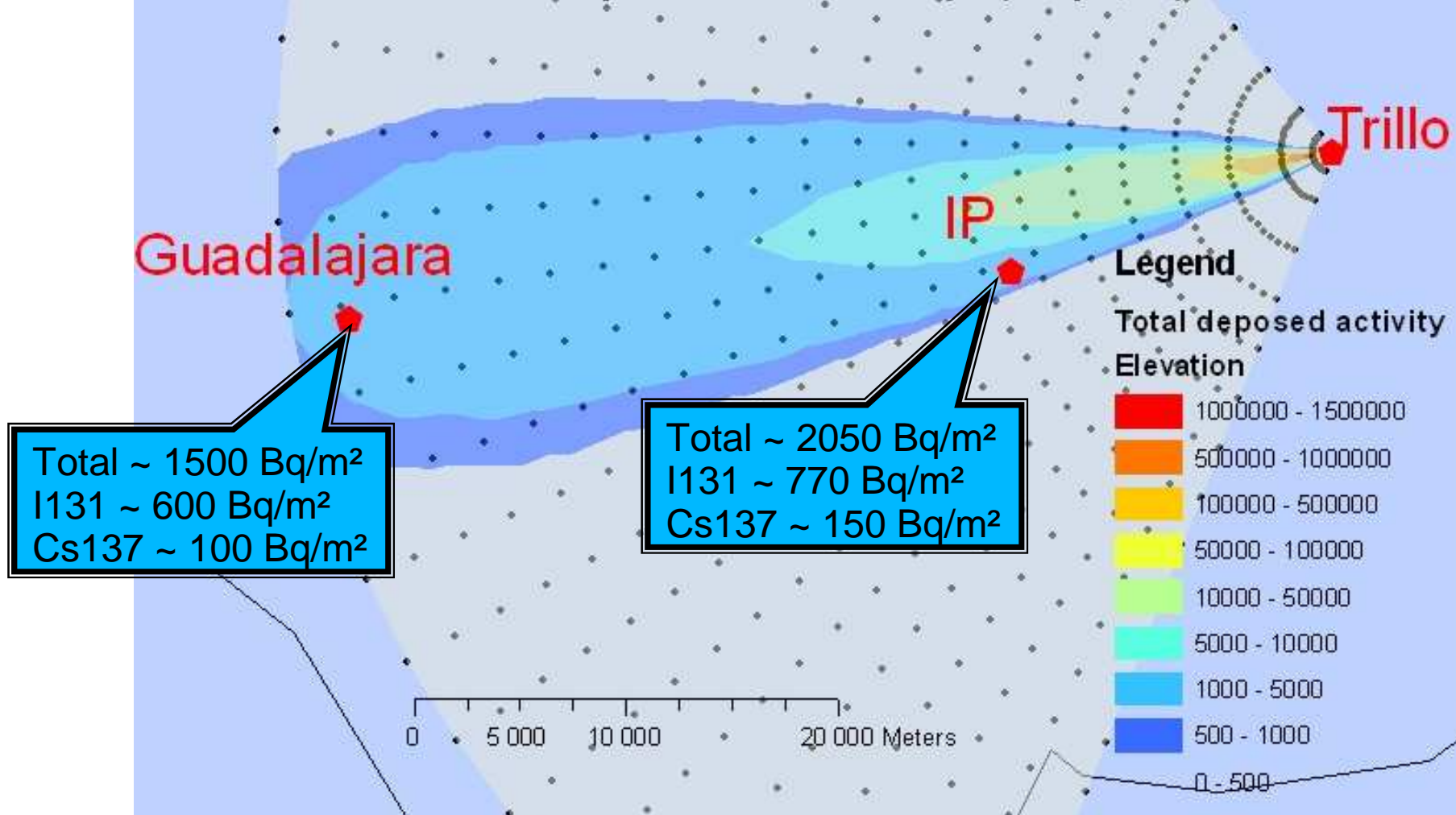
Atmospheric stability : **Stable** - wind speed : **2m/s** - direction **77°**
Deposited Activity - Guadalajara & IP



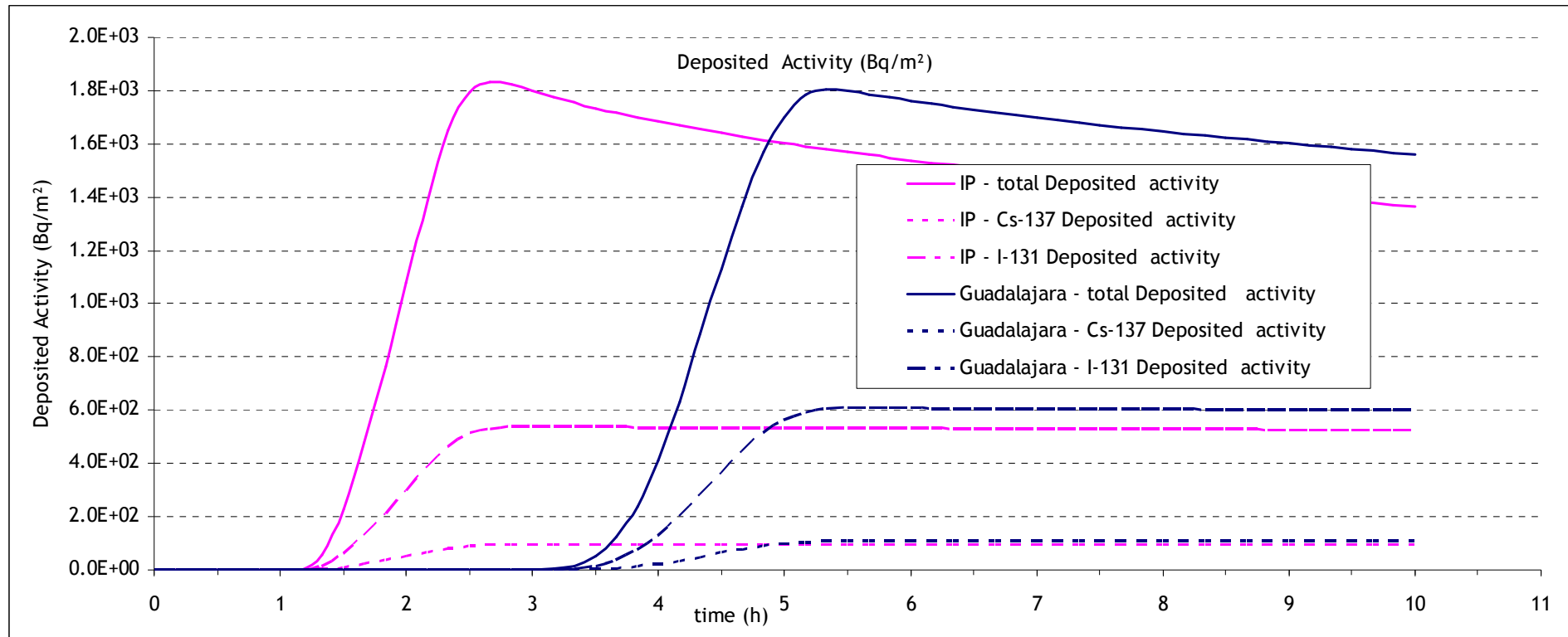
Atmospheric stability : **Stable** - wind speed : **2m/s** - direction **77°**
Air Activity Concentrations - Guadalajara & IP



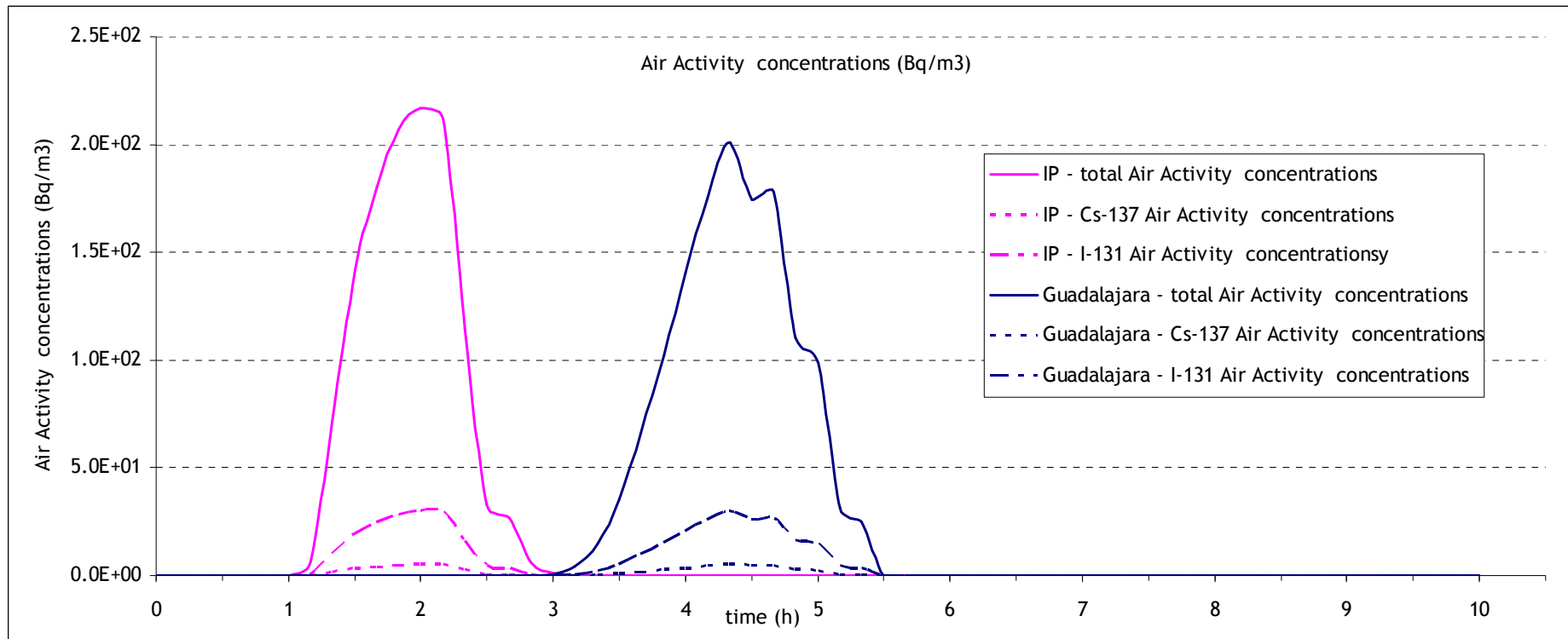
Steam Generator Tube Rupture Neutral - wind 80° - 3.2 m/s Total Deposited Activity (Bq/m²)



Atmospheric stability : Neutral - wind speed : 3.2m/s - direction 80°
Deposited Activity - Guadalajara & IP



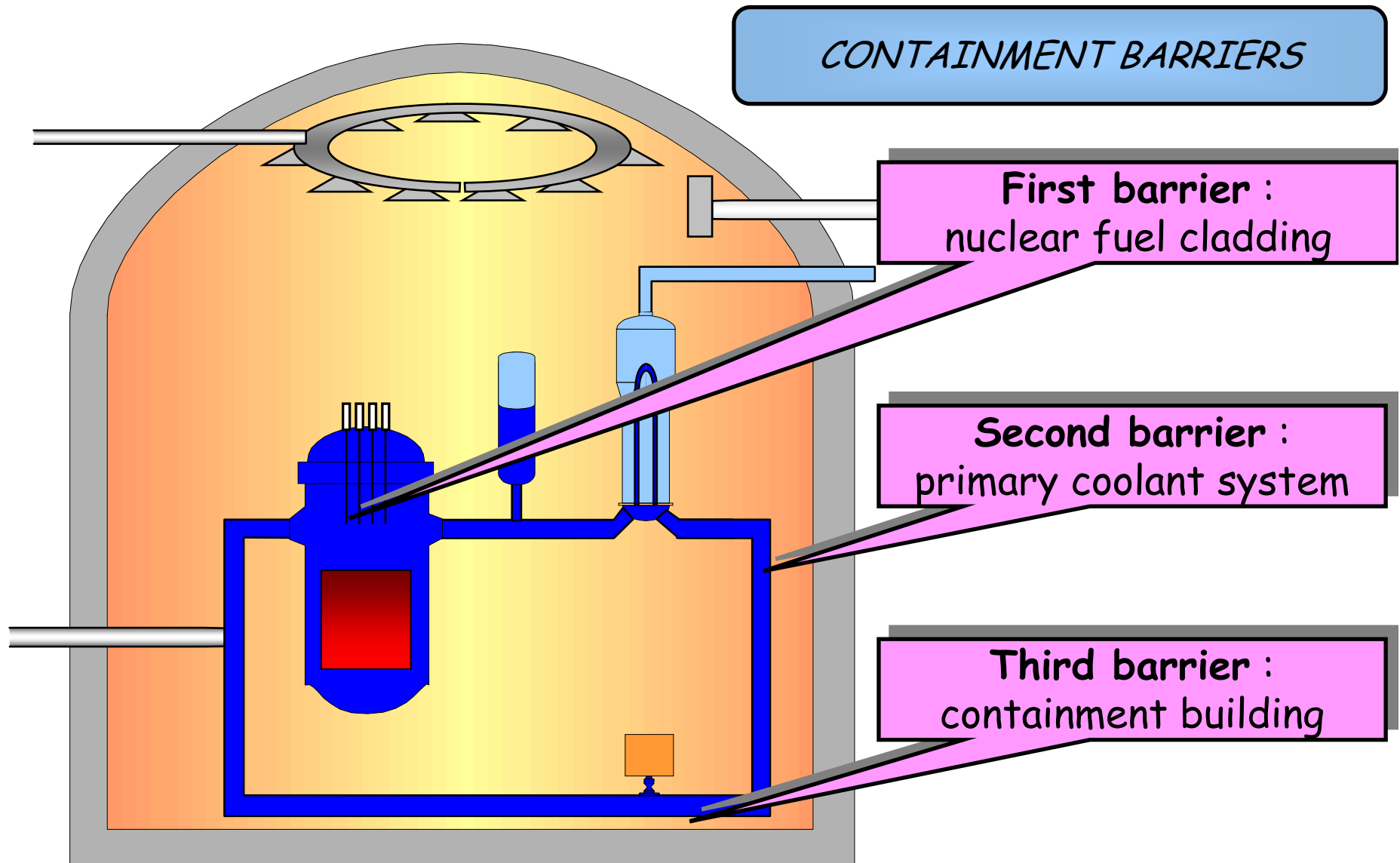
Atmospheric stability : **Neutral** - wind speed : **3.2m/s** - direction **80°**
Air Activity Concentrations - Guadalajara & IP



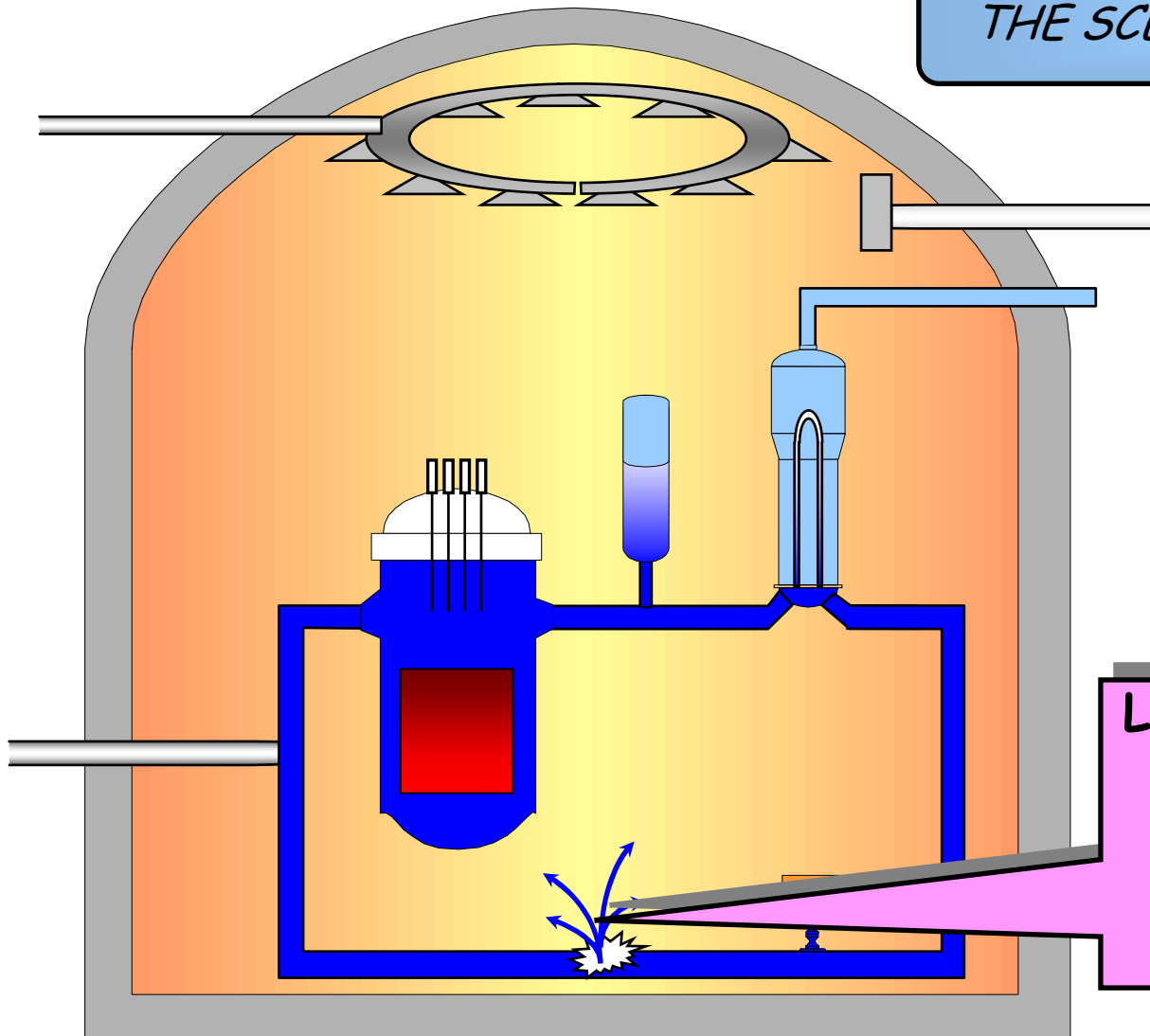
Comments

- Maximum contamination in wind axis, no dilution by complex terrain effects.
- IRSN will use the 2D wind field in the puff model (observation points : only IP and Guadalajara)
- IRSN can't use the 2D wind field proposed by the Emras Group in our long range model

Core meltdown (without vessel rupture)



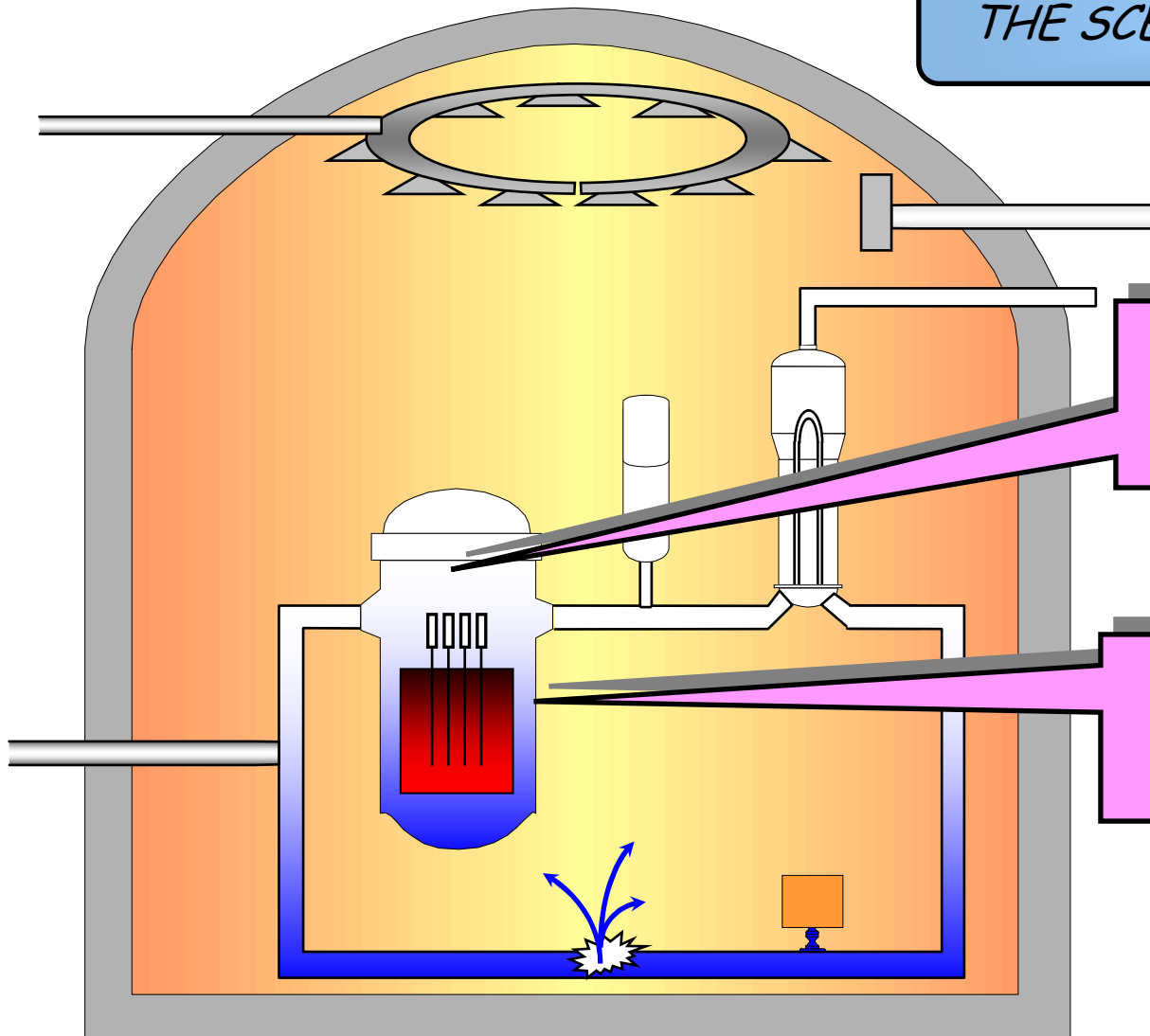
THE SCENARIO ENVISAGED (1)



Large break on primary
coolant system

➤ second barrier
rupture

THE SCENARIO ENVISAGED (2)



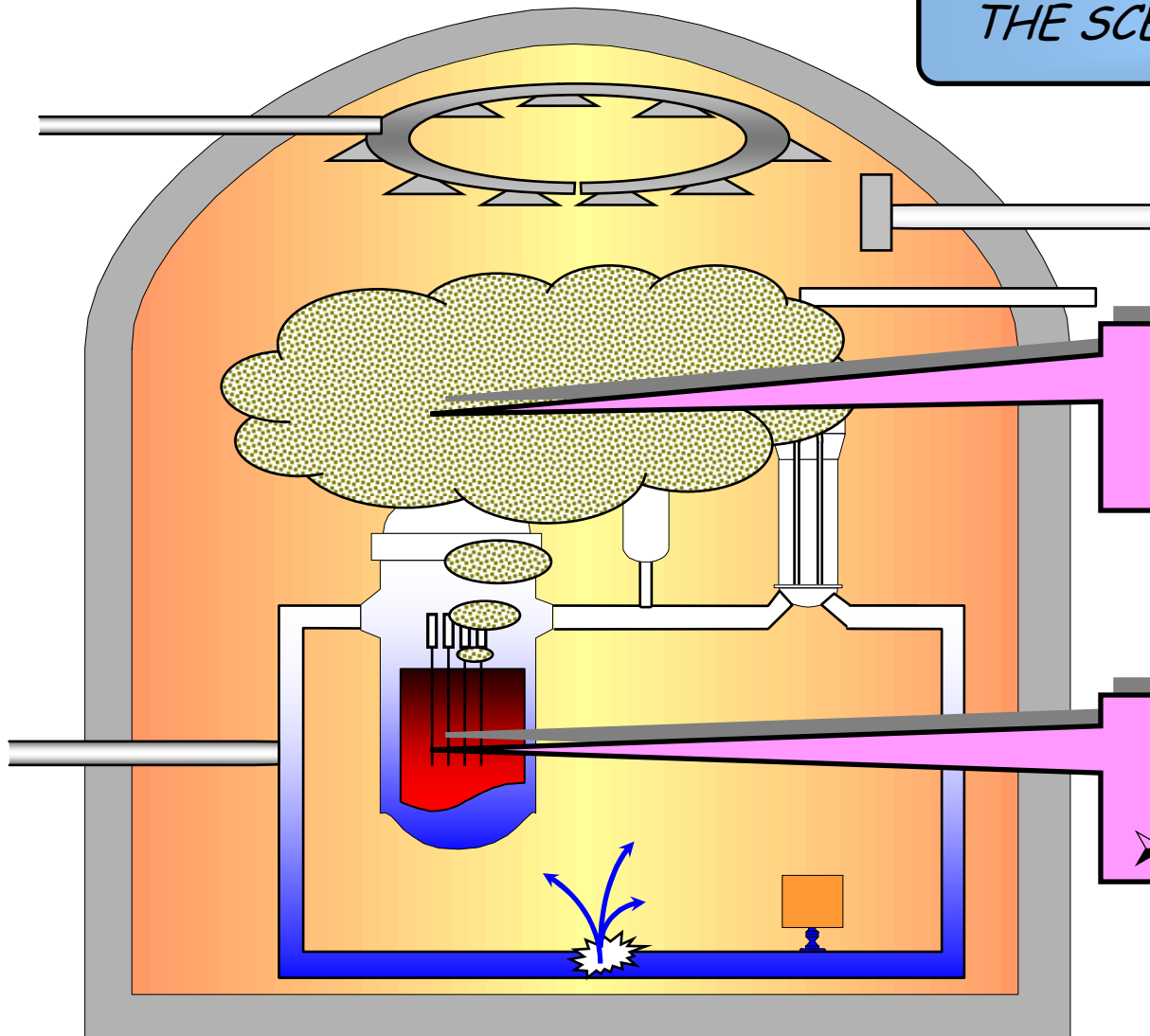
Reactor trip

➤ nuclear reaction trip

Lower water level

➤ core uncovering

THE SCENARIO ENVISAGED (3)

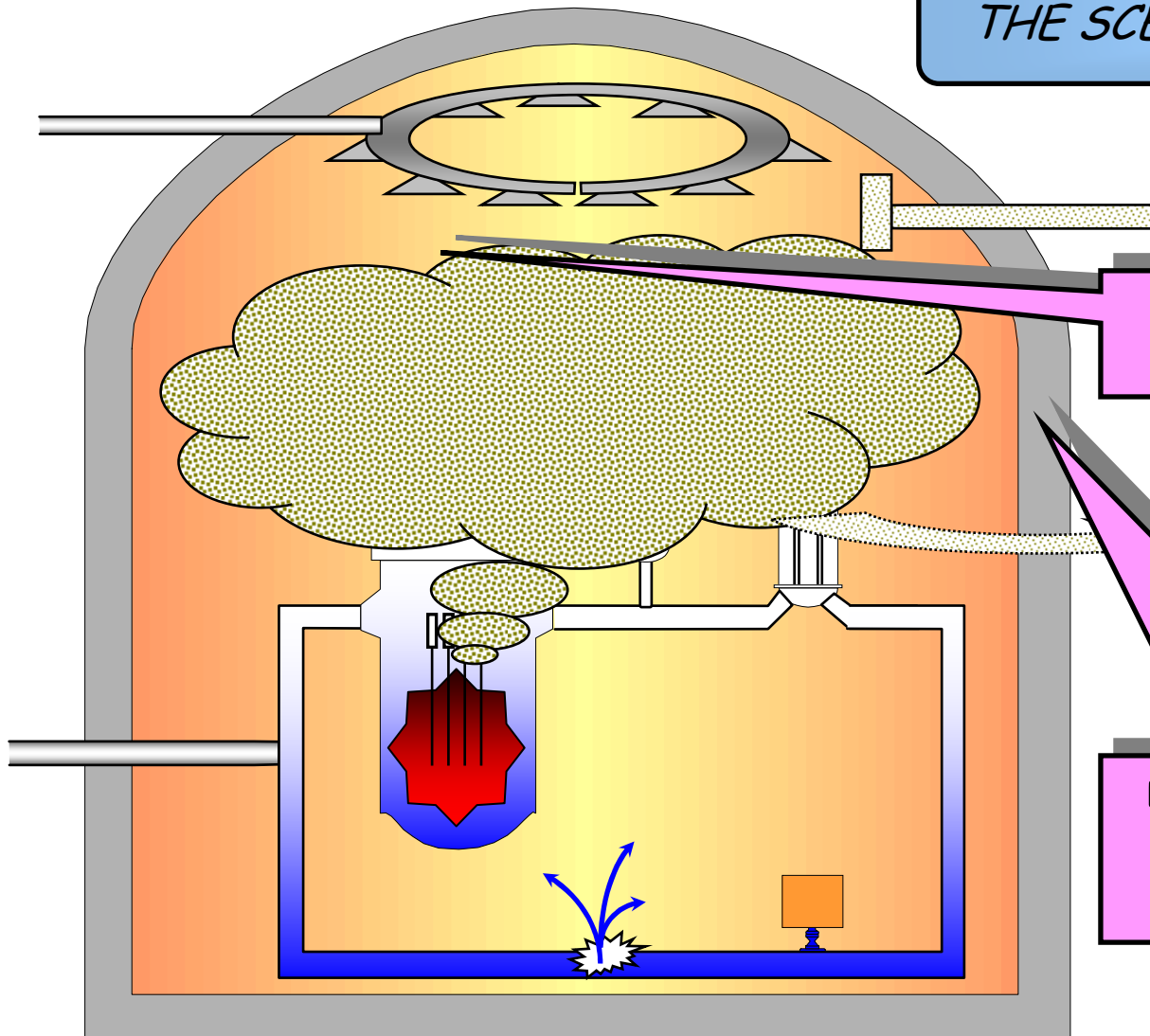


Radioactive products dispersion inside the reactor building

Core meltdown

➤ First barrier rupture

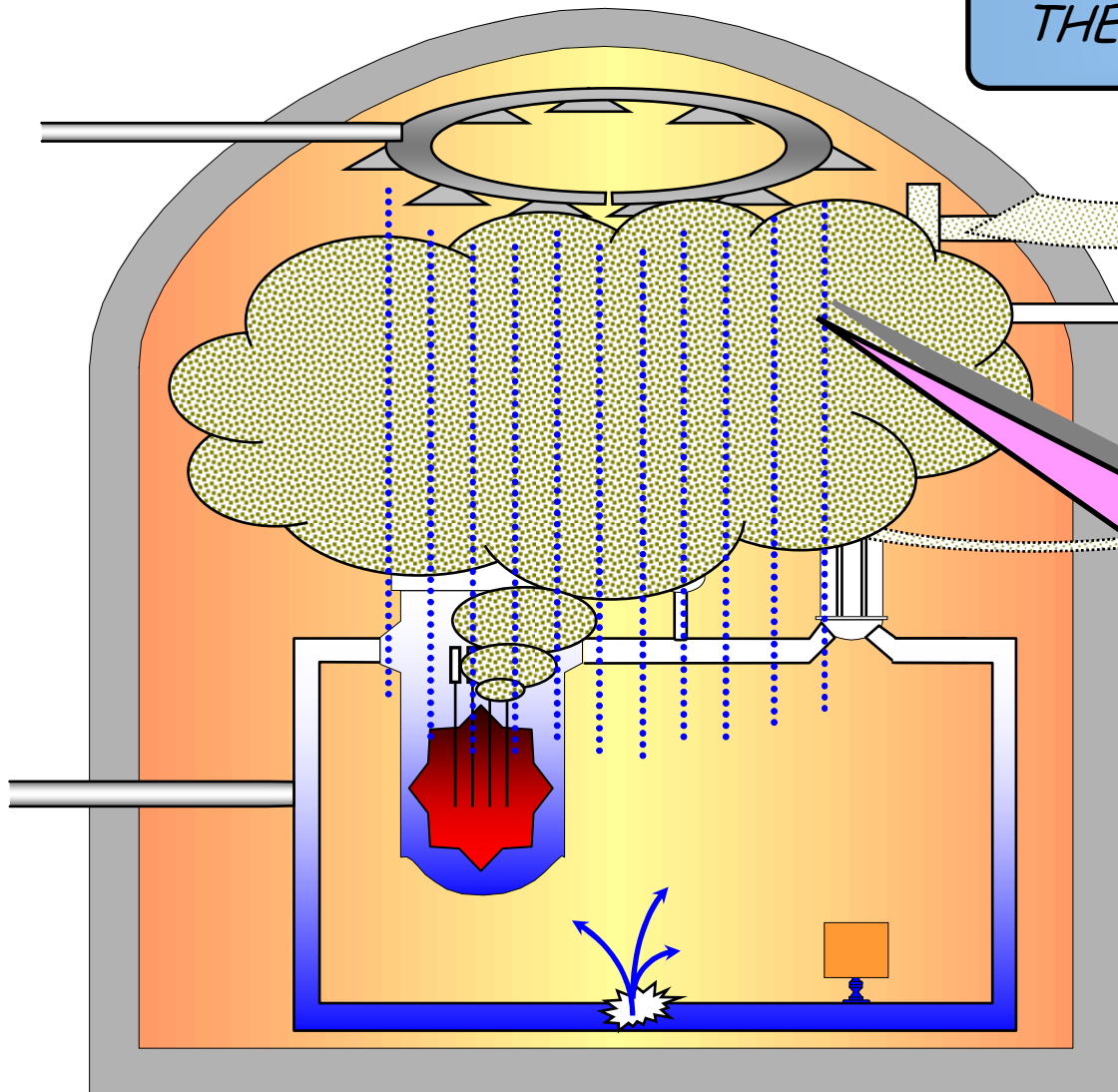
THE SCENARIO ENVISAGED (4)



Increased pressure in the building

radioactive release by containment natural leakages

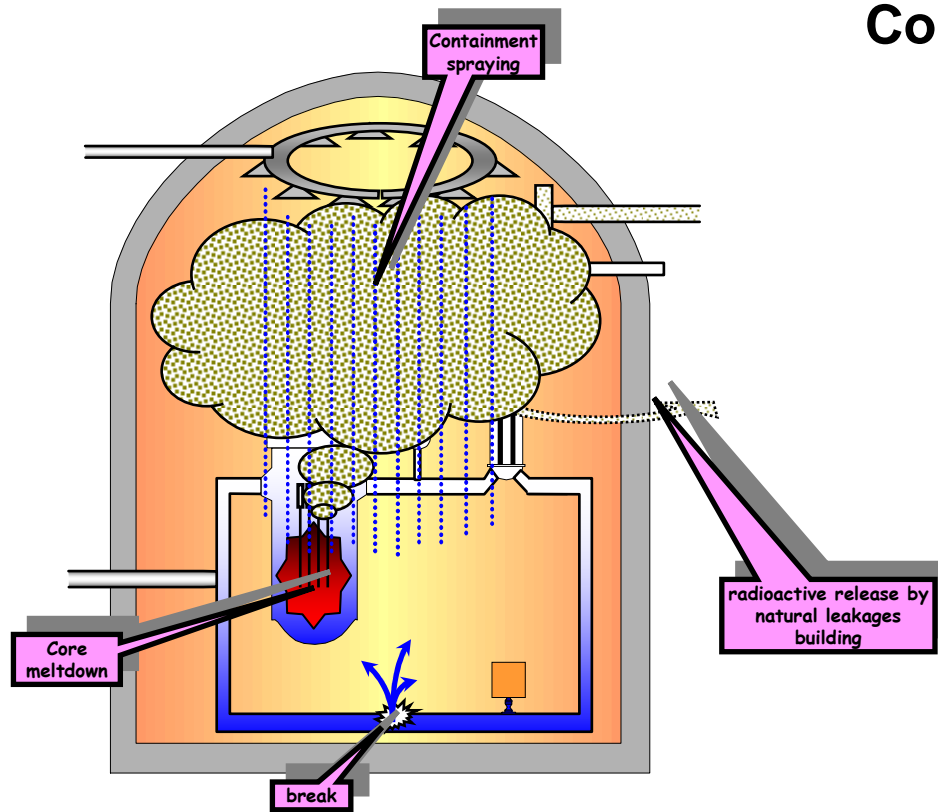
THE SCENARIO ENVISAGED (5)



Containment spraying

- Reduced pressure
- Reduced temperature
- radioactive release downwash

Core Meltdown

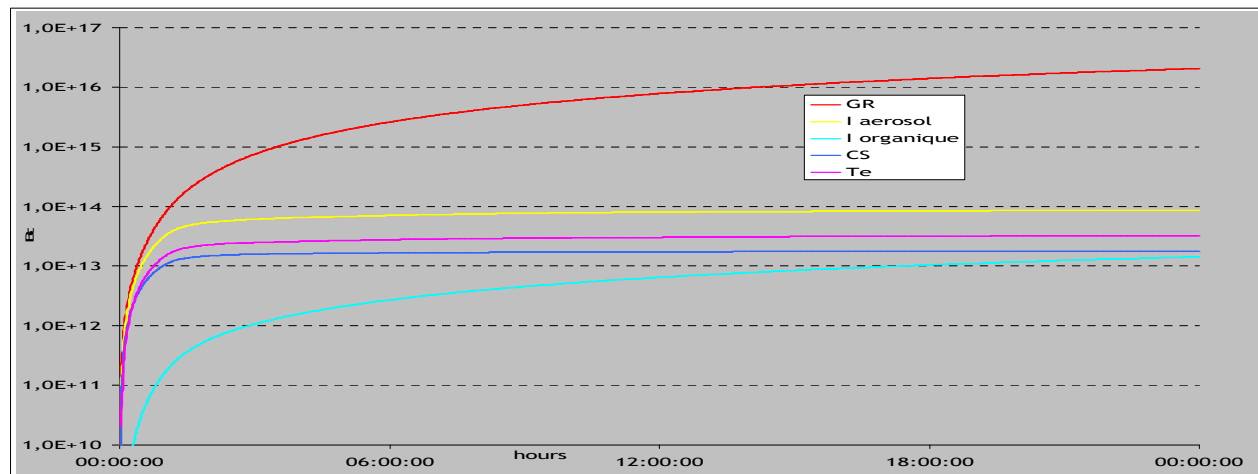
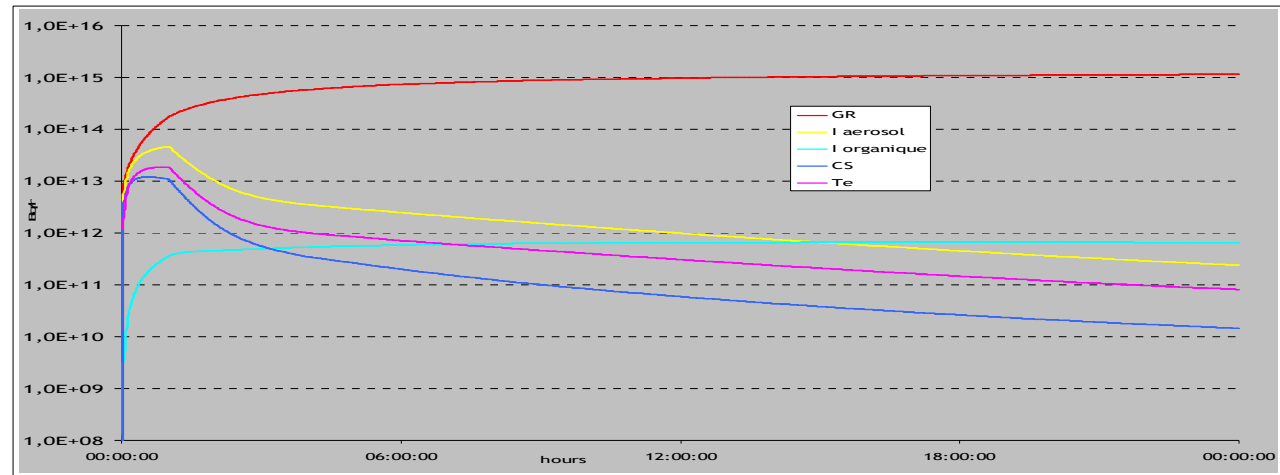


Supposed duration of release = 24 h

<i>Radionuclide</i>	<i>Total Activity released 24 h (Bq)</i>
Noble Gases	$2,1 \cdot 10^{16}$
Aerosol iodine	$8,7 \cdot 10^{13}$
Molecular iodine	$1,4 \cdot 10^{13}$
Caesium	$1,8 \cdot 10^{13}$
Tellurium	$3,25 \cdot 10^{13}$

Core Meltdown

Release rate (Bq/h)



Released activity (Bq)