



# Fuel Storage at Ports and Harbours

## The Buncefield (U.K.) accident

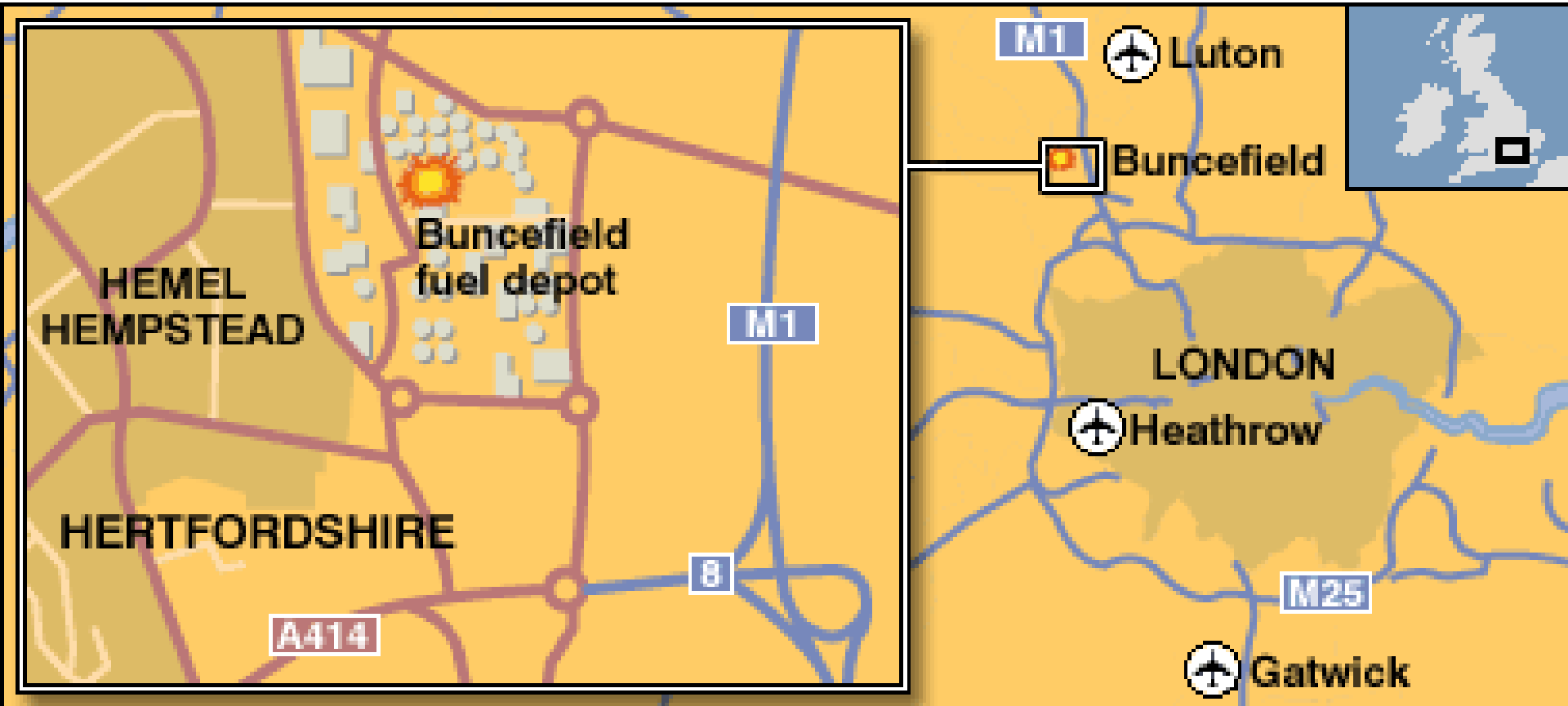
Richard Gowland Technical Director  
European Process Safety Centre



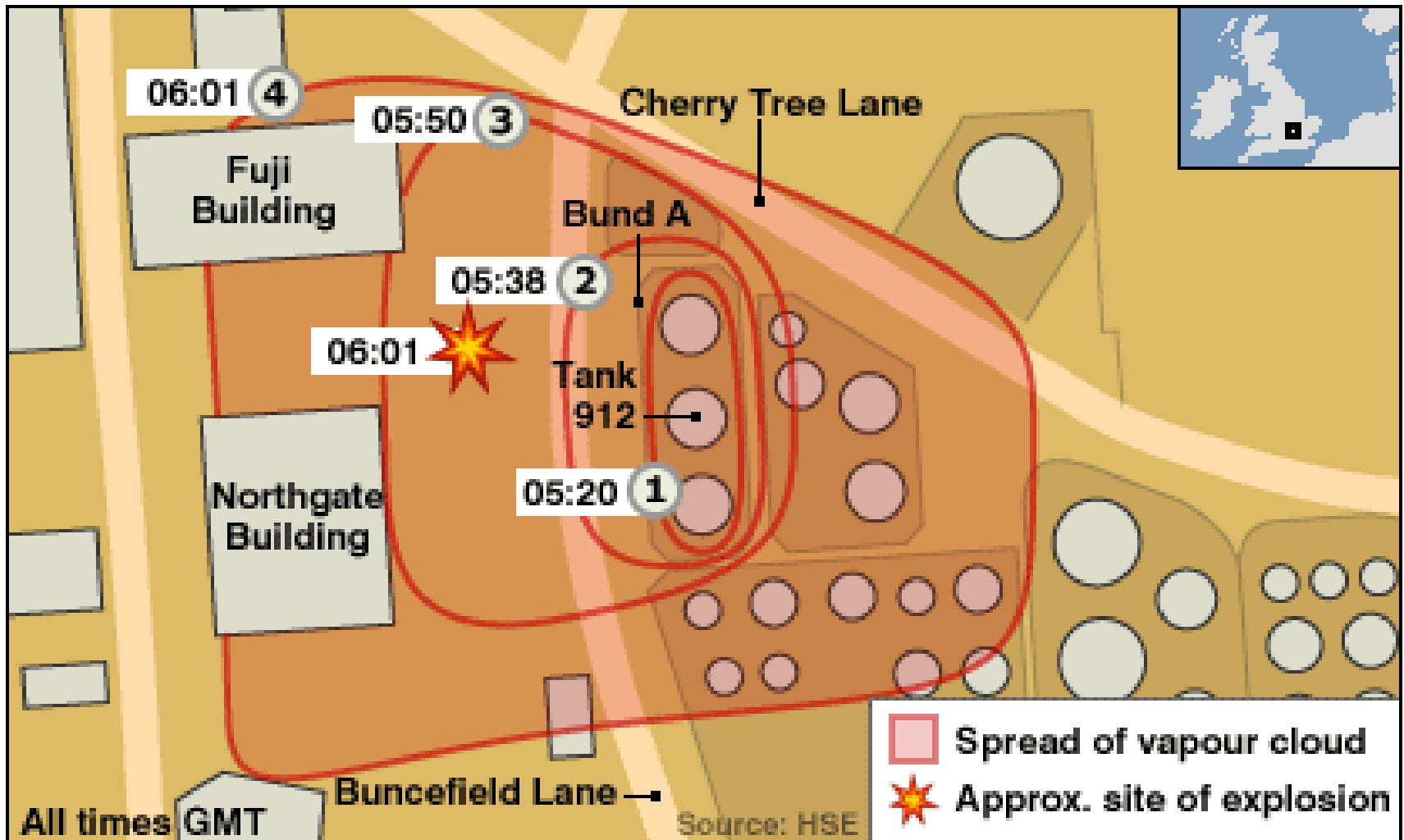
# Why me?

- EPSC is a Chemical Industry funded body dedicated to sharing and spreading Best Practice in Process Safety
- Richard Gowland is:
  - Technical Director of EPSC
  - The chair of the UK Health and Safety Executive Buncefield Process Safety Leadership Group on Overflow Prevention Risk Assessment (LOPA)

# The Buncefield Fuel Storage facility



Fed by refinery pipelines from different locations.  
Feeding users including Heathrow Airport via road  
And distribution lines



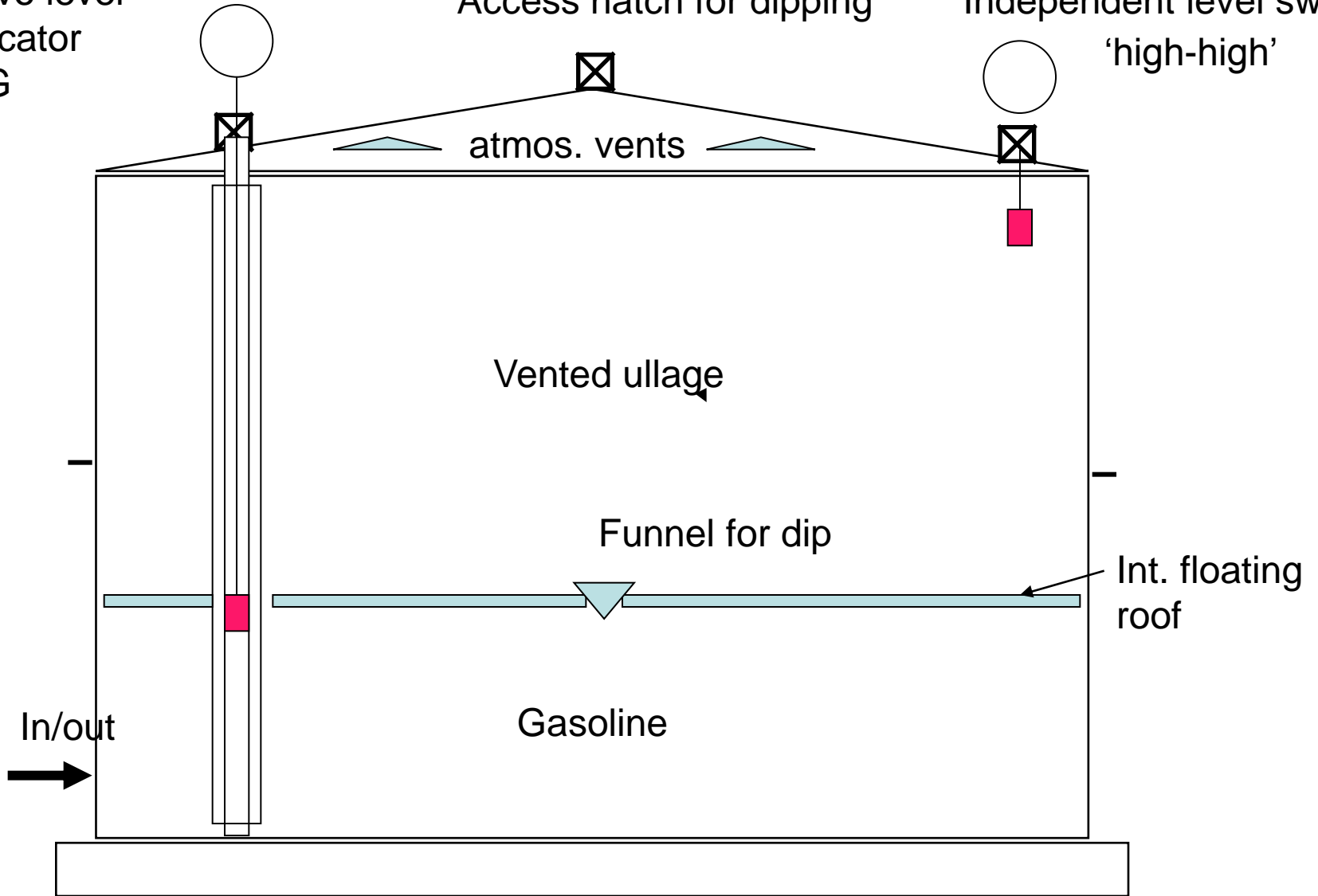
1) Fuel cascaded down the tank and formed a rich fuel/air mix, which collected in dike A

2) CCTV footage showed vapour flowing out of dike A from 0538. The cloud was initially about 1m deep, but thickened to 2m.

Servo level  
Indicator  
ATG

Access hatch for dipping

Independent level switch  
'high-high'



**T912**

# Preventing another 'Buncefield'

- The Buncefield accident has been described as the biggest fire in Europe since the Second World War.
- The 'fall out' from the event and the requirements specified in the various reports produced by:
  - the Major Incident Investigation Board (MIIB) and
  - the Buncefield Standards Technical Group (BSTG) has included a focus on the application of LOPA to facilities of the Buncefield type.
  - Process Safety Leadership Group

**Disaster struck early in the morning of Sunday 11 December 2005 as unleaded motor fuel was being pumped into storage tank 912, in the north west corner of the site. Safeguards on the tank failed and none of the staff on duty realised its capacity had been reached.**

**By 0520 GMT, investigators believe, the tank was overflowing:**

**Overflow occurred at between 500 and 900 M3 for about 40 minutes**

11 0. 65 2160  
11 12 2005  
5:30:29 AM

11 12 2005 SUN  
PLAY

5:30:29 AM  
Pause



1



110.65 HIGB  
12 2005  
5:45:39 AM

11 12 2005 SUN  
PLAY

5:45 ~ ~ ~  
Pause



110.63 HIGH 2005  
5:53:43 AM

11 12 2005 SUN 5:53:43 AM  
PLAY Pause

1

Track 1

110.65 HIGH 2005  
5:36:00 AM

11 12 2005 SUN  
PLAY

5:36:00 AM  
Pause



Tower 8

110.65 HIGH 2005  
5:51:00 AM

11 12 2005 SUN  
PLAY

5:51:00 AM  
Pause



8

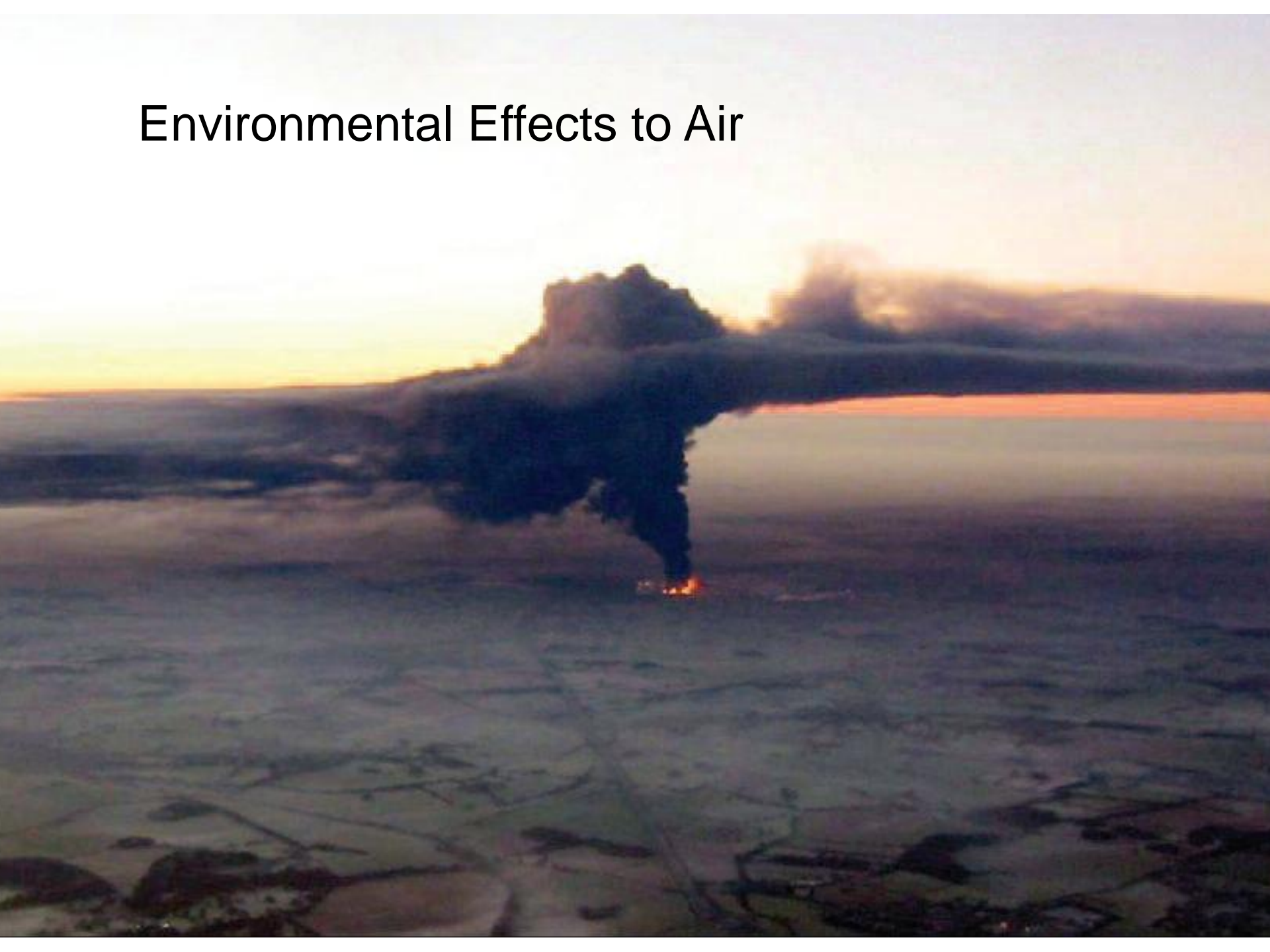
Tower 8

At 0601, with the vapour cloud cloaked over a large area and reaching buildings next to the site, the first explosion occurred.

The Vapour Cloud was 250,000 cubic metres in size.



# Environmental Effects to Air



Explosion overpressure effects on neighbour buildings  
– Safety implications!





# Environmental effects to ground



# Some key issues

- Top tier 'Seveso' establishment
- Risks previously modelled on:
  - Smaller releases
  - less severe effects (fire)
  - Assumptions on causes and protective measures
- Approximately 30 other terminals in U.K. and many more in Europe
- Lessons need to be applied here and to other sectors of our industries to...
- Overflow prevention
- Emergency Response
- Land Use Planning

# Outcomes

- Final Report and recommendations
  - Tank and containment design
  - Risk Assessment
    - Layer of Protection Analysis recommended
  - Overflow prevention
    - For filling from Pipelines most assessments indicate a need for SIL 2 protection (ref International Electrotechnical Commission standard IEC 61511)
    - For filling from trucks or ship compartments SIL 1 or 2
  - Emergency Planning
  - Land Use Planning changes
- Prosecution of owners, maintenance company and suppliers of level switch

# The main lessons from History

- Buncefield and other overflow events:
  - Keep it in the tank!
  - Don't overflow to roof
  - Large vapour clouds behave in unexpected ways
  - Some materials likely to produce dangerous levels of vapour
    - Gasoline, Naphtha etc...
  - Some materials not prone to produce dangerous vapours
    - Kerosene, Diesel
  - Secondary containment will not survive a prolonged fire event
  - It takes years for all the facts to be known
- Vapour spaces are always a danger
  - Particularly when tanks are via the vapour space (Balance, connected for Environmental requirements)



# Thank You

## The Buncefield (U.K.) accident

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