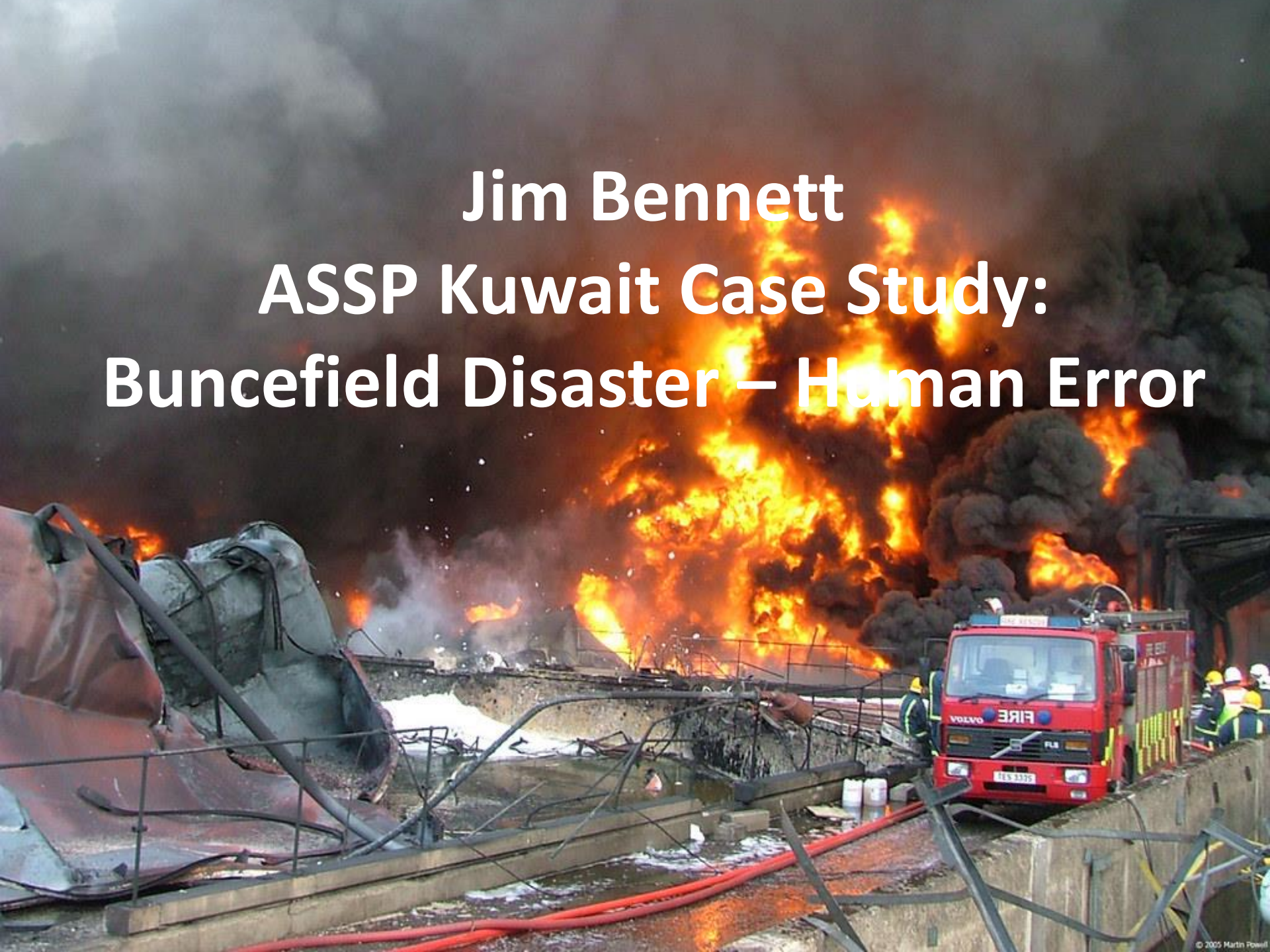

Jim Bennett
ASSP Kuwait Case Study:
Buncefield Disaster – Human Error
VOLVO
FIRE
© 2005 Martin Powell

Buncefield Disaster 11th Dec 2005

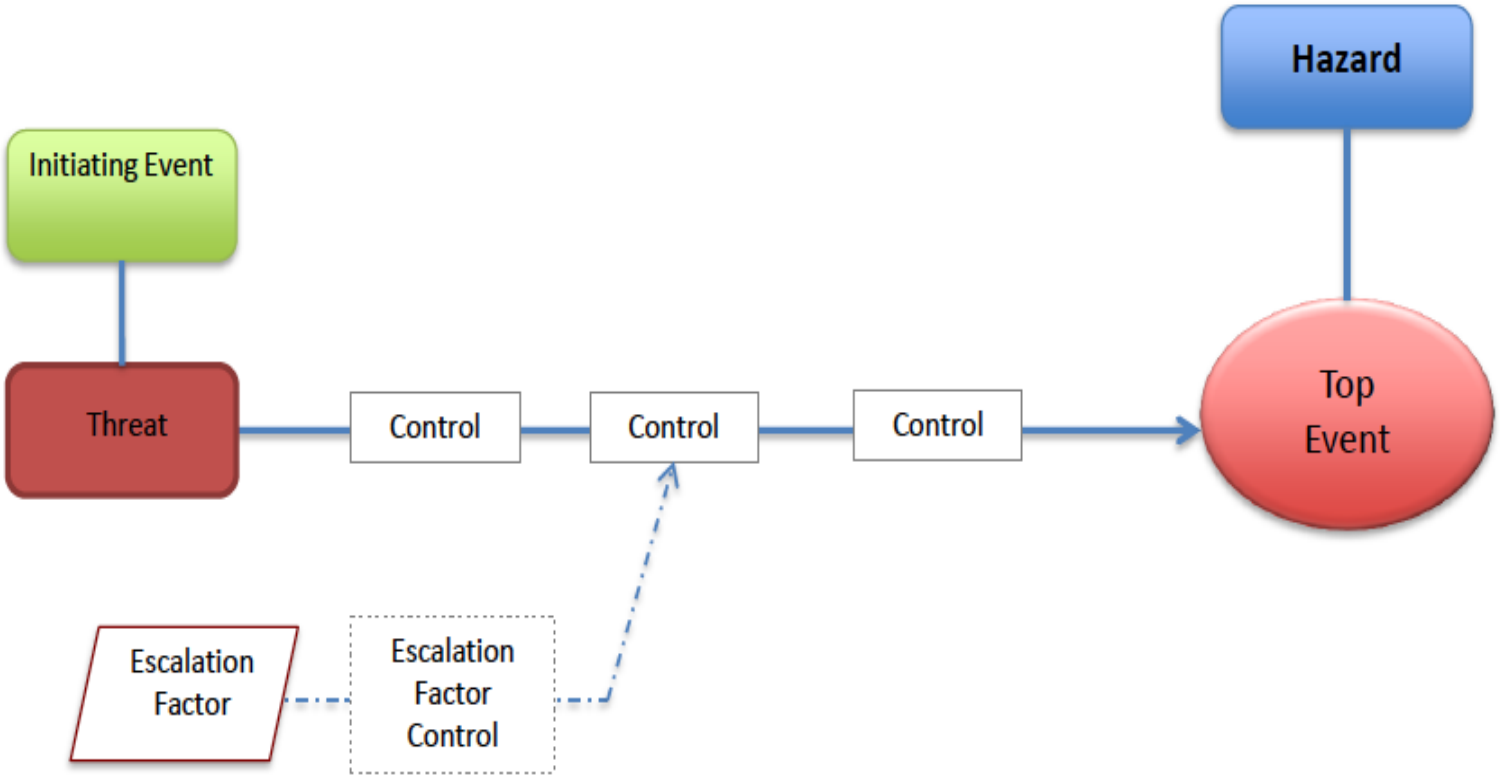
- Sat 10 Dec, 18:50
  - Receipt of parcel of unleaded fuel initiated into tank 912
- Sunday 11 Dec, 05:37
  - Tank capacity exceeded. Fuel began to spill
- 06:00
  - Vapour cloud ignited
  - 250,000l fuel
- Fire burned for 5 days
  - 0 Fatalities
  - 40 injuries
  - Major economic and social disturbance

Why did it happen?

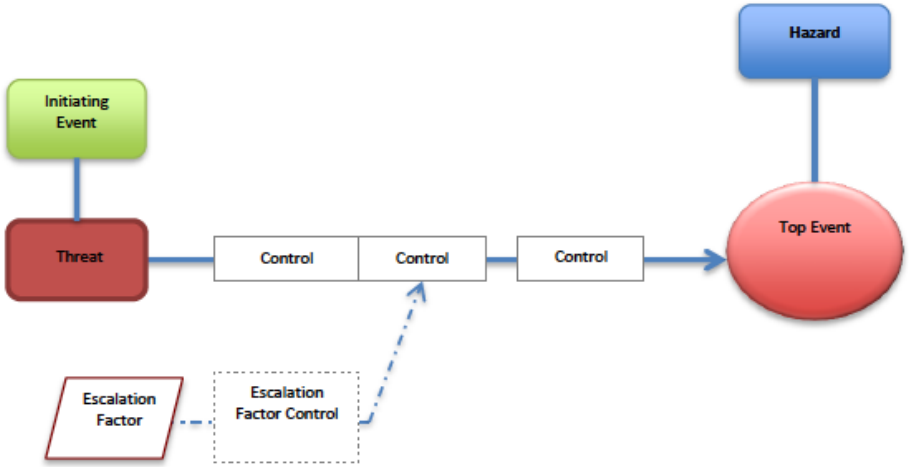
1. Failure of automatic tank gauging system
2. Failure of independent high-level switch


Engulfed 23 large storage tanks
2000 people evacuated
Fire burned for 5 days
Large plume dispersed
over southern England
Tank 912

Basic Concepts in Bow-Tie Analysis



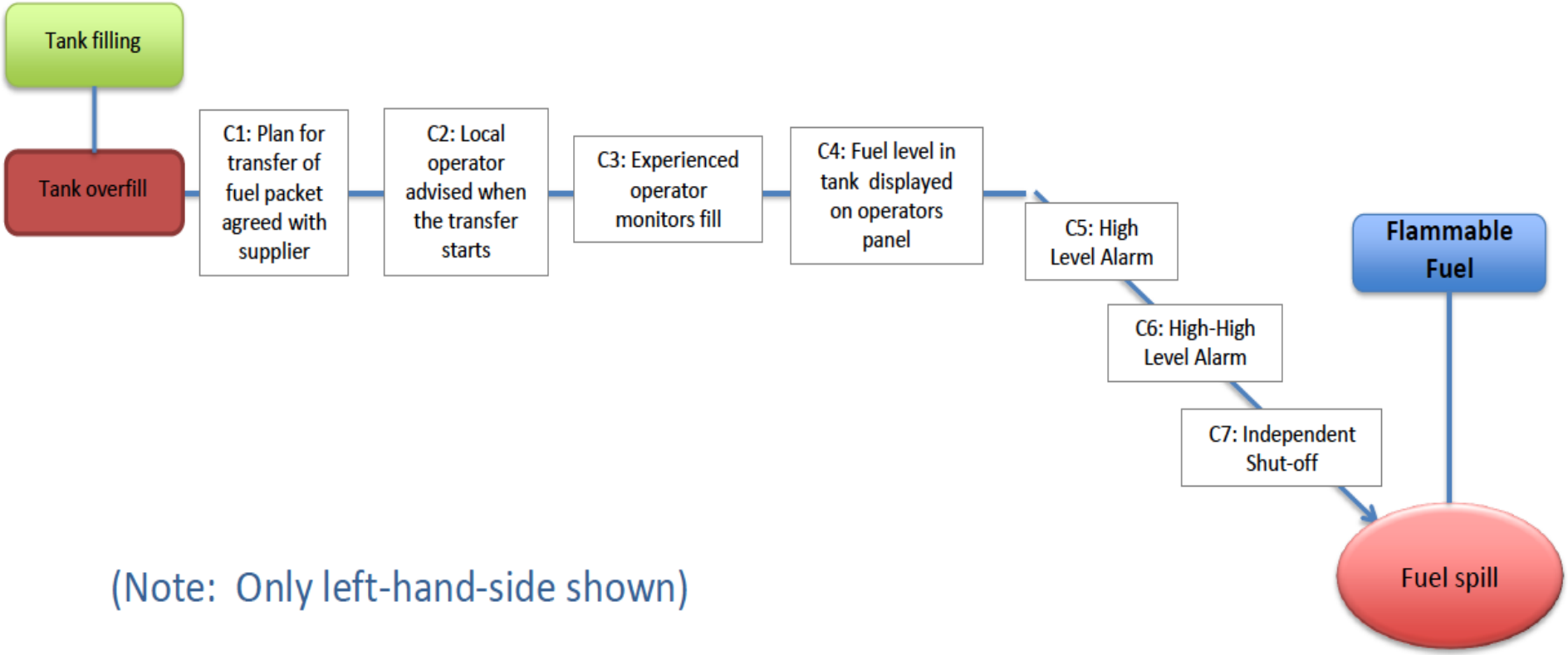
Other Outputs from Bow-Tie Analysis



- **Critical Equipment**
  - Physical structures or equipment that support a control.
- **Critical Activities**
  - Human tasks necessary to assure the integrity of structural or equipment controls.
- **Critical Positions**
  - Roles responsible for the performance of Critical Activities.

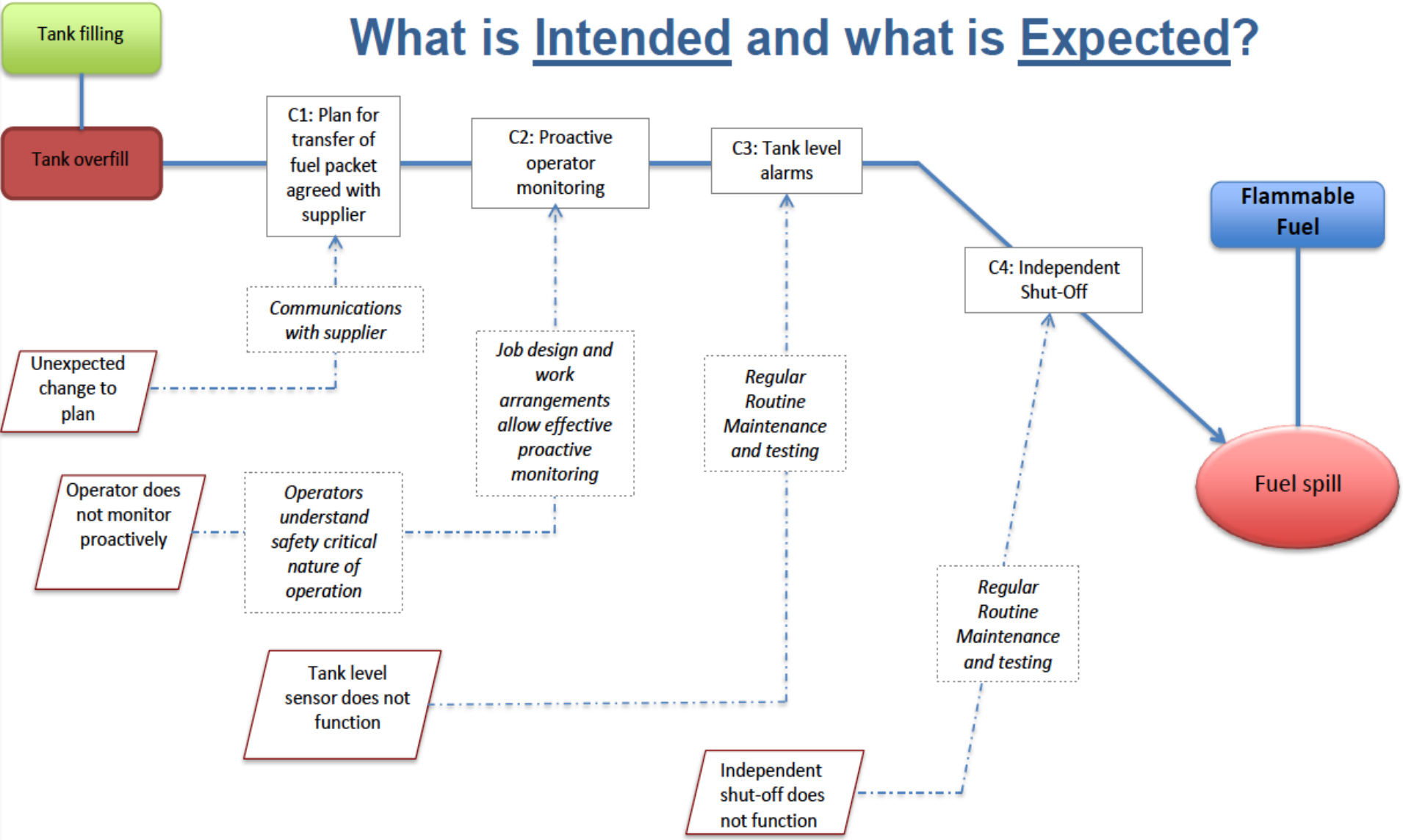
A Hypothetical Bow-Tie

Top Event = Spill of flammable fuel during tank filling

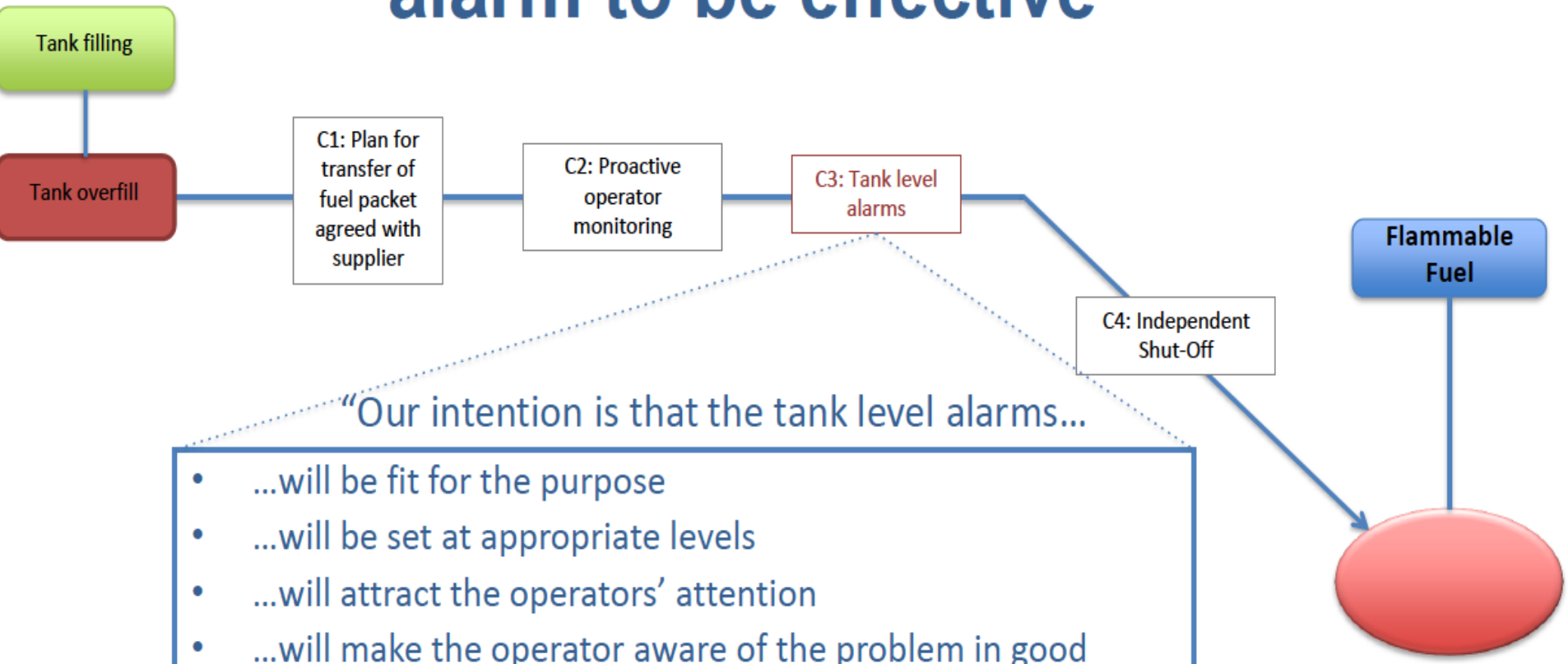


(Note: Only left-hand-side shown)

What are the Controls?



Examples of Intentions for a tank level alarm to be effective



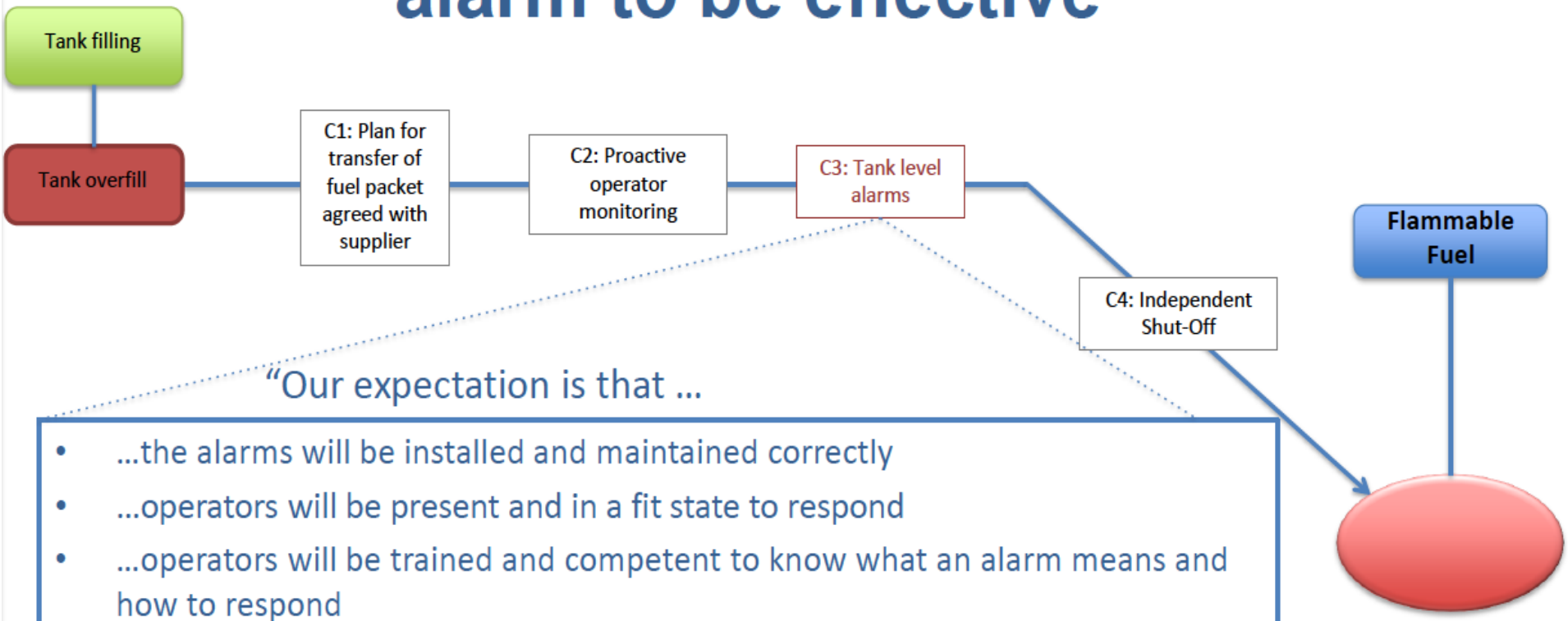
"Our intention is that the tank level alarms...

- ...will be fit for the purpose
- ...will be set at appropriate levels
- ...will attract the operators' attention
- ...will make the operator aware of the problem in good time...
- ...

And that

- ...operators will know if the alarm is not working...
- ...

Example of Expectations for a tank level alarm to be effective



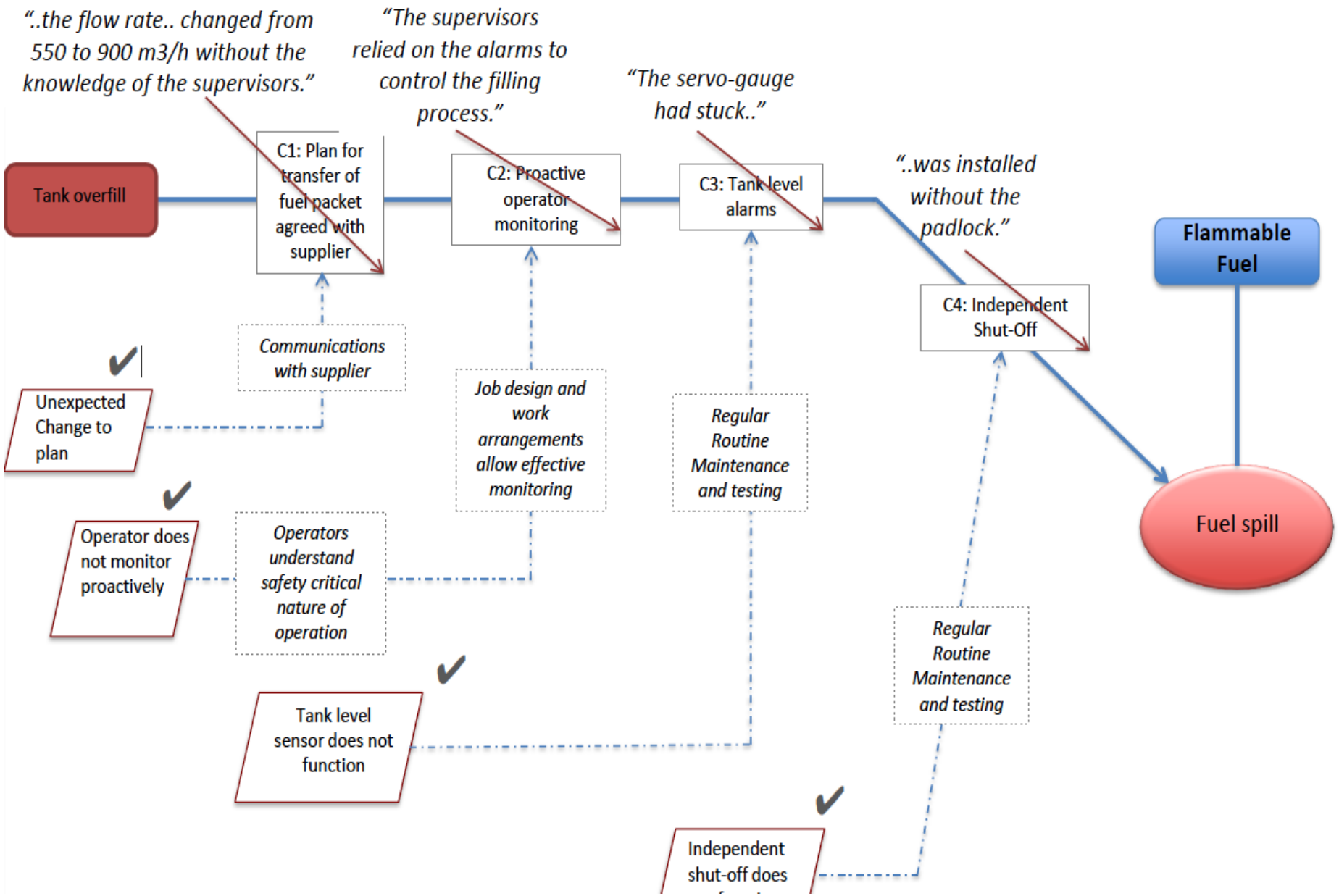
"Our expectation is that …

- …the alarms will be installed and maintained correctly
- …operators will be present and in a fit state to respond
- …operators will be trained and competent to know what an alarm means and how to respond
- …operators will do what is needed in time…

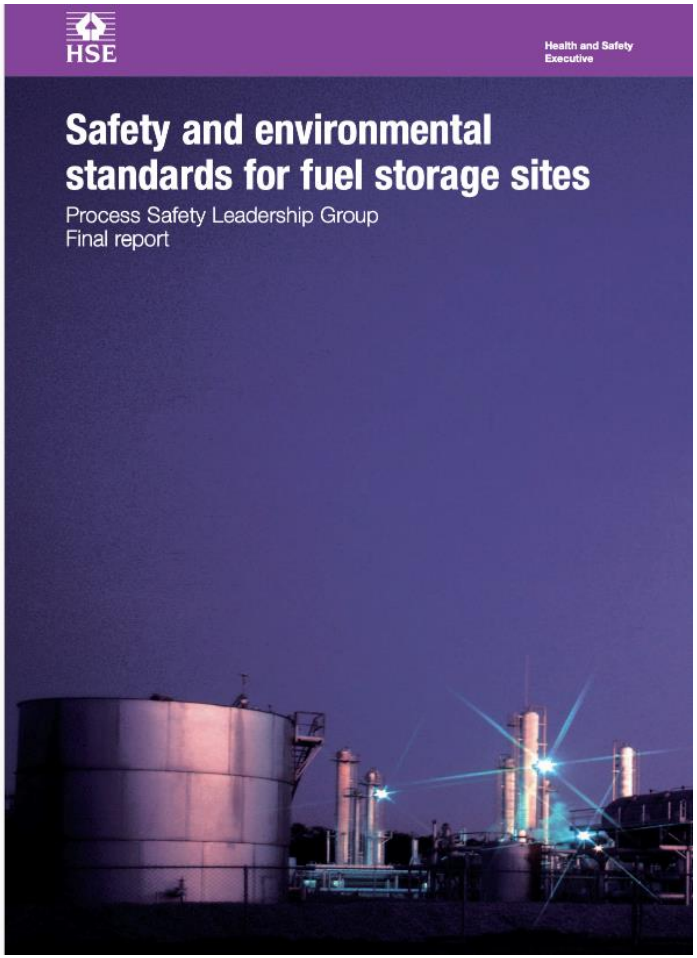
And that

- …operators will report known faults
- …reported faults will be fixed
- ..operators will not initiate a fuel transfer if the alarm system is not working…

What happened at Buncefield?



Human Factors Engineering



- Systematic assessment of safety integrity level requirements
- Protecting against loss of primary containment using high integrity systems
- Engineering against escalation of loss of primary containment.
- Engineering against loss of secondary and tertiary containment
- Operating with high reliability organizations
- Delivering high performance through culture and leadership

Smoke Plume Impacting London


Major Accident:
Grenfell Tower
Fire - 14.6.2017
72 fatalit

Major Accident Process Safety Principles to our Built Environment

UK Building Safety Bill CP 264