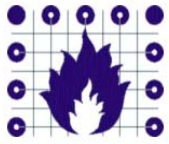


R e s o u r c e
P r o t e c t i o n
I n t e r n a t i o n a l

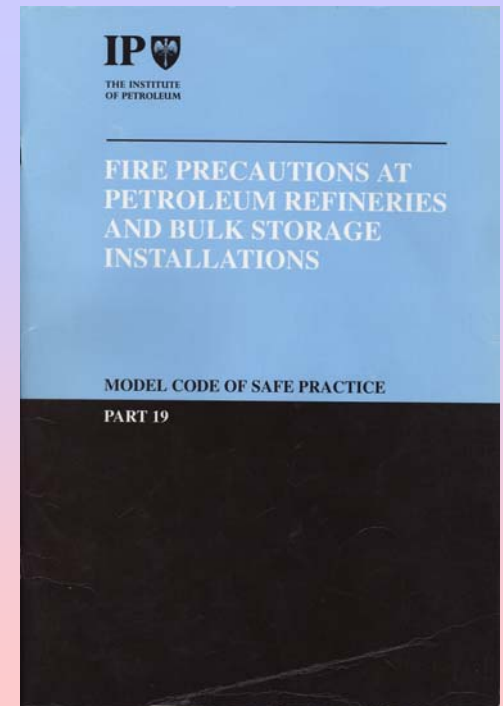
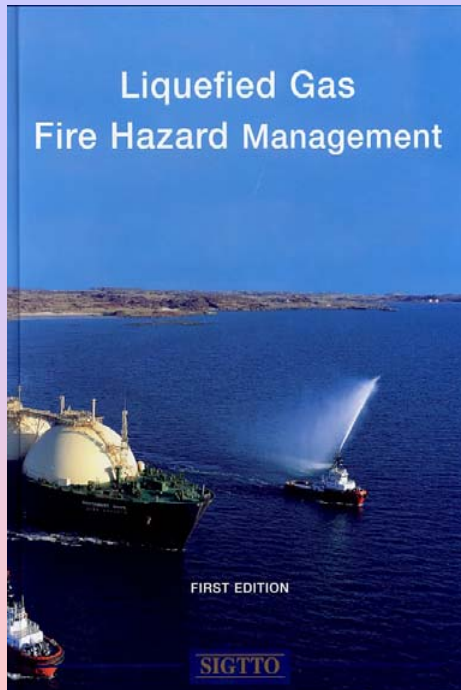


**Resource
Protection
International**

Independent Fire Hazard Management Consultants



Industry standards



Initially at Gold Command Escorted to Bronze

Foam – minimum requirements
Foam sources
Foam application





Large Atmospheric Storage Tank Fires





An industry consortium of international oil companies reviewing risks associated with storage tank fires



NESTE OIL

PETRONAS



ارامكو السعودية
Saudi Aramco



تكرير
TAKREER
شركة أبوظبي لتكرير النفط





Objectives of original study

- Determine current levels of risk
- Establish Design & Operational Practice & make knowledge available throughout industry
- Establish techniques to determine site- specific levels of risk and identify appropriate & cost-effective risk reduction measures



Objectives of update study

**To continue LASTFIRE's role as
the established recognised
international oil companies forum
on best practices of
Fire Hazard Management
of Storage Tanks**

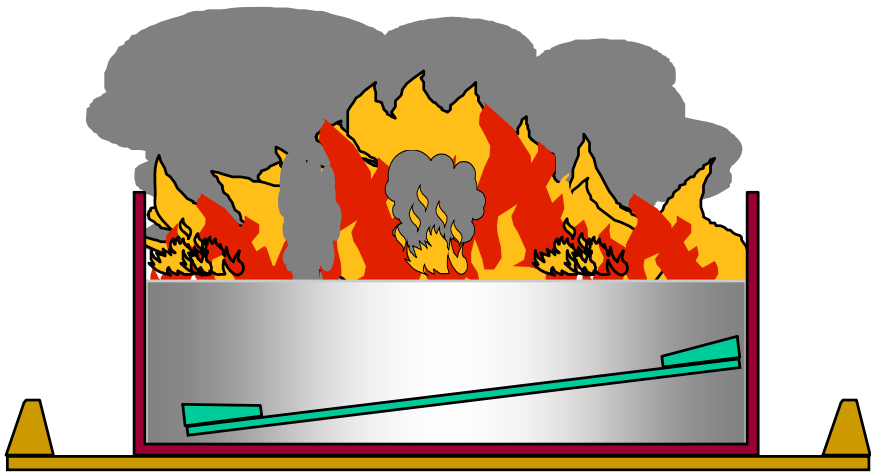


Scope

- **Review of incidents**
 - Update database on open top floaters
 - Extend database to fixed roof and internal floaters
- **Assess current practices and latest developments in risk reduction measures**
 - Detection systems
 - Foam systems
 - Major incident response systems
 - Tank / seal constructions
- **Practical research**
 - Boilovers
 - Vapour measurement in internal floating roof tanks
- **Become industry focal point / forum**

Tank Fire

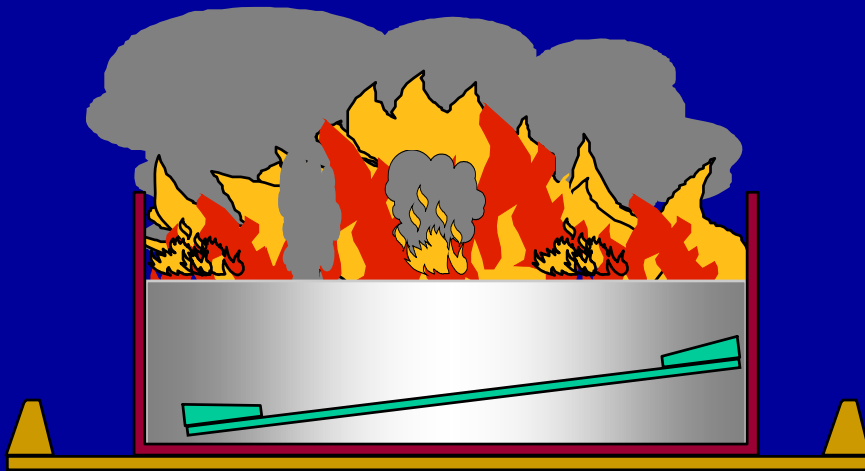
Foam Application Options



**FIRE
AND
EXPLOSION
HAZARD
MANAGEMENT**

Tank Fire

Foam Application Options



Do you want to
put it out?

Full Surface Fire Response



Pump-out and Controlled Burndown

Pump-out and Controlled Burndown

Example

- Shell, New Jersey

Note:

Cooling monitors only



Note tank height!!!



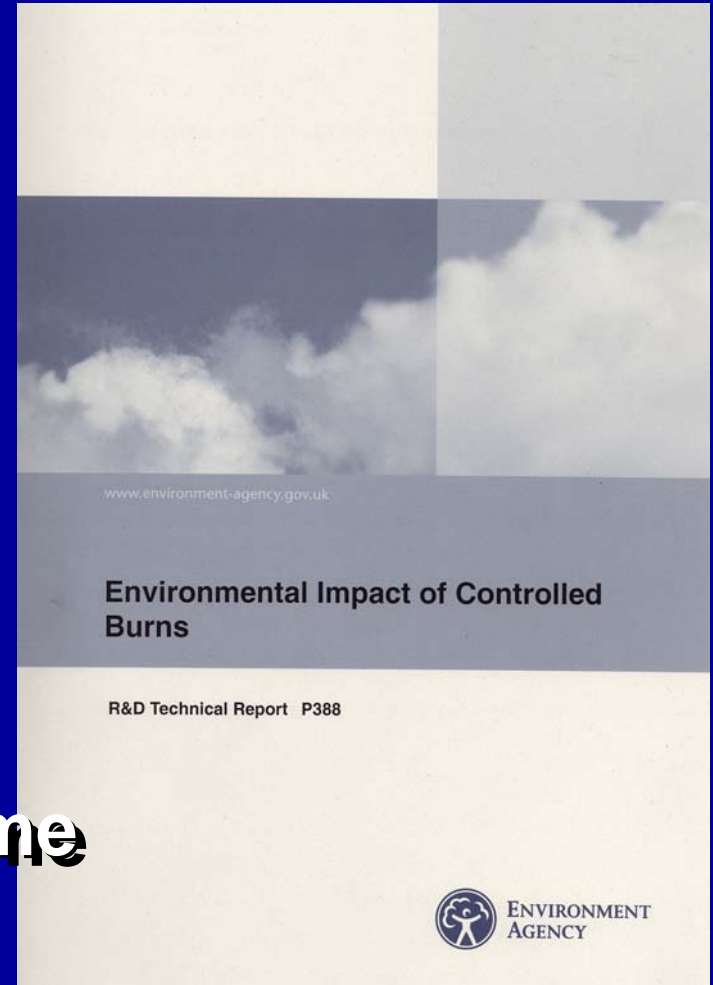
Pump-out and Controlled Burndown Considerations

- **Smoke**

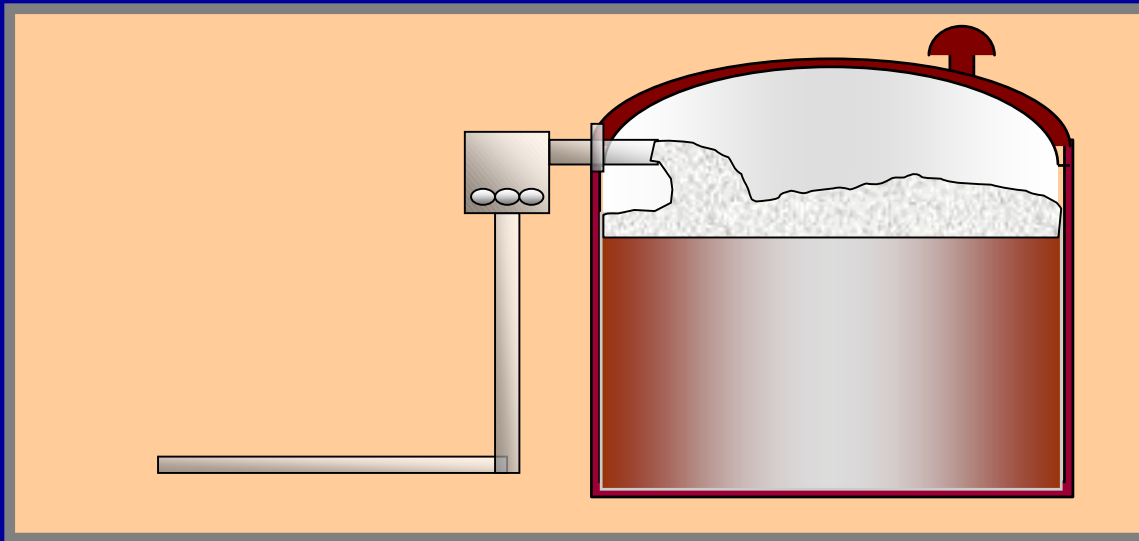


Pump-out and Controlled Burndown Considerations

- **Smoke**
- **Public Image**
- **Incident Duration**
- **Pump out capability**
 - **Spare tankage**
 - **Flow rates**
- **Exposure Protection**
 - **Requirements vary with time**
- **Boilover Potential**
- **Prior Acceptance by Authorities**

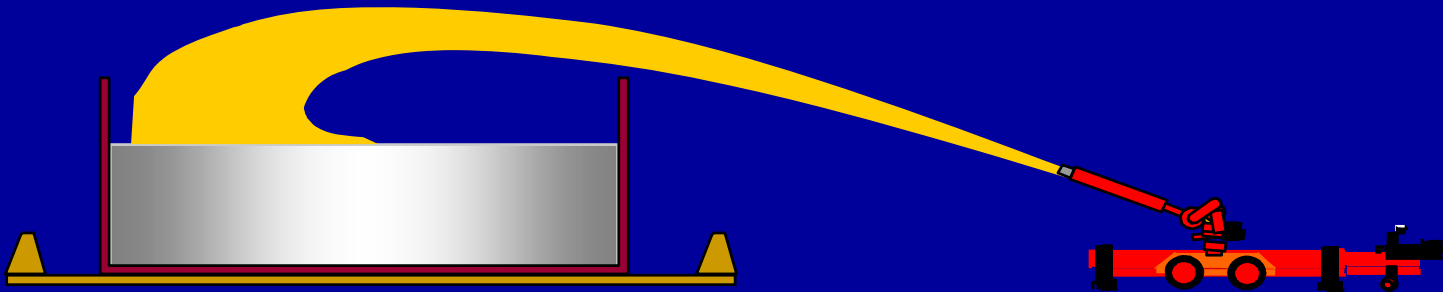


Tank Fire Foam Application Options



Systems

Monitors



Full Surface Fire Response



Full Surface Foam System

Full Surface Foam System

Example

- **OMV, Austria**

Full Surface Foam System

Considerations

- **Manning Exposure Minimised**
- **Response Time Minimised**
- **Cost**
- **System Maintenance / Testing**
- **Reduced Flow Rates**
- **Foam Flow Issues if Tank > 60m**

Full Surface Fire Response



Monitor Application

Monitor Attack

Small tanks (NFPA <~10m)
Can use handlines





Monitor Attack

Examples

- Sunoco, Sarnia, Canada
- Orion, USA

Monitor attack started

 LIVE



skyVISION

NEWS CHOPPER 



Norco Fire, June 2001



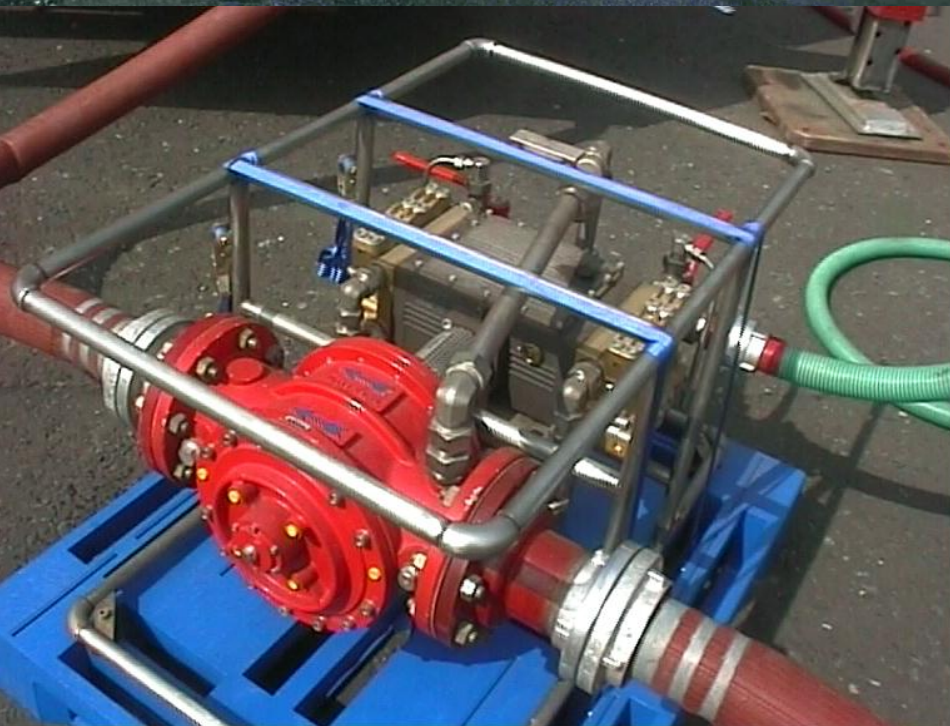
83m diameter
Gasoline with MTBE
Fire



General industry trend:
Response shifting to large capacity monitors



A designed, well engineered package
Not just an item of equipment!





Typical Russian equipment



Tank Fire Exercise and Demonstration



First involvement?

What did I think about the plan to ignite a 40m diameter tank in the middle of an operating refinery and adjacent to other “live” tanks?

“I don’t know whether you are brave or crazy”

Test Parameters



Tank Diameter	42 m
Surface Area	1385 m ²
Total application rate	~10,000 lpm
Solution rate	7.2 lpm/m ²
EN* rate for tank fire	10 lpm/m ²
EN* Run time	60 mins

*Draft and dependent on foam quality



Comparison with real incident

	Test	Incident
Preburn	2-3mins	~hours
Fuel Depth	~30mm	~metres
Response Time	Immediate	~hours
Fuel	Diesel	Crude?

Care required with drawing too many direct conclusions

However... Valuable lessons to learn!!

Deployment logistics

Large water flow requirement

Foam flow (100 lpm if 1%)

Radiant heat



Test



Incident 2004

2004

However... Valuable lessons to learn!!

Deployment logistics

Large water flow requirement

Foam flow (100 lpm if 1%)

Radiant heat

Monitor throw/height

Smoke plume

It is possible!!!

Good planning

Good equipment

Good training

Competent personnel

Crude? Maybe time dependent



Monitor Attack

**Scenes
from
commissioning trials**

The background image is a faded, low-resolution photograph of an industrial or construction site. In the foreground, a yellow forklift is visible, positioned on a flat surface. Behind it, there are various industrial structures, including a large cylindrical tank on the left and a multi-story building with a tiled roof in the center. The overall scene is dimly lit, suggesting an overcast day or a shaded area.



7 16:56





5 3:23



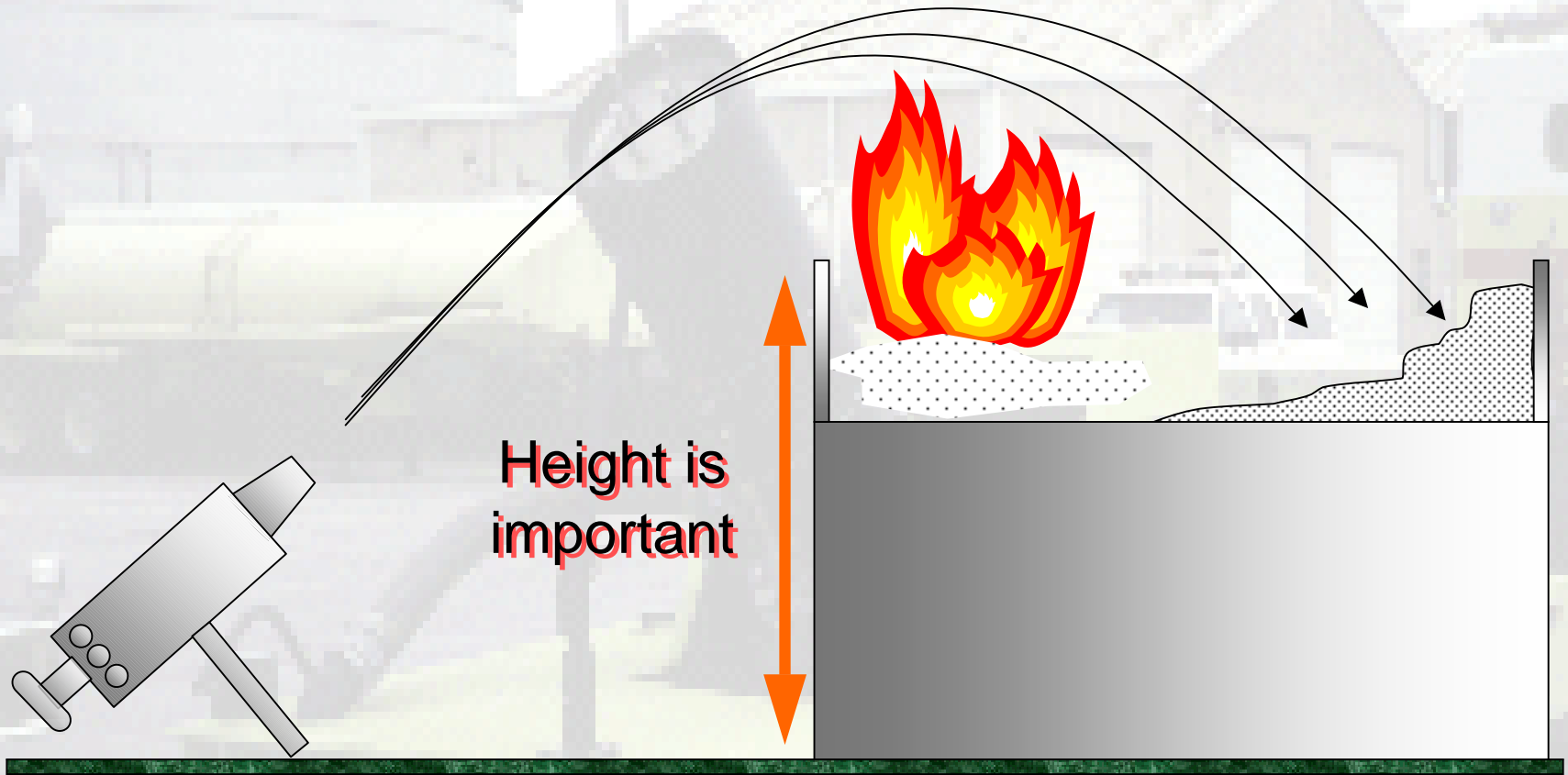
7 17:18



7 17:18



Monitor Application



Beware of range claims!





Monitor Application - Considerations

- **Tank Size**

- **NFPA Standards suggest 20m max (EN will go to 60m+)**
- **Much more possible in practice**

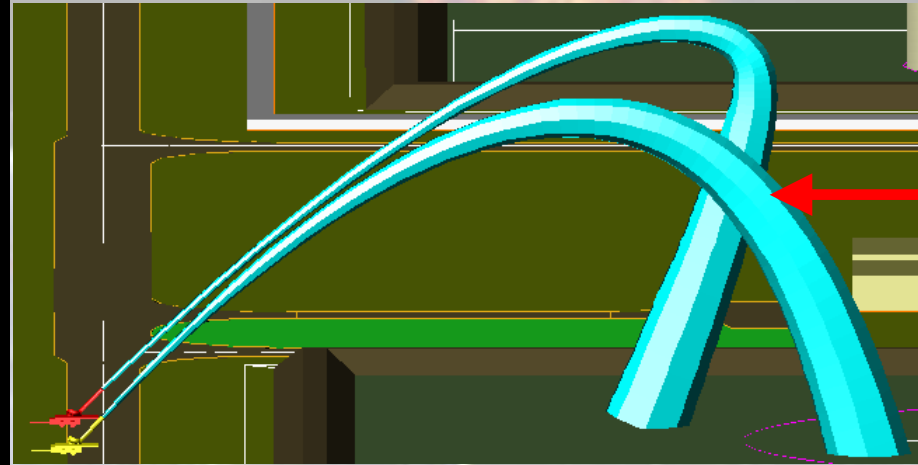
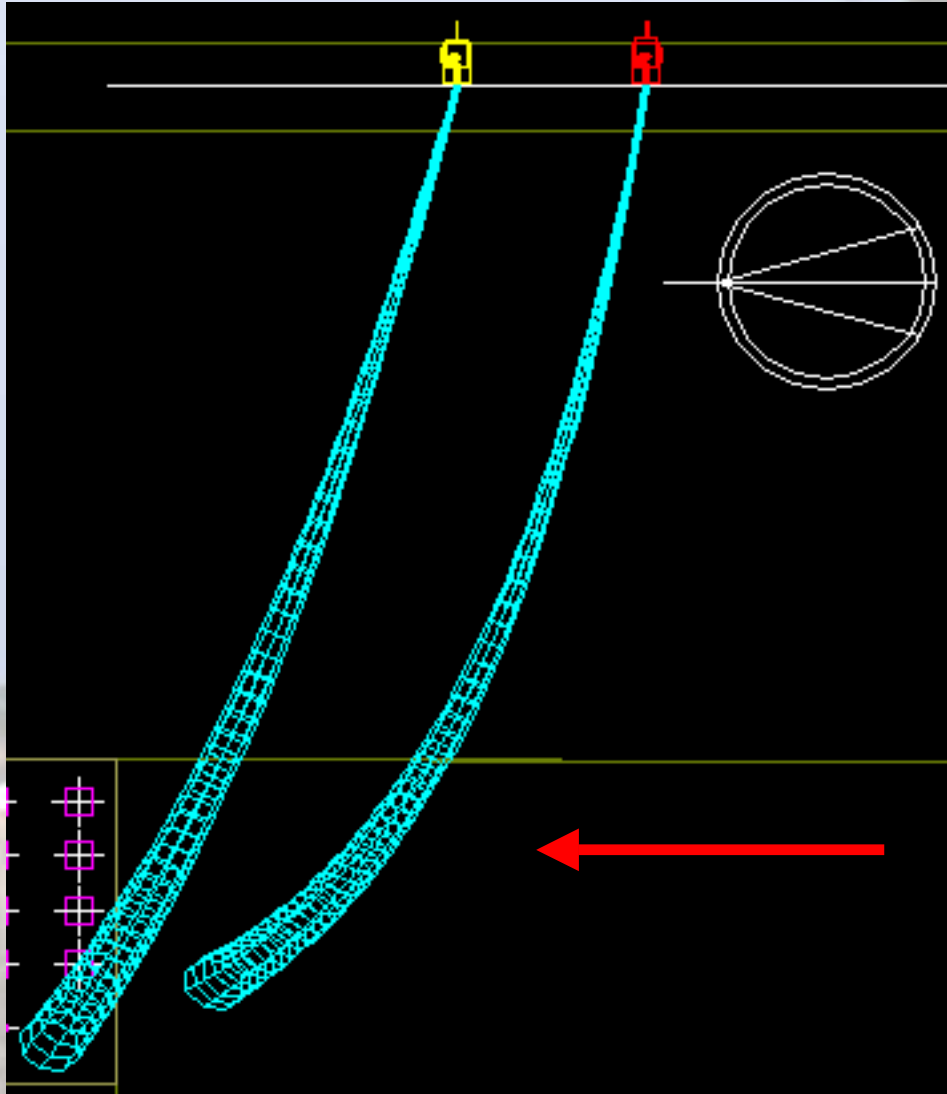
- **Manning Levels**

- **Large tank incidents involve >100 people**

- **Stream Range / Height**

- **Bund access may be required**
- **Wind direction / strength**

Monitor Application - Considerations



Monitor Application - Considerations

- **Tank Size**

- **NFPA Standards suggest 20m max (EN will go to 60m+)**
- **Much more possible in practice**

- **Manning Levels**

- **Large tank incidents involve >100 people**

- **Stream Range / Height**

- **Bund access may be required**
- **Wind direction / strength**

- **Logistics**

- **Foam supply** (1800 lpm for 60000 monitor)
- **Water supply**

Monitor Application - Considerations



Monitor Application - Considerations



Monitor Application - Considerations



Monitor Application - Considerations



Monitor Application - Considerations



Monitor Application - Considerations

- **Foam Losses**

- **Up to 60%**

