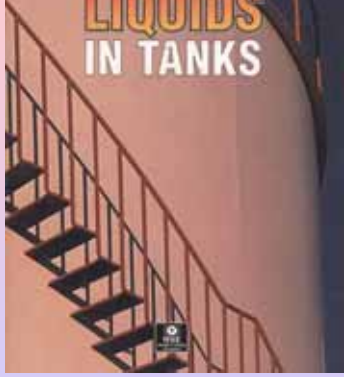


THE STORAGE OF
FLAMMABLE
LIQUIDS
IN TANKS



Risk Assessment



Legislation

Risk based!

RISK

=

PROBABILITY x **CONSEQUENCES**

REDUCED PROBABILITY *OR* CONSEQUENCES

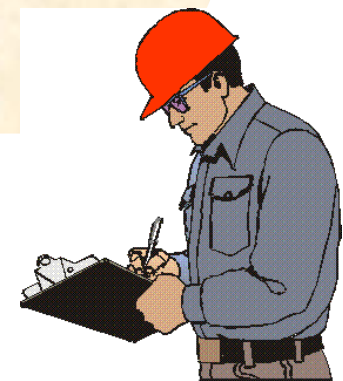


REDUCED RISK

FIRE AND EXPLOSION HAZARD MANAGEMENT



**OPERATOR NEEDS
*COST EFFECTIVE,
JUSTIFIED FEHM
ACCORDING TO
RISK***



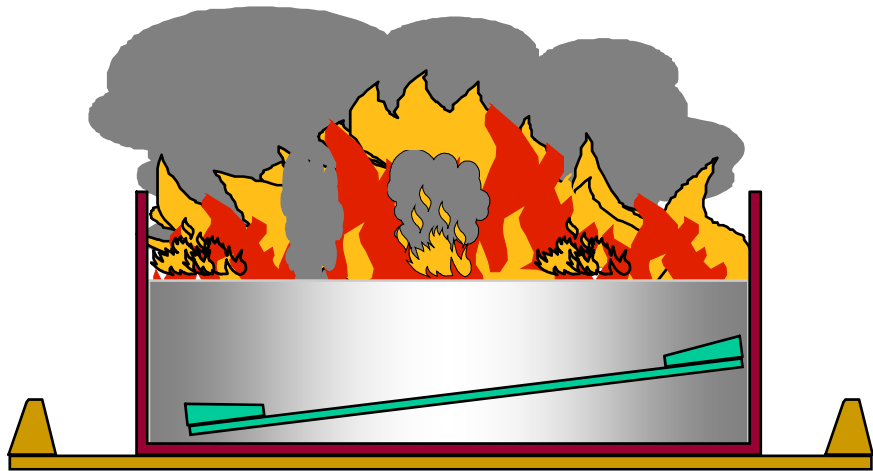
FIRE AND EXPLOSION HAZARD MANAGEMENT

LEGISLATOR AND
OPERATOR
BOTH *RISK* BASED



NO CONFLICT!

Tank Fire Response Options



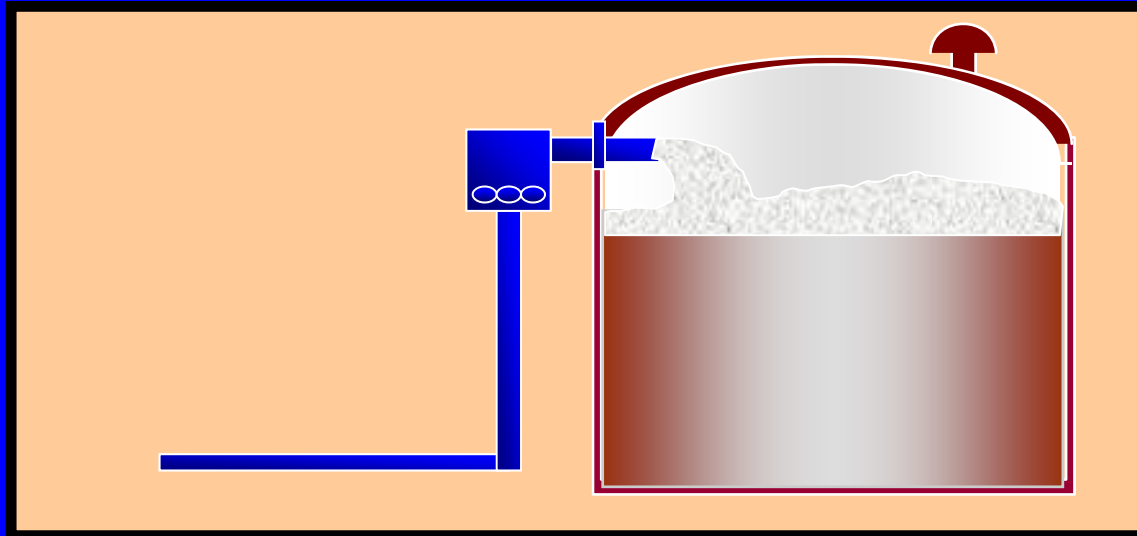
Do you want to
put it out?

Full Surface Fire Response



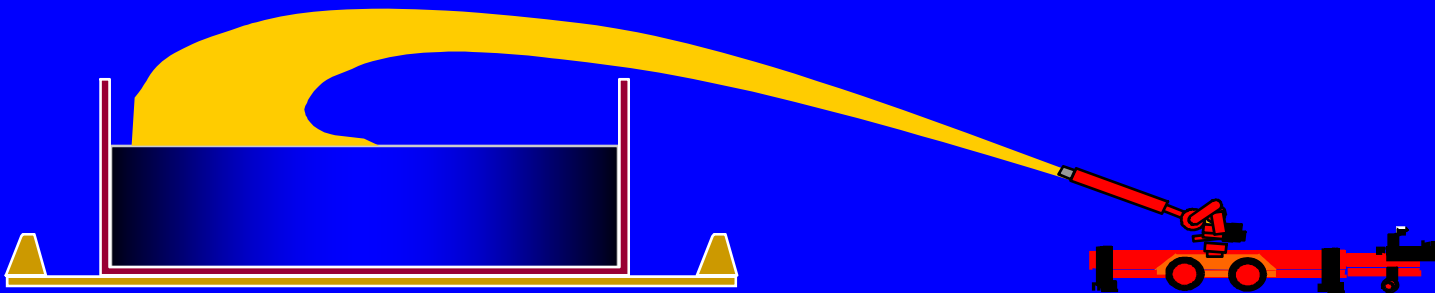
Pump-out and Controlled Burndown

Tank Fire Foam Application Options



Systems

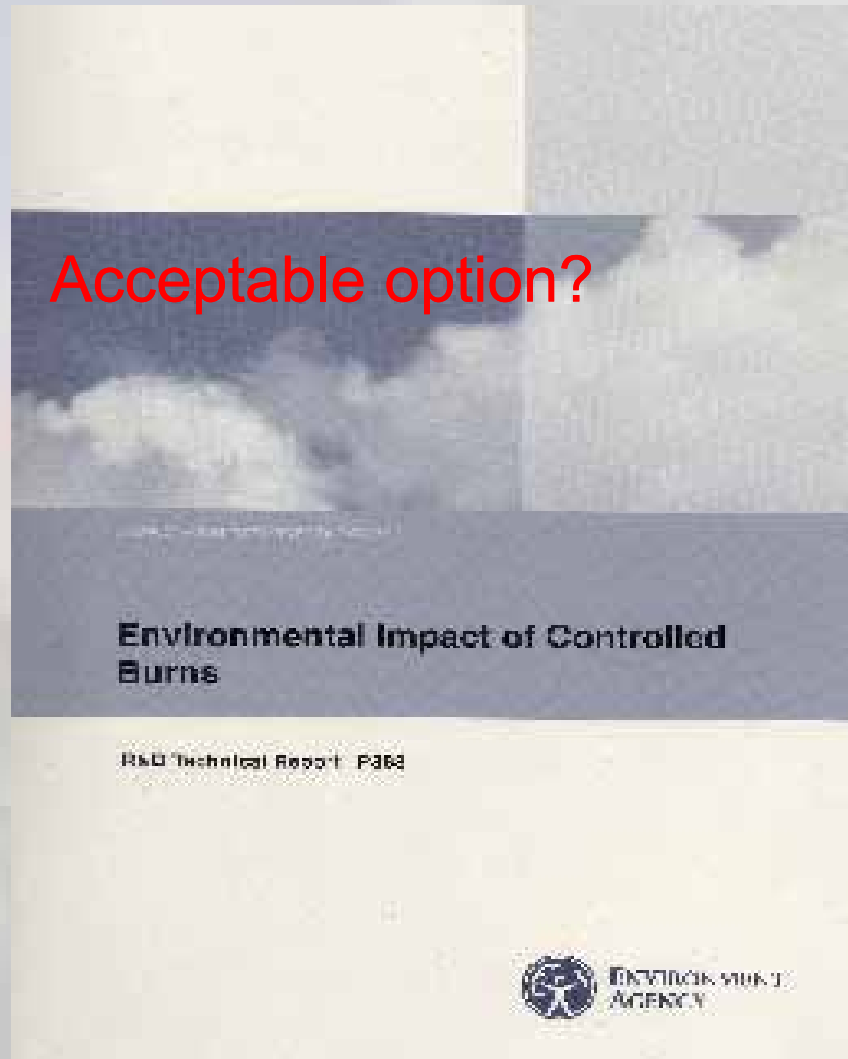
Monitors



Full Surface Fire Response



Full Surface Foam System

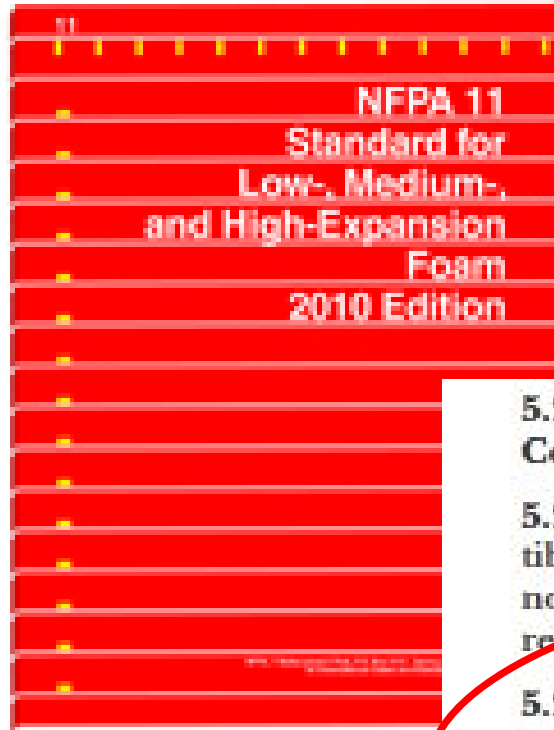


Burndown Policy

e.g. Tank fires
but
Public concern
Incident duration

A blurred background image of a landscape with a rainbow in the sky. The text "Special Ethanol Issues" is overlaid in red.

Special Ethanol Issues



Not fully definitive

5.2.5.3* Design Criteria for Tanks Containing Flammable and Combustible Liquids Requiring Alcohol-Resistant Foams.

5.2.5.3.1 Water-soluble and certain flammable and combustible liquids and polar solvents that are destructive to nonalcohol-resistant foams shall require the use of alcohol-resistant foams.

5.2.5.3.2* In all cases, the manufacturers of the foam concentrate and the foam-making equipment shall be consulted as to limitations and for recommendations based on listings or specific fire tests.

5.2.5.3.3 Fixed-roof (cone) tanks shall be provided with approved fixed foam discharge outlets as indicated in Table 5.2.5.2.1.

5.2.5.3.4 Minimum Discharge Times and Application Rates. Minimum discharge times and application rates for fixed-roof (cone) tanks containing flammable and combustible liquids requiring alcohol-resistant foams shall be in accordance with Table 5.2.5.3.4.

Energy Institute Guidance on Ethanol



Chapter 8 - Firefighting

Guidance for the storage and
handling of fuel grade ethanol
at petroleum distribution installations

<http://www.energyinstpubs.org.uk>

CHAPTER 8 – FIRE FIGHTING

8.1 – GENERAL

- **Ethanol compared with gasoline**
- **Vapour behaviour**
- **Fire Properties**
- **Properties of ethanol that require additional considerations**

8.2 – FLAME VISIBILITY

- **Clean flame**
- **Flame virtually invisible to firefighters.**
- **Important that firefighters are made aware of this**
- **Thermal imaging cameras have been successfully used by firefighters to gain a better assessment of flame size and exposed areas.**



Gasoline



Ethanol





8.3 – FIRE DETECTION

- Ethanol fires may not be detected by devices that work by detecting radiation emitted
- Conventional flame detectors may be less sensitive to ethanol fires than they are to gasoline
- Important to ensure that the detection system used is suitable for ethanol
- Seek certified data from detector manufacturers.



8.4 – FIRE FIGHTING RESPONSE

8.4.1 USING WATER

- **Dilution possible but usually impractical!**

FLASHPOINT OF ETHANOL / WATER MIXTURES

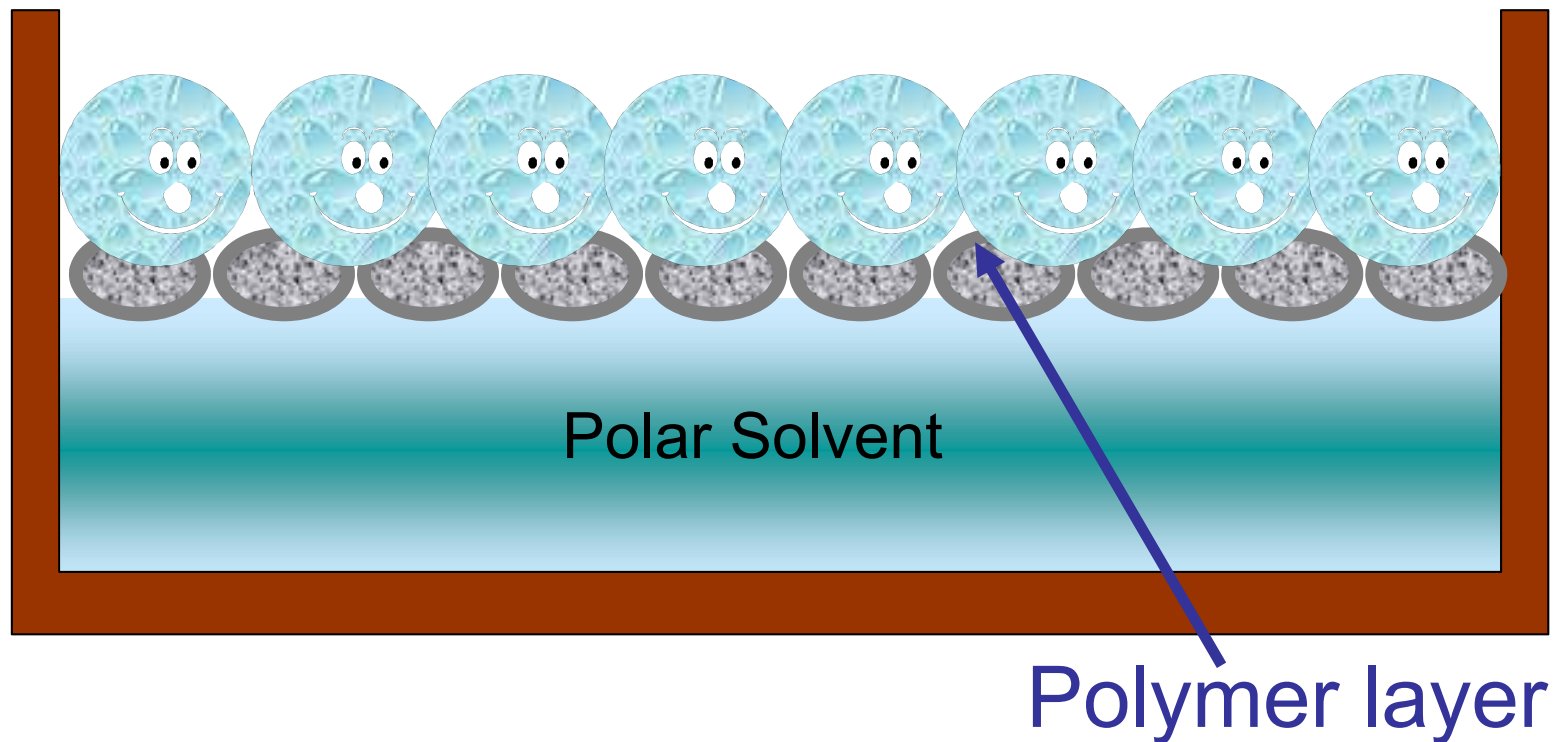
Ethanol concentration (% by volume)		5	10	20	30	40	50	60	70	80	90	96
Flashpoint	(° F)	144	120	97	84	79	75	72	70	68	63	63
	(° C)	62	49	36	29	26	24	22	21	20	17	17

8.4 – FIRE FIGHTING RESPONSE

8.4.2 USING FOAM

- >10% EtOH – need alcohol resistant “Multi Purpose” type

Multi-purpose Foam with polymer



8.5 – STORAGE TANK FOAM SYSTEMS

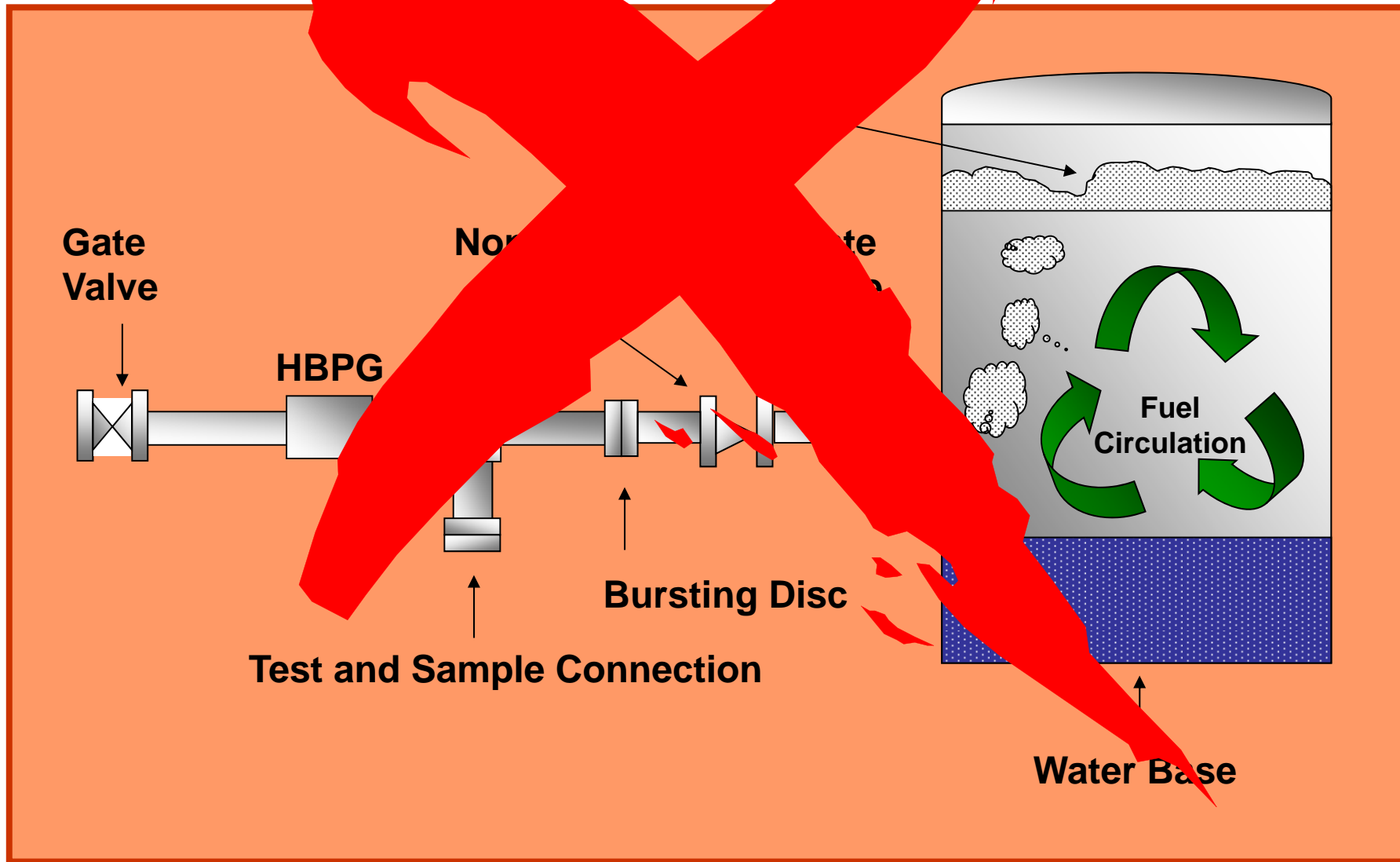
- **Foam monitors are generally inefficient method for ethanol.**
- **Subsurface applications should not be used even with alcohol resistant foam**
- **Semi-subsurface application can be used but not a preferred method.**
- **Most appropriate system is a fixed foam pourer system designed to a recognised standard**





No foam build up

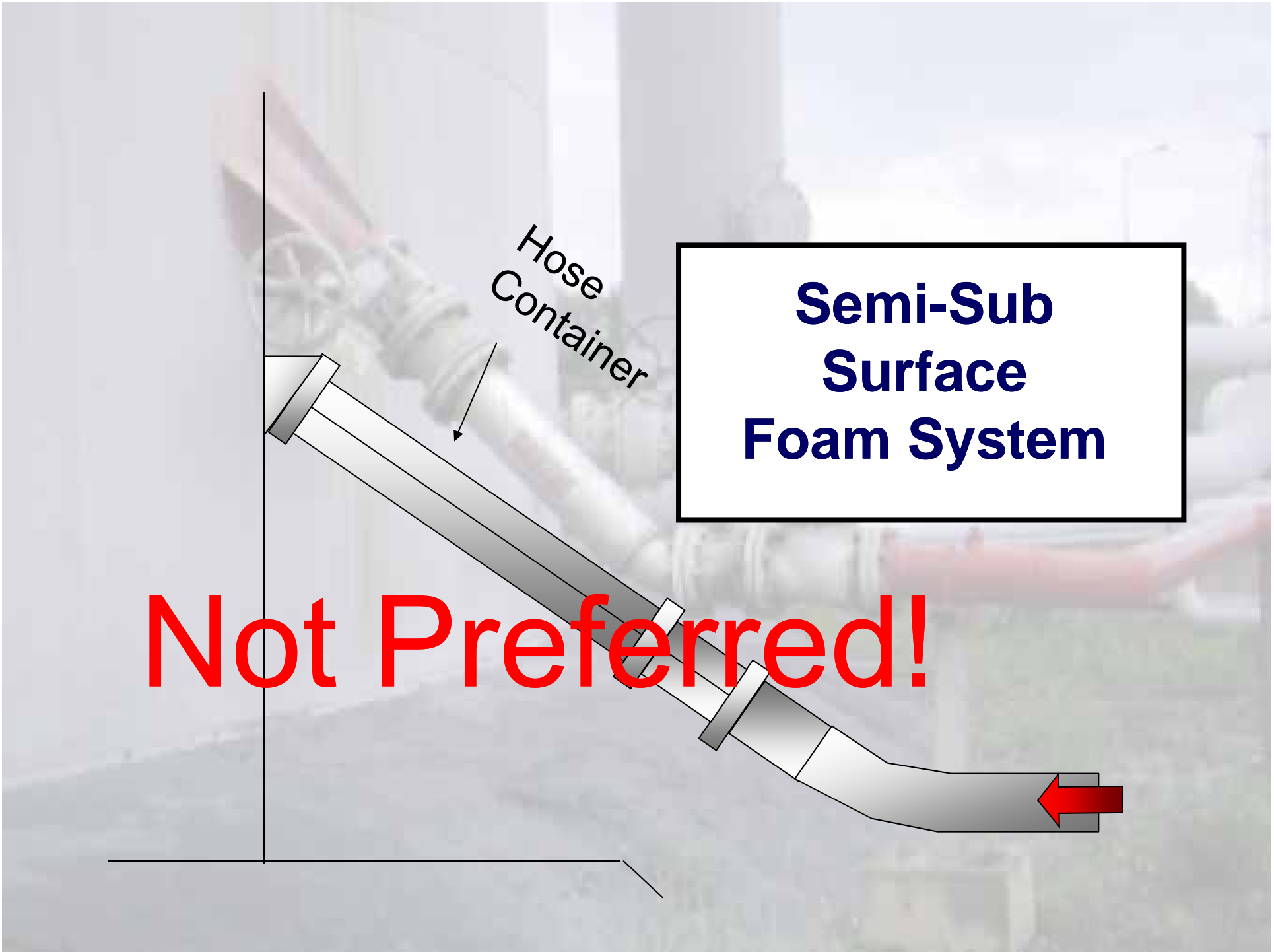
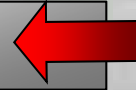
SubSurface Foam Detection



Hose
Container

**Semi-Sub
Surface
Foam System**

Not Preferred!



“The foam pourer should be a type that directs the foam against the tank wall so it runs down the inside of the tank shell and is consequently applied as gently as possible”

