

LASTFIRE
Large Atmospheric Storage Tank Fires

**Cradle to Grave
Foam Assurance
The LASTFIRE Process**

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The dilemma!

Risk based Fire Hazard Management is always a balance between cost and risk reduction achieved. Especially with tank fires – not normally a life safety issue! Increasing environmental issues

Risk factors:

- Environmental issues
- Asset loss
- Business Interruption
- Public Image

Always a balance!

Both have an environmental consequence

And other consequences of course!

Let it burn

Fire response effects including water/product run off

But now even more important!!



Certainly a lot of concern!



The LASTFIRE response

- What are we doing?
- Developing interim best practice Position Paper
- Assurance procedures
- Reviewing alternatives
- Assessing new foams



LASTFIRE Position Paper

Foam concentrate usage and options
Subjects

Response strategies





LASTFIRE Position Paper

Foam concentrate usage and options

Subjects

Response strategies
Standards/Approvals
Foam concentrate performance test



The ideal fire test!

Tends to be expensive!



The LASTFIRE Test

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LASTFIRE Position Paper

Foam concentrate usage and options

Subjects

Response strategies
Standards/Approvals
Foam concentrate performance test
Foam Types and Properties
Environmental constraints/Legislation
Environmental Data
Water Treatment/Separators Effects
Foam Concentrate Developments
Testing Systems/Equipment
Training
Changing Foam Concentrate
Public Concerns
Preplanning for Foam Usage
Contaminated Firewater Treatment
Reference Sources

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LASTFIRE Position Paper

Commitments

Ongoing monitoring
Additions to typical procurement specification
Waste water treatment effect
Research
Control and assurance

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LASTFIRE Assurance Process

- ◆ Site Specific Assurance
 - ◆ Optimise use and application
 - ◆ Get the balance right
 - ◆ “Cradle to Grave” approach
 - ◆ Containment
 - ◆ Control
 - ◆ System Assurance
 - ◆ Training
 - ◆ Disposal

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LASTFIRE Process

- ◆ Foam Assurance Protocol
 - ◆ Ten elements to address different areas
 - ◆ Key and sub questions
 - ◆ Extensive practical guidance
 - ◆ Member feedback/buy in
 - ◆ Red, Amber, Green ranking
 - ◆ Self audit or Third Party
 - ◆ Not just applicable to tanks

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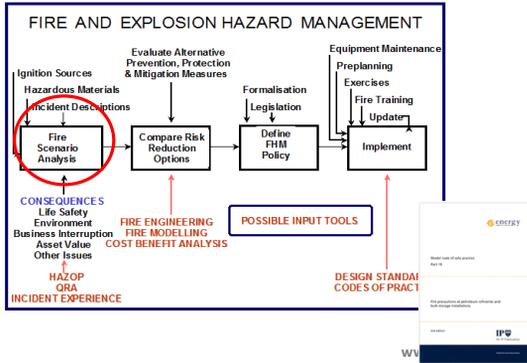


Element 1 - Assessment of Needs

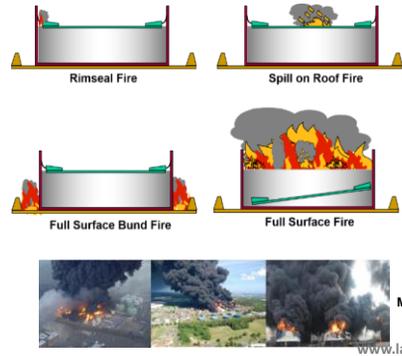
Has a formal site wide evaluation of potential scenarios been carried out in order to determine the quantity of foam concentrate required to manage the incidents to the selected strategy?

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Element 1 - Assessment of Needs



Element 1 - Assessment of Needs



Multi-tank Fires

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LASTFIRE Element 1 - Assessment of Needs
Large Atmospheric Storage Tank Fires

Sub Questions 1 – Some Examples

- 1.1 *Has a specific list of foam related tank fire scenarios and the accepted strategy to handle them been developed?*
- 1.2 *Did the development of the list have input from Process Operators, Maintenance, Internal Responders, relevant External Responders and Regulatory Authorities, with all team members confirming their acceptance of the outcome?*
- 1.3 *Is there a Scenario Worksheet quantifying the amounts of foam concentrate and associated equipment/systems required for each scenario.*
- 1.4 *Are all foam application rates and concentrate quantity calculations in accordance with a recognised standard and/or certified test results relevant to the specific fuels on site?*

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LASTFIRE Element 2 - Foam Concentrate Procurement Specification & Procedures
Large Atmospheric Storage Tank Fires

Has there been a detailed “fit for purpose” Foam Concentrate Procurement Specification developed?

The most critical section!!!

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LASTFIRE Element 2 - Foam Concentrate Procurement Specification & Procedures
Large Atmospheric Storage Tank Fires

Fire performance

Foam

The most important tool for controlling large flammable liquid fires!



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Yet often no detailed
PERFORMANCE SPECIFICATION
 prepared when purchases made!



LASTFIRE Test Protocol

- Test procedure developed designed to simulate considerations for tank incidents
 - Initially developed by MRDC – taken over by LASTFIRE
 - Forceful foam impact
 - Hot tank walls
 - Distorted tank shells
- Two protocols – water miscible fuels and non water-miscible
- Three nozzles used to evaluate performance on the basis of foam/foam-making equipment combinations
 - Semi-aspirating
 - Aspirating
 - System
 - Medium expansion nozzle also added for latest tests

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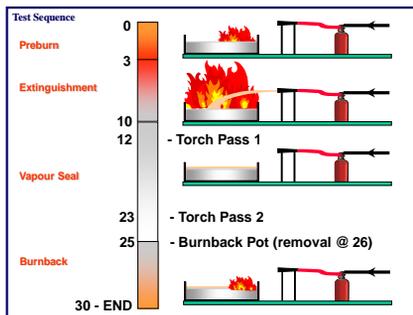
Research Work

LASTFIRE Test Protocol

- Semi-aspirating and aspirating nozzles designed such that they produce foam properties typical of commercially available monitors
 - Foam thrown directly on to fuel surface
 - Semi-aspirating application rate: 3.74 lpm/m²
 - Aspirating application rate: 3.63 lpm/m²
- System nozzle used overhanging tank rim
 - Simulates foam from a foam pourer
 - System nozzle application rate: 2.5 lpm/m²



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Element 2 - Foam Concentrate Procurement Specification & Procedures

- Fire performance*
- Environmental effects data*
- Wastewater treatment effects*
- Materials compatibility/Corrosion Data*
- Shelf Life/Accelerated ageing*
- Physical Properties – Tolerances/Acceptable drift*





Element 2 - Foam Concentrate Procurement Specification & Procedures

Fire performance
Environmental effects data
Wastewater treatment effects
Materials compatibility/Corrosion Data
Shelf Life/Accelerated ageing
Physical Properties – Tolerances/Acceptable drift
Maximum/Minimum Temperatures
Compatibility with proportioners/pumps
Compatibility with other agents

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Element 2 - Foam Concentrate Procurement Specification & Procedures

Legislative Regimes
Occupational Health issues
Premix issues
Chemical Footprint
Labelling/Containers
Batch Testing
Long term availability
Guarantees
Retained samples
Documentation

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Element 2 - Foam Concentrate Procurement Specification & Procedures

Sub Questions 2 – Some Examples

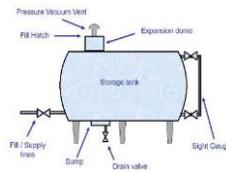
- 2.1 *Is the foam concentrate type suitable for all fuels on site, including any water soluble flammable liquids?*
- 2.2 *Is the nominal proportioning rate (percentage) appropriate for the fuels and proportioning equipment on site?*
- 2.3 *Is there a requirement for all foam concentrate on site to have been batch tested to an appropriate fire performance standard (LASTFIRE fire test is the most appropriate for tank fires)?*
- 2.4 *Has sufficient Environmental/Toxicity data been provided to carry out a full environmental impact assessment of using the concentrate in major incidents?*

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Element 3 - Site Foam Storage and Stock Management

Are foam stocks on site managed in such a way to ensure adequate supplies, optimise shelf life and minimise risk of degradation or loss of containment?



- **Minimum stock level**
- **Rotation**
- **Storage containers**
- **Basic rules**

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Element 3 - Site Foam Storage and Stock Management

Sub Questions 3 – Some Examples

- 3.1 *Has a minimum stock level for foam concentrate on site been set to trigger new purchases with sufficient lead time to ensure sufficient for worst case scenario remains available?*
- 3.2 *Is foam stock rotated so that the oldest is used for regular testing and training?*
- 3.3 *Is there a procedure in place to enable 100% replacement of stock used in the event of an incident within 24 hours – or is there 100% back up stock held on site?*
- 3.4 *Are bulk foam concentrate storage vessels filled to an expansion dome or alternatively a compatible sealer oil is used on the concentrate surface?*

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Element 4 - Site Foam Concentrate Assurance

Is a system in place to test and assess the ongoing condition of the foam concentrate on a regular basis?



- % Sediment
- Viscosity
- Refractive Index
- Specific Gravity
- Film formation
- pH

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LASTFIRE  **Element 5 - System specification and design**
Large Atmospheric Storage Tank Fires

Have all foam systems and mobile applications been specified and designed in accordance with appropriate standards and are they operable during an emergency?



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LASTFIRE  **Element 6 – Testing of Foam Application Equipment and Systems**
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Are foam systems and other foam application equipment tested on a regular basis to provide sufficient assurance that they continue to meet their original performance criteria?

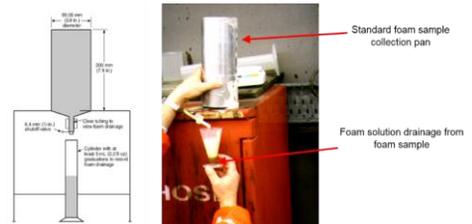


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LASTFIRE  **Element 6 – Testing of Foam Application Equipment and Systems**
Large Atmospheric Storage Tank Fires



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LASTFIRE  **Element 7 – Environmental Fire-Fighting Foam Management Assurance**
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Has a detailed environmental risk assessment has been performed related to foam storage and usage with appropriate measures being put in place to ensure environmental risk from using foam is minimised whilst maintaining effective fire response?

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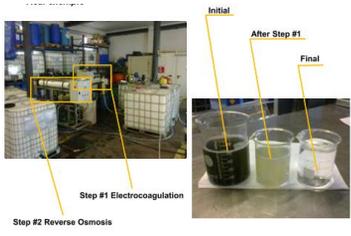
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Large Atmospheric Storage Tank Fires



Source Pathway Receptor analysis

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LASTFIRE  **Element 7 – Environmental Fire-Fighting Foam Management Assurance**
Large Atmospheric Storage Tank Fires



Disposal

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LASTFIRE  **Element 8 – Site Logistics for Foam Application**
Large Atmospheric Storage Tank Fires

Are measures in place to facilitate procurement and movement of bulk foam stocks and associated equipment required for major incidents?



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LASTFIRE  **Element 8 – Site Logistics for Foam Application**
Large Atmospheric Storage Tank Fires

Are measures in place to facilitate procurement and movement of bulk foam stocks and associated equipment required for major incidents?



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LASTFIRE  **Element 8 – Site Logistics for Foam Application**
Large Atmospheric Storage Tank Fires

Not just the foam concentrate!



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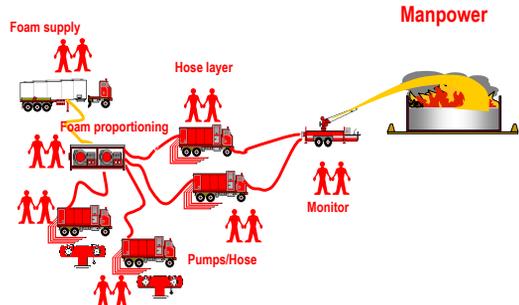
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Large Atmospheric Storage Tank Fires

Access



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LASTFIRE  **Element 8 – Site Logistics for Foam Application**
Large Atmospheric Storage Tank Fires



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LASTFIRE Foam Assurance Case Study

Case study carried out using Assurance Guidance and Questionnaire in Q1 2017

Very successful exercise for both the assessor and site personnel

Questionnaire in very useable format – could be used with assessor or by site personnel

Client Comment: "Excellent process to identify areas to improve and work towards, especially on environmental aspects (e.g. containment and disposal of firewater run off)"

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LASTFIRE Foam Assurance Case Study – Element 1

Incident/Issue	Is there a requirement for all foam concentrate on site to have been batch tested to an appropriate fire performance standard (LASTFIRE fire test is the most appropriate for tank fires)?	Yes	No	Partially	Comments	Desired Actions	Action Transferred to
Is there a requirement for all foam concentrate on site to have been batch tested to an appropriate fire performance standard (LASTFIRE fire test is the most appropriate for tank fires)?	Yes	Yes	No	Partially	No requirement currently	Consider batch testing of foam concentrate on site.	

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LASTFIRE Foam Assurance Case Study – Element 2

Incident/Issue	Is there a requirement for all foam concentrate on site to have been batch tested to an appropriate fire performance standard (LASTFIRE fire test is the most appropriate for tank fires)?	Yes	No	Partially	Comments	Desired Actions	Action Transferred to
Is there a requirement for all foam concentrate on site to have been batch tested to an appropriate fire performance standard (LASTFIRE fire test is the most appropriate for tank fires)?	Yes	Yes	No	Partially	No requirement currently	Consider batch testing of foam concentrate on site.	

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LASTFIRE Foam Assurance Case Study – Element 3

Incident/Issue	Is foam stock rotated so that the oldest is used for regular testing and training?	Yes	No	Partially	Comments	Desired Actions	Action Transferred to
Is foam stock rotated so that the oldest is used for regular testing and training?	Yes	Yes	No	Partially	Stock is kept in separate production dates and used accordingly	No actions identified.	

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LASTFIRE Foam Assurance Case Study – Element 7

Incident/Issue	Is all relevant data required to carry out an Environmental Risk Assessment for firefighting foam application available on site?	Yes	No	Partially	Comments	Desired Actions	Action Transferred to
Is all relevant data required to carry out an Environmental Risk Assessment for firefighting foam application available on site?	Yes	Yes	No	Partially	Not yet implemented, but site are aware of issue.	Request required information from supplier in order to be able to carry out an environmental risk assessment. Consider using LASTFIRE Foam Procurement Specification as a template	

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LASTFIRE Foam Assurance Case Study – Element 10

Incident/Issue	Do SSERPs clearly identify the quantity and source of foam and foam solution required to manage the incident?	Yes	No	Partially	Comments	Desired Actions	Action Transferred to
Do SSERPs clearly identify the quantity and source of foam and foam solution required to manage the incident?	Yes	Yes	No	Partially	Tank plans include amount of foam required and foam equipment needed	No actions required	

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LASTFIRE  **Foam Assurance Case Study – Summary**

Critical Issues Identified:

- Auditable track availability
- Prioritising issues for longer term
- Involvement of relevant parties n.b environmental and fire fighting
- True understanding of issues and policies

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LASTFIRE  **Some myths!**

A “controlled burn down” is not an acceptable option

**Sometimes it is!
It can be the least environmentally damaging!
It can be the safest option!
It happens!**



**Smoke?
Incident duration?
Asset loss?
Public image?**

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LASTFIRE  **Some myths!**

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**Sometimes it is!
It can be the least environmentally
It can be the safest option!
It happens!**



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LASTFIRE  **Some myths!**

A “controlled burn down” is not an acceptable option

Sometimes it isn't!

Could still have a “burn down” though!



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LASTFIRE  **Some myths!**

**One test certificate proves the foam is always good!
Formulation changes
Production mishaps
Batch Acceptance**



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LASTFIRE  **Some myths!**
Large Atmospheric Storage Tank Fires

Having a UL certificate proves the foam is good for every scenario and application!
Different applications – different requirements!



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LASTFIRE  **Some myths!**
Large Atmospheric Storage Tank Fires

Manufacturers know better than the end users what the end user needs!

Not just fire Performance
Environmental data
Compatibility
Long term stability
Effect on materials

Don't rush into change!!

All of this applies to some extent whatever the foam change – FF or C6 or other!

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LASTFIRE  **Some myths!**
Large Atmospheric Storage Tank Fires

Manufacturers know better than the end users what the end user needs!



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Firefighting Foam

Do we have a crisis?

No crisis but a crossroads

And an opportunity!!

So look on the bright side!



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