



MAIN PROJECT CONCLUSIONS

Generic event frequencies for fires other than rimseal fires are:-

Fire Type

↓ Spill on roof
↓ Small bund fire
↓ Large bund fire
↓ Full surface fire

Frequency

3x10⁻⁵/tank year 9x10⁻⁵/tank year 6x10⁻⁵/tank year 3x10⁻⁵/tank year

Slide 3 of 4

MAIN PROJECT CONCLUSIONS

- Detailed design of detection & protection systems is often incorrect due to lack of operational experience in design houses
- Incident response strategies must be developed prior to incident with regular exercises & training

FHM policies should be developed from site specific analysis, but risk reduction options most likely to be cost effective are:-

Secondary seals
Fire retardant rimseal material
Independent high-high alarm
Linear heat detection
Extended discharge rimseal foam system
Walkways allowing foam application by handlines

Slide 4 of 4

FLOATING ROOF TANK FIRE SCENARIOS





Rimseal Fire

Spill on Roof Fire



Bund Fire

Pontoon Explosion



RIMSEAL FIRE IGNITION SOURCES





RIMSEAL FIRE FREQUENCY BY AREA

Country/ Region	Nigeria	Southern Europe	Northern Europe	North America	Venezuela	Thailand	Singapore	Saudi Arabia
Number of fires	7	13	15	9	2	3	2	1
Tank years	333	6247	1 5264	4611	159	224	1035	3392
Frequency (x 10 ⁻³ /tank year)	21	2	1	2	13	13	2	0.3
Thunderstorm days per year	160	30	20	40	60	70	120	10



FULL SURFACE FIRE ANALYSIS

Total of 6 full surface fires during 4 incidents

- 1 escalation in 55 rim seal fires (Roof pontoons contained vapours and/or liquid)
- 1 escalation in 2 bund fires impinging on tank shell
- I escalation from a spill fire on the roof
- ☺ 1 full surface fire in 37 sunken roofs incidents
- Escalation to 2 downwind tanks in 1 full surface fire (Low boiling temperature fuel)
- I boilover in 6 full surface fires



Options addressed:-

- Tank & Bund Design & Operation
- Incident Detection
- **Fire Protection Systems**
- Portable/Mobile Fire Fighting
 Equipment
- Fire Response Strategies

Final options chosen should be based on site-specific analysis



Fire related Tank Inspection

- Mechanical failure
- Electrical fittings
- **Fire detection systems**
- Fire protection systems
- Fire Fighting Equipment

Ideally, via a weekly walk-round checklist



Fire retardant rimseal



Fire retardant rimseal Fire containment



Non fire retardant rimseal Fire spread



Linear Heat Detector



in rimseal area

Tank Roof







End-of-line device



Linear Heat Detector - specification considerations

•*Environmental & Operating conditions **•Normally no zoning required on tank** Normally do not require back-up detector **Monitor for integrity Care with routing onto tank roof •*Include additional length for easier repair Markov Include test mechanism**

Linear Heat Detector - detector location

Good location - detector close to top of seal



Linear Heat Detector - detector location

Poor location - detector away from top of seal



Rimseal Foam Systems



Foam applied to rimseal area

Rimseal Protection Systems

"One Shot Systems"

Limited application time

Maintenance issues



Rimseal Protection Systems

Extended Discharge Systems

Longer application time







Rimseal Foam Systems Foam Concentrate Proportioning Systems





Fully Fixed System

Semi Fixed System



Foam Systems - Specification considerations

- Minimise system outlet blockage potential
- Cohesive foam discharge
- Foam dam higher than seal assembly
- Drain holes in foam dam
- Hydrant outlets at top of tank
- Ease of inspection/testing
- Correct proportioning at all possible flows
- Operator training



RISK REDUCTION

Preplanning

- Formalise
 - Deperator actions
 - Firefighter actions
- ▲ Training
- Exercises
- Systems/Equipment maintenance
- ➡ Update

Full Surface Fire Response

Options

Burn Down

System Application

•Monitor Attack

Full Surface Fire Response





Pump-out and Controlled Burndown

Pump-out and Controlled Burndown



Shell, New Jersey

Note: Cooling monitors only

Note tank height!!!

Pump-out and Controlled Burndown Considerations

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

Full Surface Fire Response





Full Surface Foam System

Full Surface Foam System



•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

Examples

Sunoco, Sarnia, Canada

Orion, USA





Monitor attack started

skyvision



Monitor Attack Considerations Manning Requirements Numbers Competencies Personnel Safety Radiant heat Boilover Bund access / footing Logistics Foam supply Water supply Allowance for Foam Losses (60%) Drainage Issues

- Made by Fire-fighters for Fire-fighters
- Draws extensively from LASTFIRE
 Project knowledge
- Practical guide to fighting rimseal fires
- Fire-fighting strategies outlined
- Guidance on creating pre-fire plans for rimseal scenarios

STEIRE

Scenes from LASTFIRE Video - 'Fighting Floating Roof Tank Rimseal Fires'

Foam Fire Test For Storage Tank Fires

Rimseal FireFighting Tactics

