Can you stand the heat ?
[of LNG FIRES]

by

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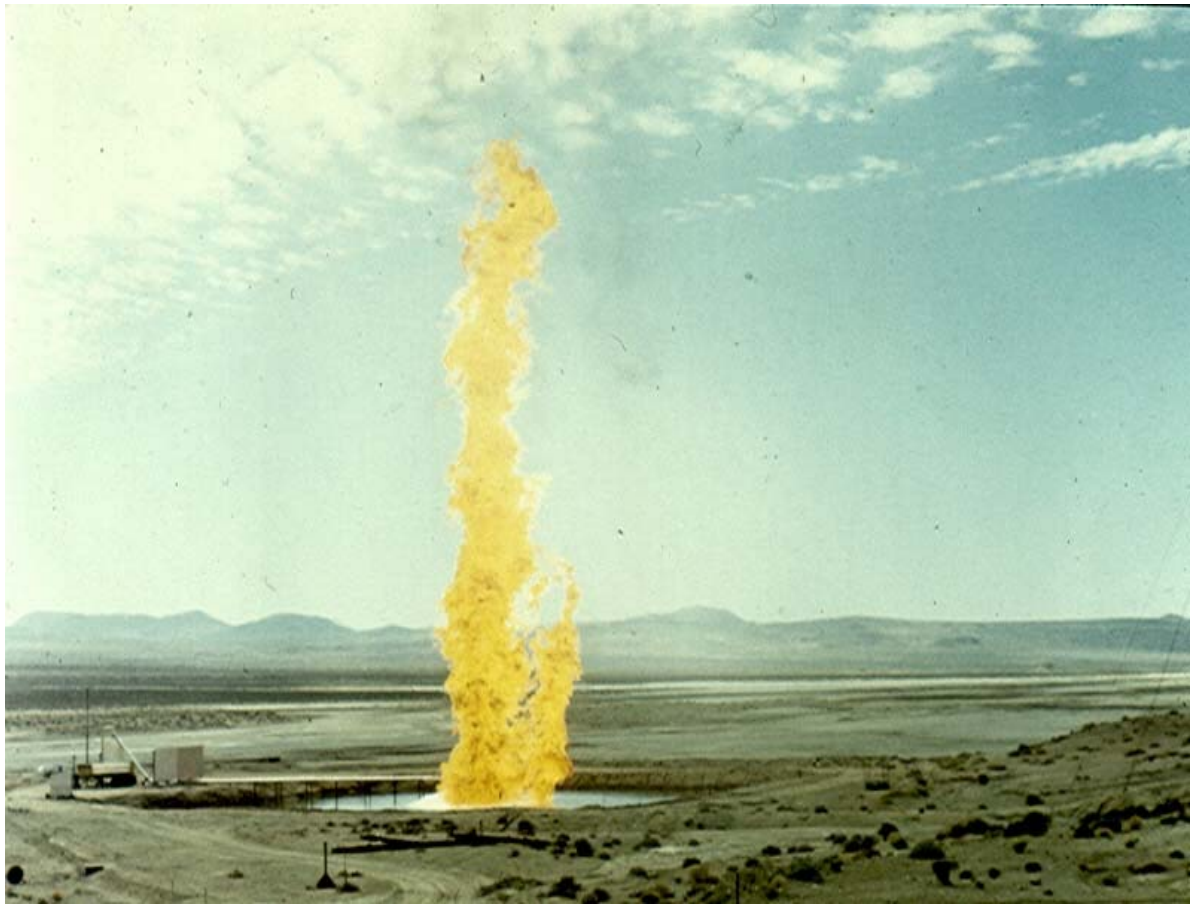
Organization of the Presentation

1) Show you a (“dirty”) movie of large LNG fire burning.
2) Present the features and shortcomings of current (regulatory and other) models used in calculating LNG fire hazards and exclusion distances
3) Talk about the controversy regarding what level of exposure constitutes a ‘hazard’
4) Discuss the problems in their use to assess real life hazards
5) Answer your questions

LNG Pool Fire (~15 m dia) on water
China Lake, CA tests 1976-78



Similarities in burning characteristics in 35m dia LNG Pool Fire & an Oil Fire

35 m dia LNG pool fire test on insulated concrete
(Fire in methane burning period at ~100s after ignition)
Source: Gaz-de-France

Oil pipeline rupture fire @ Beiji, Iraq, 2004
Source: Printed with permission from AP

Shortcomings of current regulatory LNG model & hazard criteria

- **Extrapolates from small test (< 20 m) results to very large fires (> 400 m)**
- **Does not alter the fire characteristics with increase in size. As seen in the movie, large LNG fires burn more like oil fires and radiate less energy.**
- **May not be applicable to (nor validated for) such situations as fire on top of tanks (with liquid level considerably below the tank top), spills on water in high winds, etc., are not validated.**
- **Does not recognize that level of injury to a person depends upon both the intensity of heat flux and time of exposure**
- **Does not allow credit for mitigation or circumstances where the effective heat flux is below the calculated value at any location because of building shade, clothing on people, emergency response action, etc.**

General Hazard Criteria

Hazard Phenomenon	Hazardous Effect	Quantitative values		Remarks
		SI units	Conventional units	
Fire	2nd degree burn to unprotected skin	5 kW/m^2	1,600 B/hr ft^2	For exposure longer than 30 s
	Piloted ignition of wood	12.5 kW/m^2	4,000 B/hr ft^2	
	Unpiloted ignition of wood	25 kW/m^2	8,000 B/hr ft^2	
	Steel structure loss of strength	37.5 kW/m^2	12,000 B/hr ft^2	

Conclusions

1. Models [used for determining whether a hazard exists at a particular distance from a tank, impoundment or a LNG ship] need to consider realistic behavior of LNG fires.
2. Hazard distance calculations must be based on real conditions near the facility of concern (building density and height, line of sight obstructions, shortest distance to a safe haven, etc.)
3. The people exposure hazard criterion should take into account different groups of people, protection provided by clothing and shelter in place opportunities, etc.

Can you stand the heat?

Yes you can, if you are:

1) **farther away from where the radiant heat intensity is lower than 5 kW/m^2 and do not keep looking at the fire, OR**

2) **inside a building, OR**

3) **fully clothed or behind a building, tree or any other shade providing object [even at distances closer to the fire than the calculated hazard distance]**