

# Facing challenges to broad ethanol introduction

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CTIF meeting, Bergen, 15th September 2011



SP Technical Research Institute of Sweden



# Fuel Storage Safety

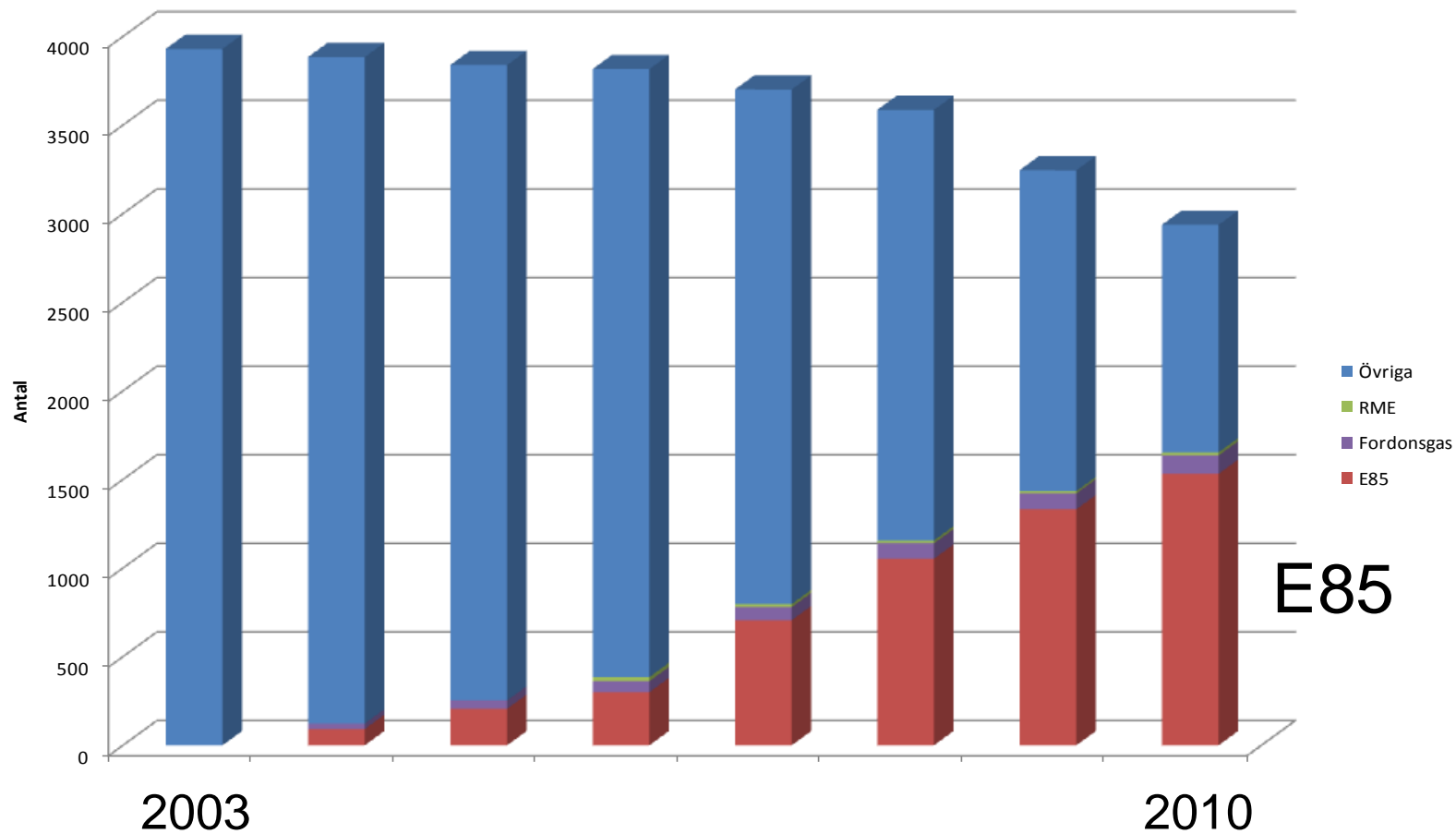


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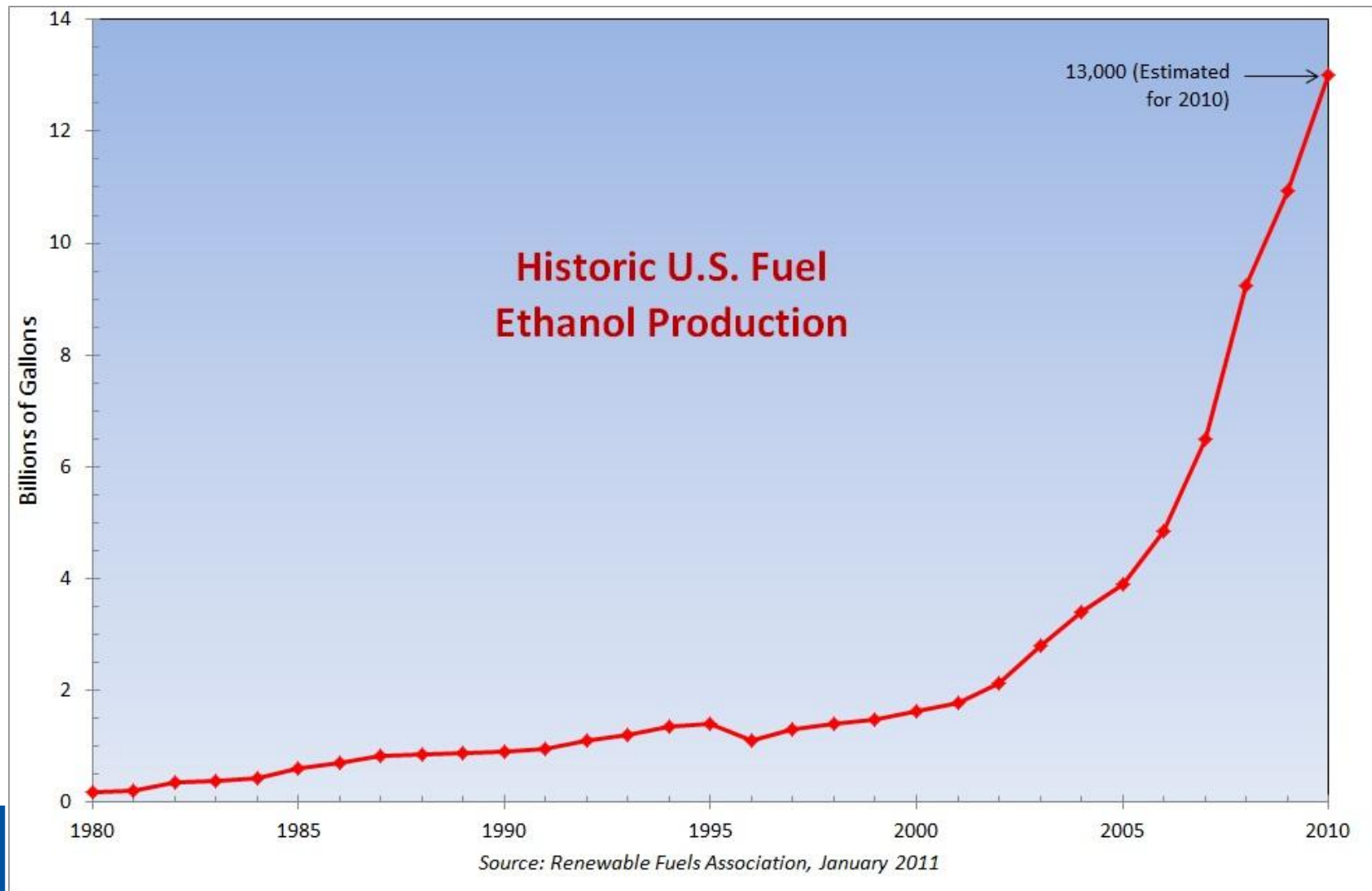


# Fuel stations providing renewable fuels

Development of service stations and proportion of renewable fuels (ethanol)

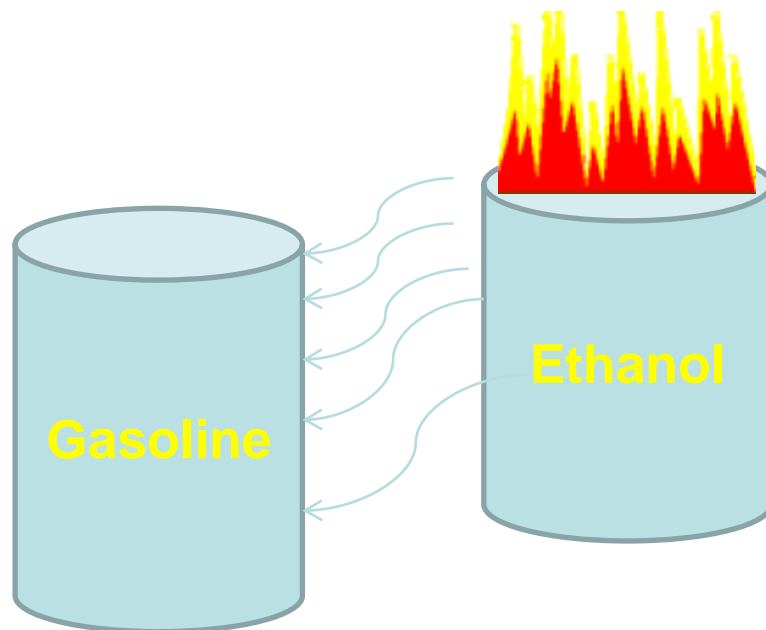


# Ethanol production in US 1980-2010



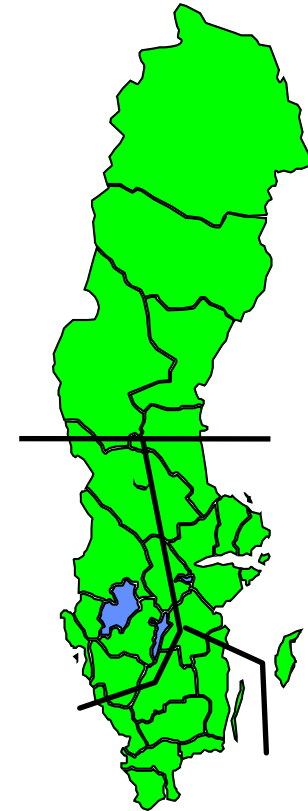
# ***Operational Risk Management Issues***

**Is Ethanol more likely to cause a major incident scenario compared to Gasoline?**



**➤ Need for fixed cooling systems to avoid escalation due to flammability properties and increased heat radiation?**

# Operational Risk Management Issues



- Need to complement our existing mutual aid system ?
- Change equipment and tactics for succesful fire fighting of ethanol tank fires?



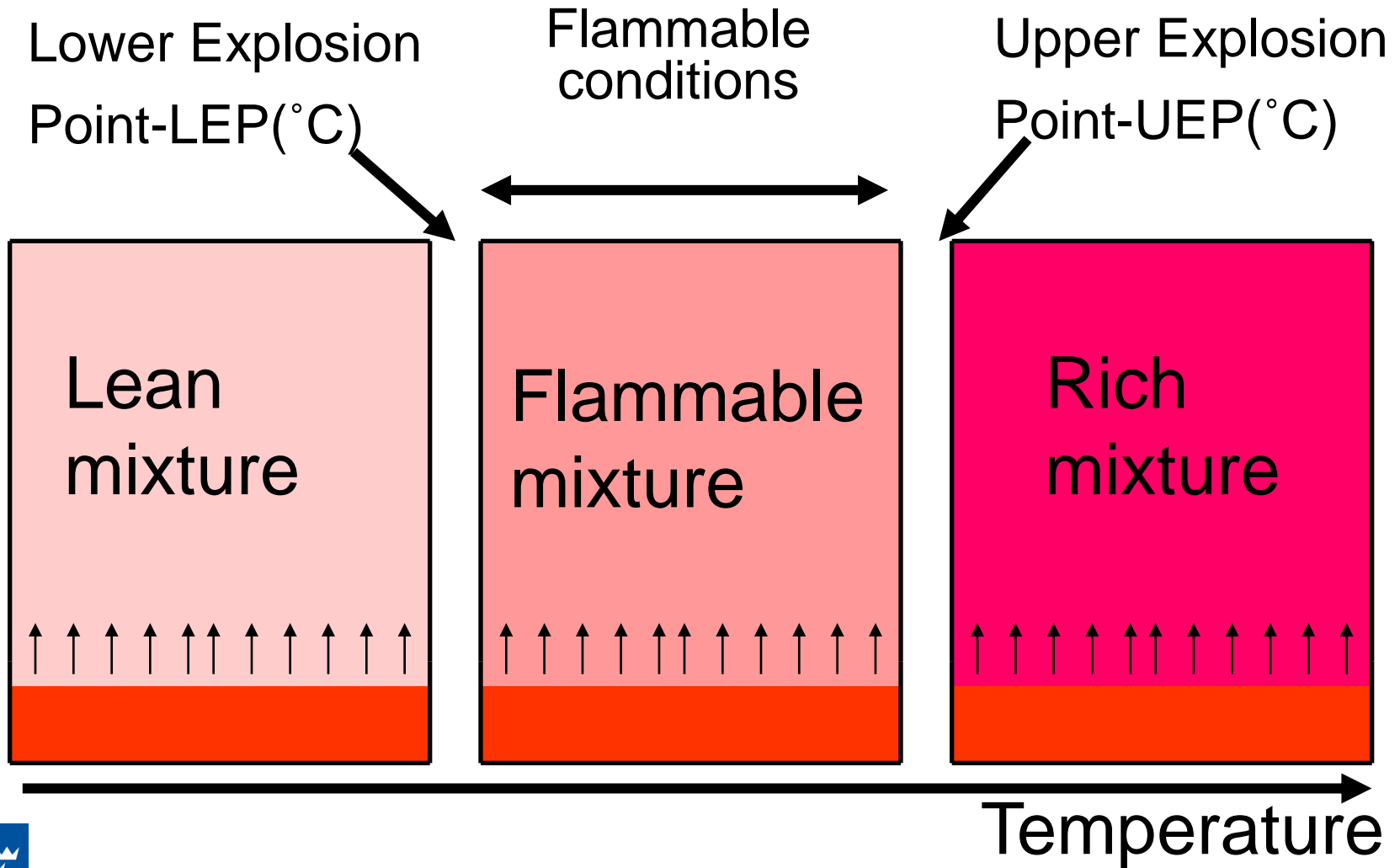
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# What are the important differences Ethanol - Gasoline?

- **Flammability**
- **Burning behaviour**
- **Extinguishment**

# Parameters defining risk for fire and explosion



# "Rich" vapour concentration-flame only in opening



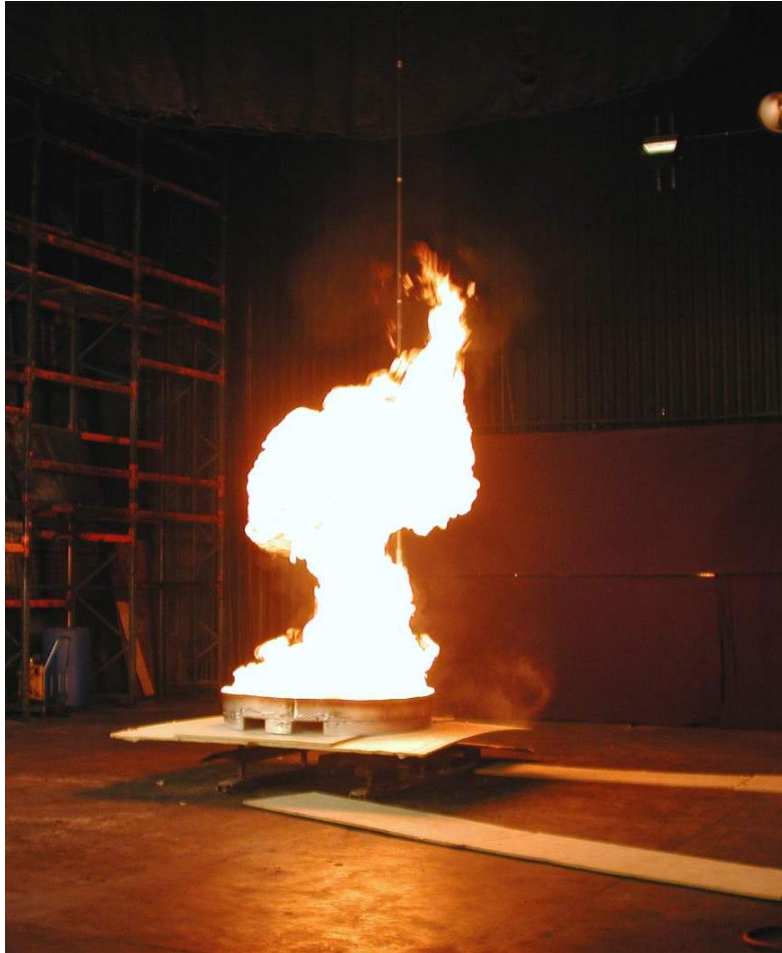
# Flammable vapour concentration – flame penetrates into vessel



# Increased risk for tank explosion



# Burning behaviour, 1,7 m<sup>2</sup>



E85



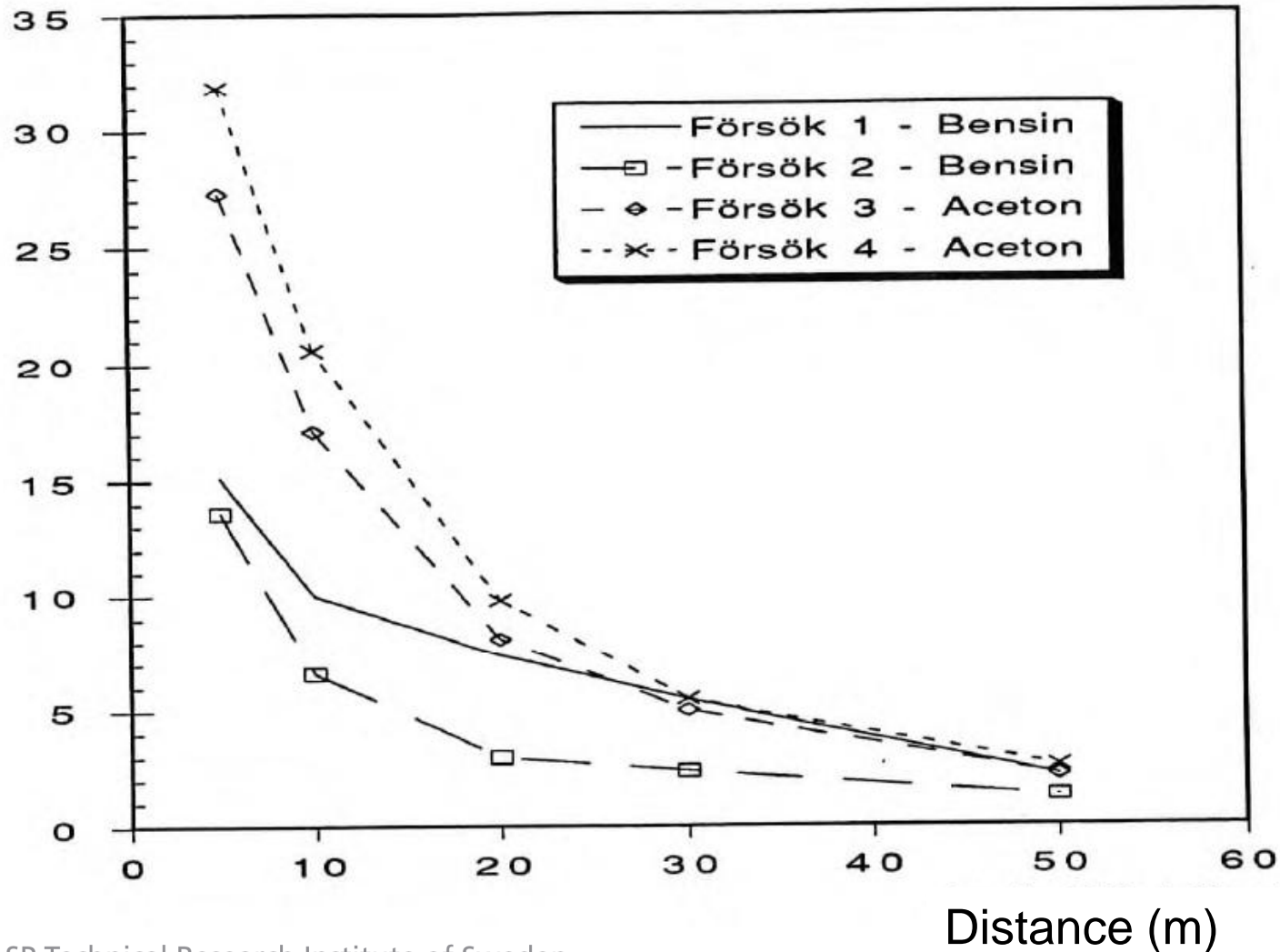
Gasoline

# Increased heat radiation compared to Gasoline ?



# Heat radiation from Gasoline and Acetone/Ethanol

Radiation (kW/m<sup>2</sup>)



# Fire extinguishment tests on water miscible fuels

Metanol och M15	50 >> 0,25 m <sup>2</sup> (1980)
Aceton/etanol	200 m <sup>2</sup> (1990)
Gasoline plus 0-10% ethanol	0,6 m <sup>2</sup> (2003)
EERC- E10 and E95	4,5 m <sup>2</sup> (2007)

# 200 m<sup>2</sup> Acetone/Ethanol - AFFF-AR, "Backboard"



# 200 m<sup>2</sup> Acetone/Ethanol - AFFF-AR, Bounce



# Limitations of standard tests for foams

- Represent spill fires
- Thin fuel layers 35 - 70 mm
- Preburn time 1-3 minutes
- Indirect application (back-board)
- Extinguishment 3-7 min
- Dilution effect about 30%

# What about tank fires?



# Conditions for tank fire fighting

- Large diameters (long foam run)
- Large fuel depth ("no" dilution effect)
- Long preburn time (heated fuel, hot steel surfaces)
- Bounce/backboard application not possible

# Port Kembla - Ethanol tank fire



- 32 m in diameter, about 4000 m<sup>3</sup> ethanol
- Explosion blow off the roof
- Very "hot" fire

# Port Kembla experience



Photo: Fire & Rescue NSW

- Extinguished after about 25 hours (burn-out)
- Diluted to about 10% ethanol
- About 50 000 l of AFFF-AR



## Ethanol Tank Fire Fighting



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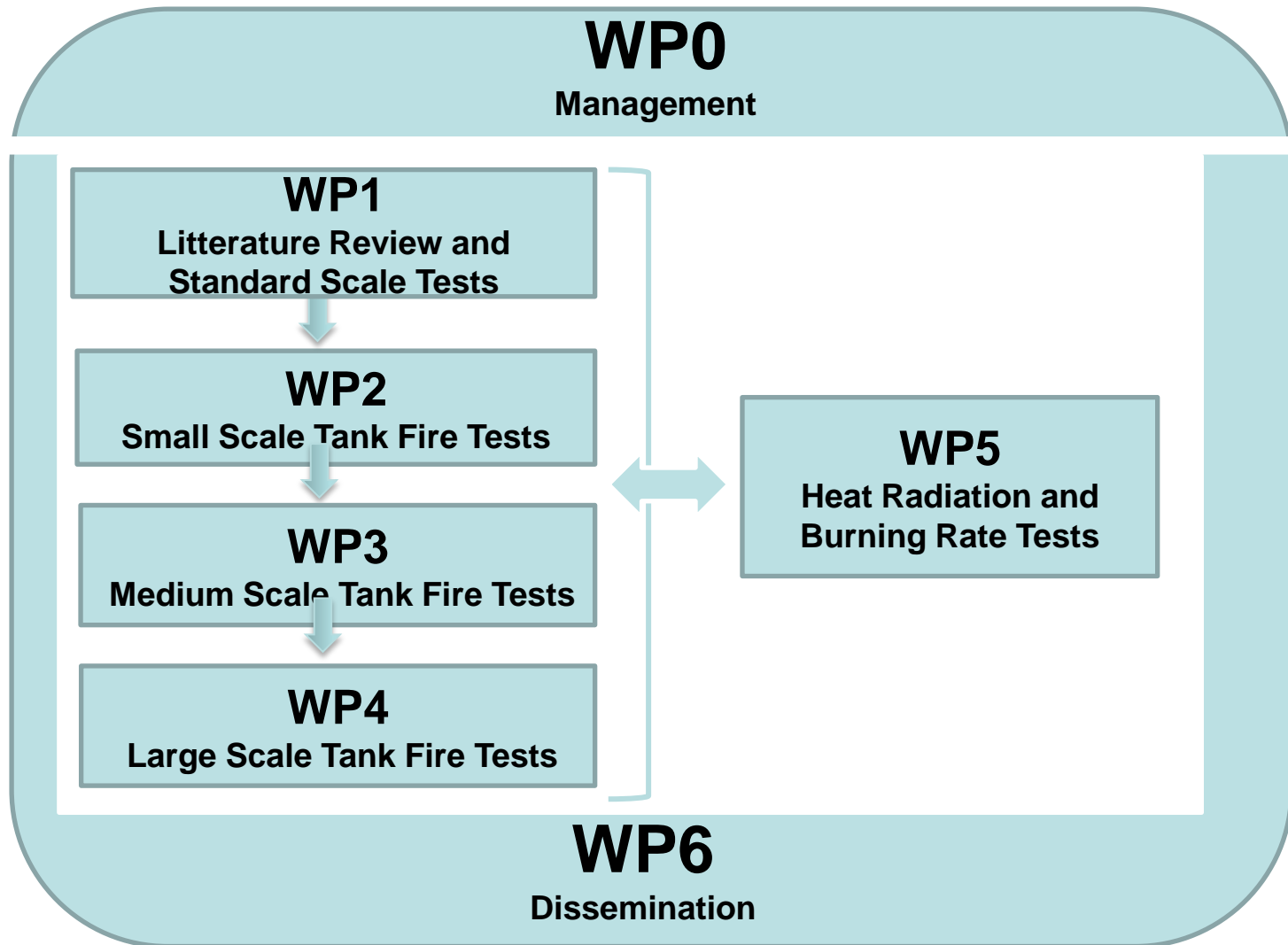


# Goal of ETANKFIRE project

## Ensure proper investments in fire protection of ethanol storage plants

- ❖ Determine the large scale fire behaviour of ethanol fuels
- ❖ Develop and validate a methodology for fire fighting of tank fires containing ethanol fuels

# Proposed structure of ETANKFIRE project



# What is needed to launch ETANKFIRE?

Personell/Experimental:	320
Fuel:	90
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Total:	400-450 kEUR

- Min 8-9 partners x 50 000 kEUR

## Existing commitments

- Swedish Fire Research Board 60 kEUR (WP5)
- Swedish Petroleum Institute 60 kEUR (WP5)

- Project start 2011-2012?

## More information and feedback

Visit the ETANKFIRE website

[www.sp.se/en/index/research/etankfire](http://www.sp.se/en/index/research/etankfire)