

# T87.6 Task Force

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## AFFTAC Modeling Subgroup: Preliminary Results

September 23, 2011  
DOT Headquarters  
Washington, DC

# Assumptions

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- Objective: to provide comparative data on fire survival for a variety of car configurations
- 30,000 gallon, 7/16"-thick A516 tank (baseline)
- Pure ethanol, 1% outage @ 115F initial temperature (105F for jacketed cases)
- 75 psi STD PRV, 35,660 cfm capacity, flow rating @ 82.5 psi per 179.15
- 1500F fire completely immersing tank

# Pool vs Torch Fire

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- Bare tank baseline car case was run for
  - pool fire and torch fire
  - upright and overturned (120°) positions
- Only the overturned condition in a pool fire caused tank failure
- Therefore this presentation focuses only on overturned cars in pool fires

# Cases

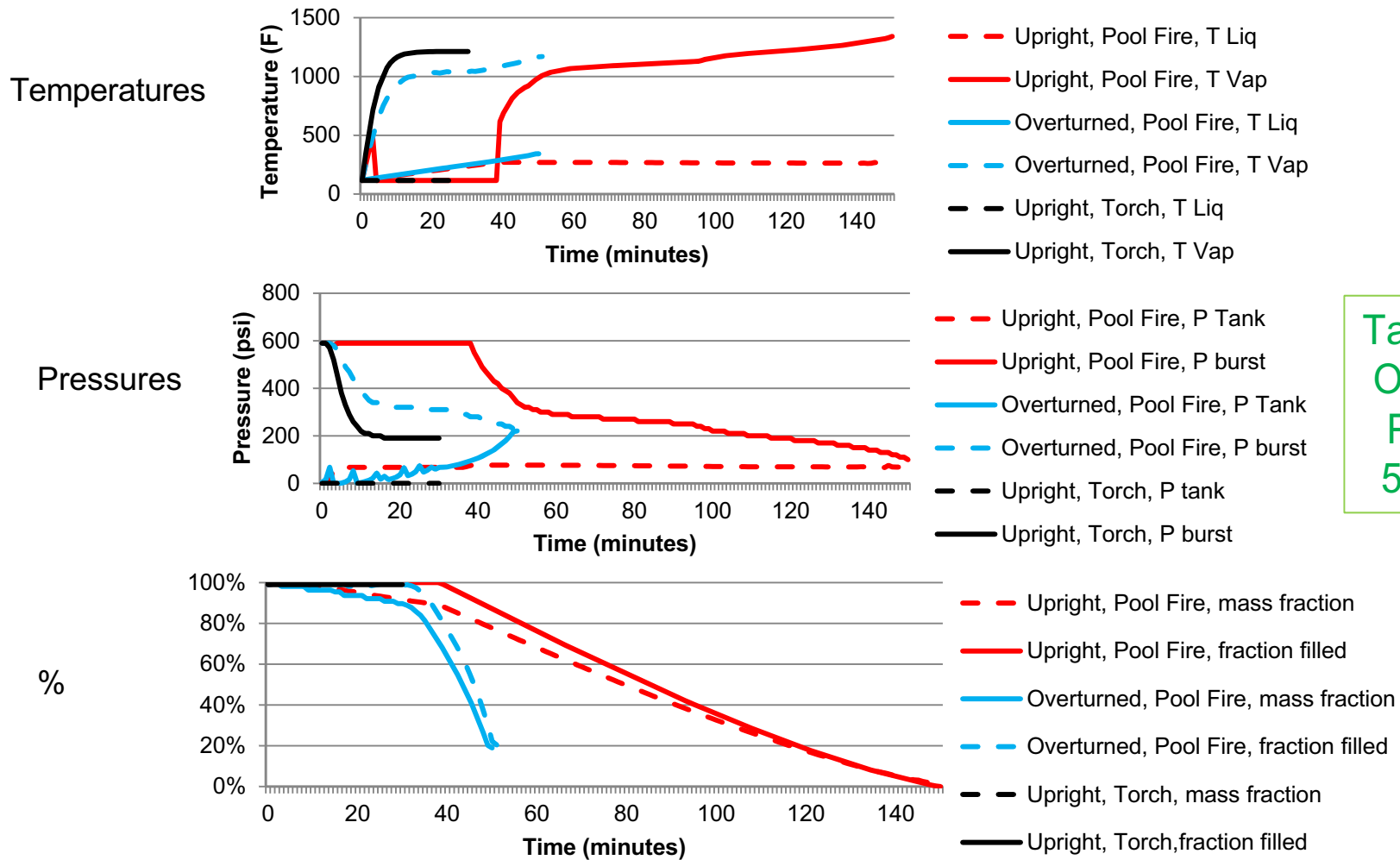
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- Case 1 (baseline): Pre-T87.5 car  
(ADMX 29420 from Arcadia – bare tank, 7/16” thick, 30K gals., 2 PRV)
  - Upright torch fire, upright pool fire, overturned pool fire

## Following cases for overturned pool fire only:

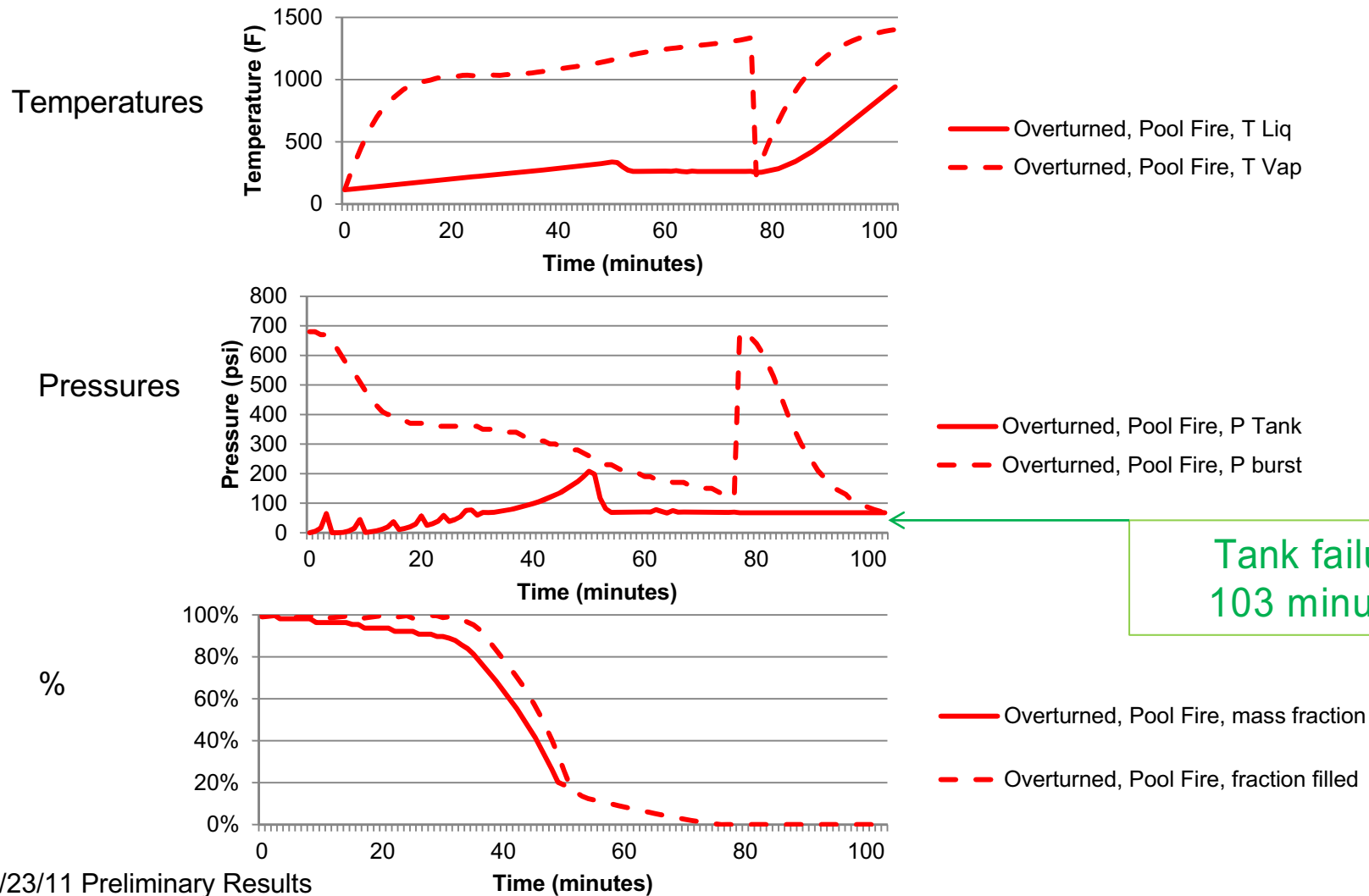
- Case 2: T87.5 (CPC-1230) car: ½” -thick tank
- Case 3: T87.5 (CPC-1230) car: ½” -thick tank, varying PRD Capacity
- Case 4: T87.5 (CPC-1230) car with 2% outage @115F, varying PRD Capacity
- Case 5: T87.5 (CPC-1230) car, plus jacket alone
- Case 6: T87.5 (CPC-1230) car, plus jacket and thermal protection

# Case 1 – Typical Pre-T87.5 Car



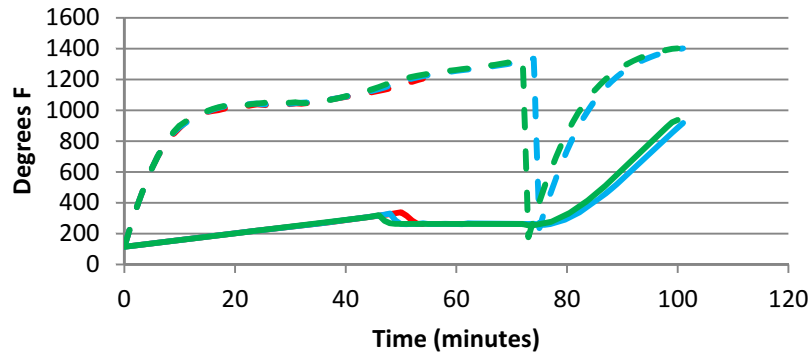
Tank Failure:  
Overturned,  
Pool Fire -  
50 minutes

# Case 2 – CPC-1230 Car



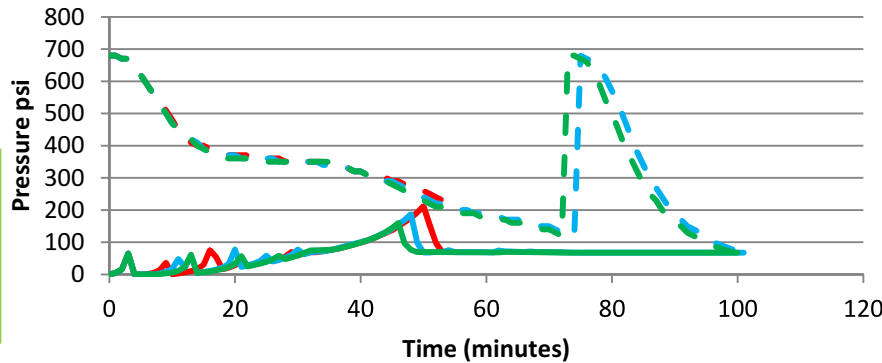
# Case 3 – CPC-1230 Car & Various Pressure Relief Capacities

Temperatures



- Overturned, Pool Fire, T Liquid
- - Overturned, Pool Fire, T Vapor
- Overturned, Pool Fire, T Liquid, +10K scfm
- - Overturned, Pool Fire, T Vapor, +10K scfm
- Overturned, Pool Fire, T Liquid, +20K scfm
- - Overturned, Pool Fire, T Vapor, +20K scfm

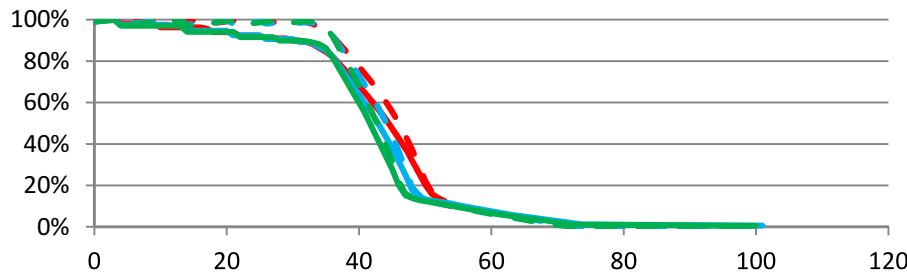
Pressures



- Overturned, Pool Fire, P Tank
- - Overturned, Pool Fire, P Burst
- Overturned, Pool Fire, P Tank, +10K scfm
- - Overturned, Pool Fire, P Burst, +10K scfm
- Overturned, Pool Fire, P Tank, +20K scfm
- - Overturned, Pool Fire, P Burst, +20K scfm

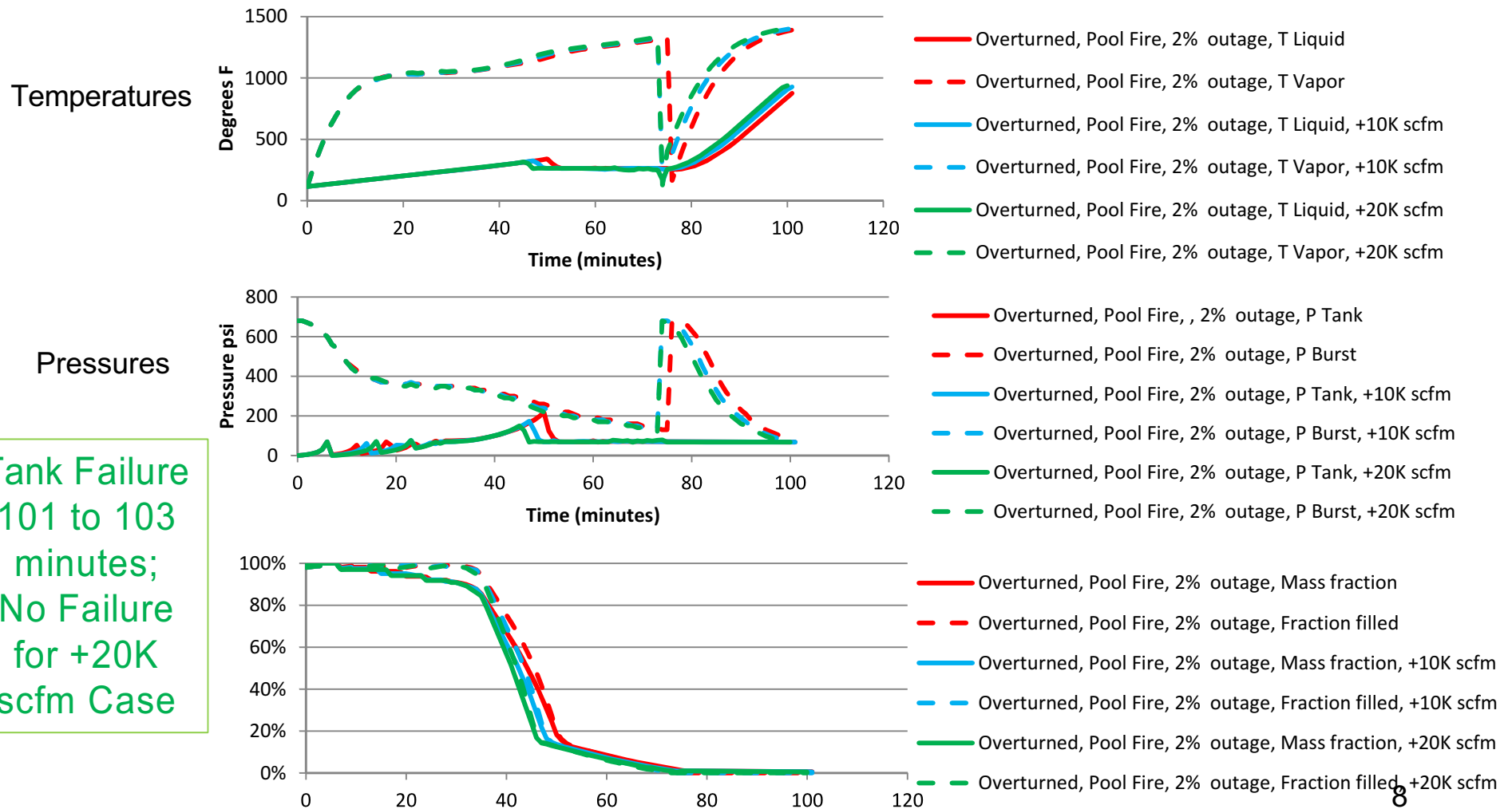
Tank Failure  
99 to 101  
minutes

%



- Overturned, Pool Fire, Mass fraction
- - Overturned, Pool Fire, Fraction filled
- Overturned, Pool Fire, Mass fraction, +10K scfm
- - Overturned, Pool Fire, Fraction filled, +10K scfm
- Overturned, Pool Fire, Mass fraction, +20K scfm
- - Overturned, Pool Fire, Fraction filled, +20K scfm

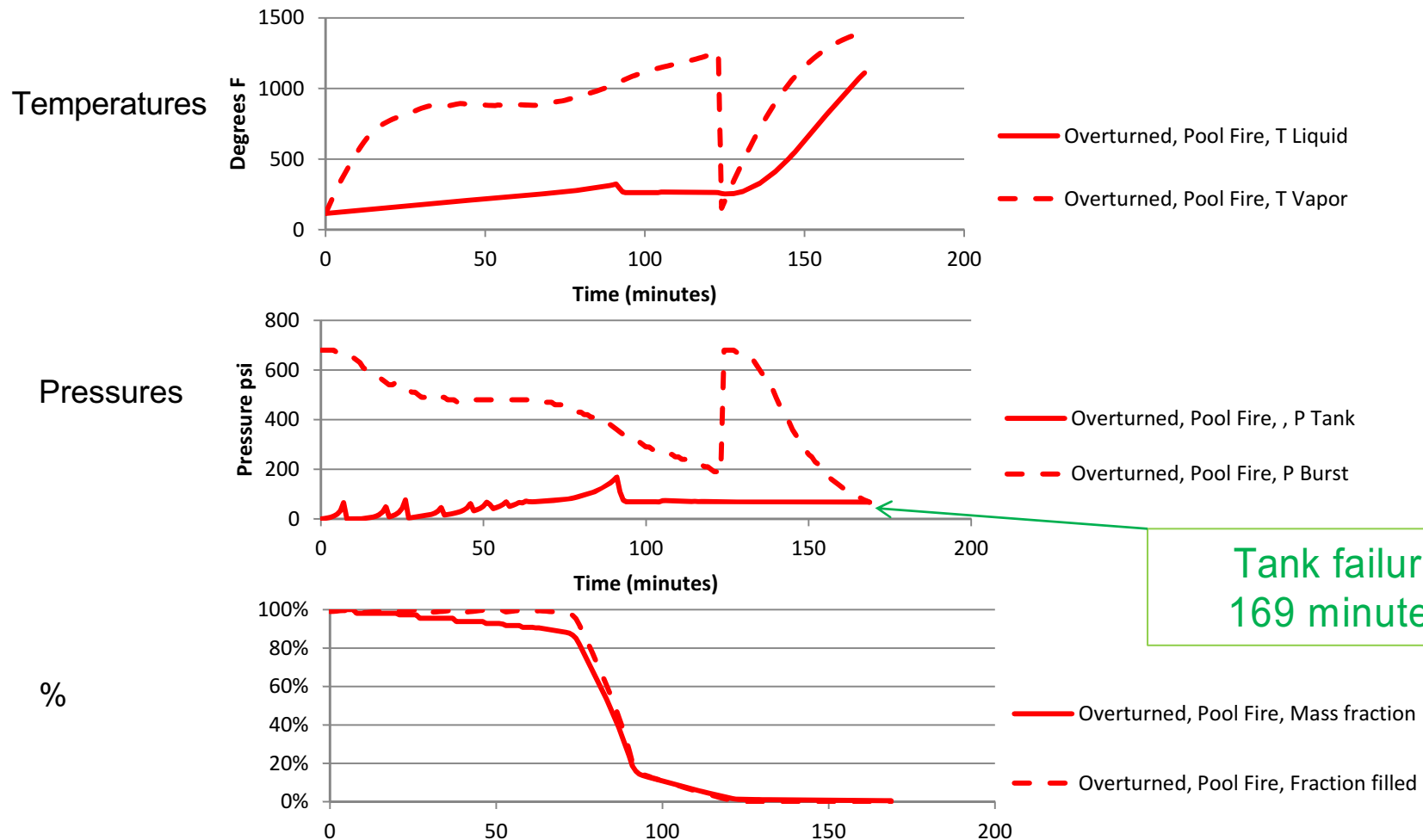
# Case 4 – CPC-1230 Car & 2% Outage & Various Relief Capacities



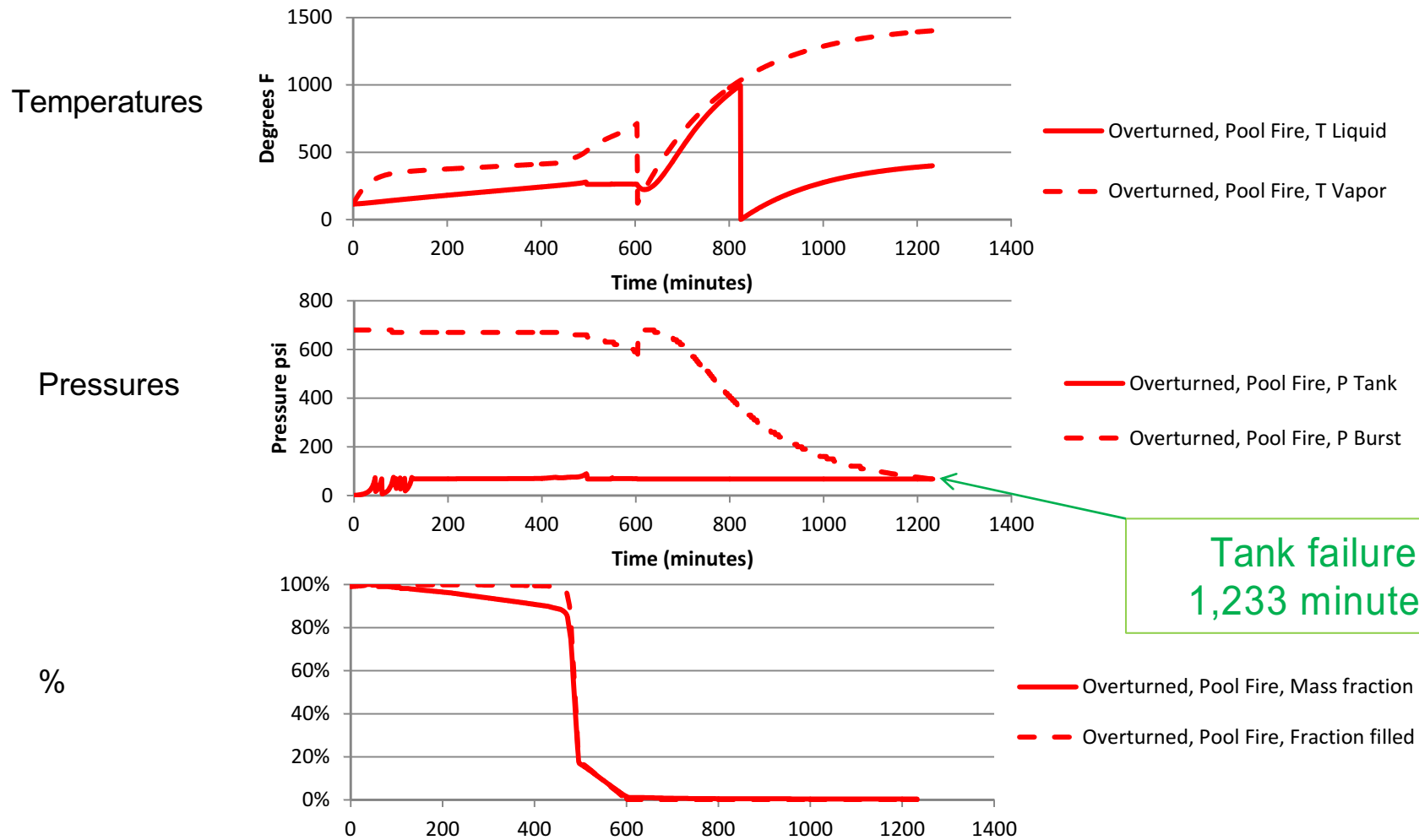
Tank Failure  
101 to 103  
minutes;  
No Failure  
for +20K  
scfm Case



# Case 5 – CPC-1230 Car & Jacket (Only; No Thermal Blanket)

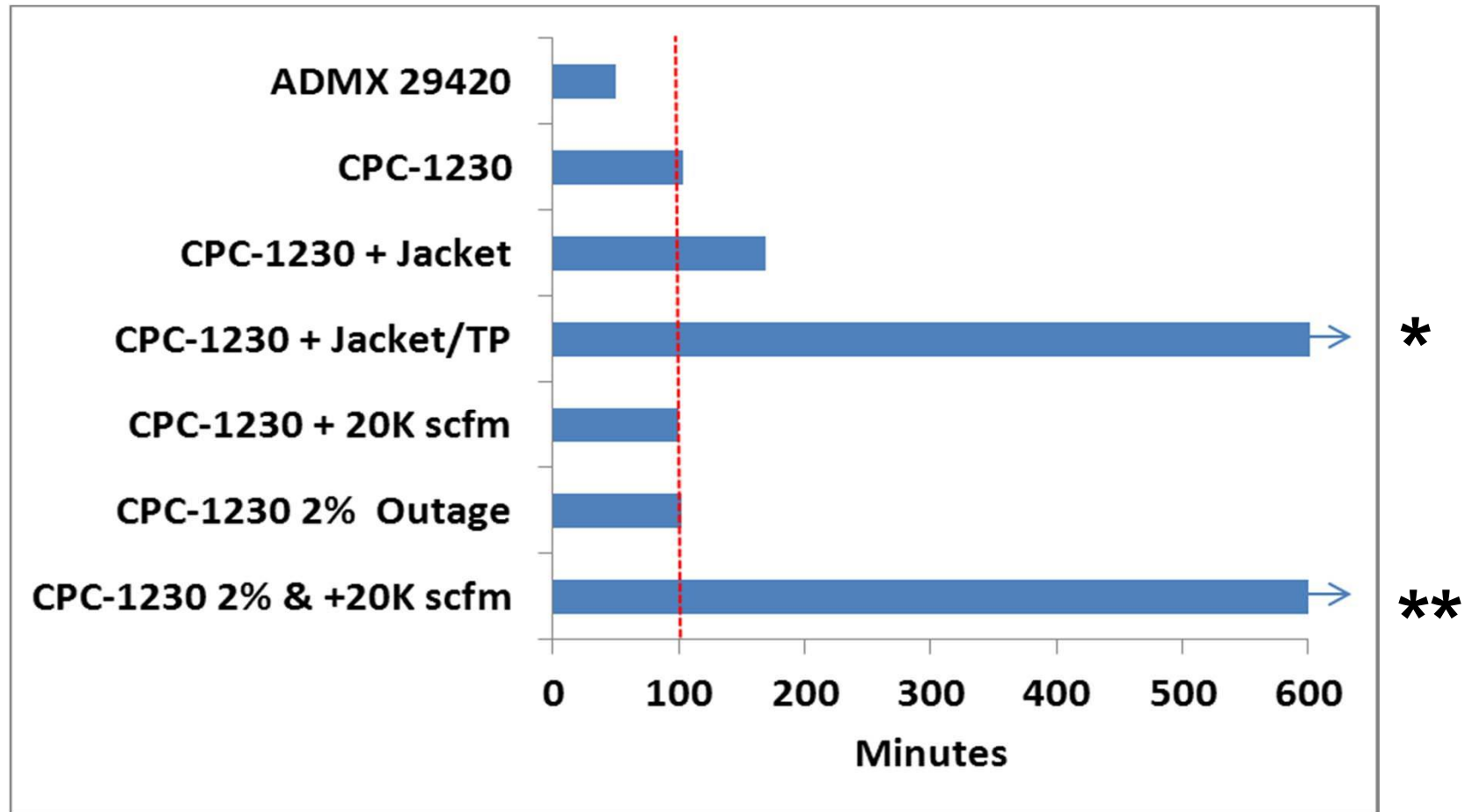


# Case 6 – CPC-1230 Car & Jacket and Thermal Protection



# Comparison by Survival Time

## Pool Fire, 120° Rollover



\* Tank failure at 1,233 minutes

\*\* Tank emptied at 73 minutes and never failed

# Preliminary Conclusions

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- Torch fires appear not to cause tank failure, because the vapor pressure never rises significantly with this non-pressure lading
- The existing, pre-CPC-1230 car, upright, appears to survive well beyond 100 minutes.
- The existing, pre-CPC-1230 car, rolled over 120°, does not appear to survive 100 minutes.

# Preliminary Conclusions, ctd

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- Increasing tank shell thickness (i.e., CPC-1230 car) appears to increase survival time significantly
- Adding PRD capacity appears to have minimal effect, by itself
- Increasing outage to 2% appears to have minimal effect, by itself
- Adding PRD capacity and increasing outage to 2% appears to have a significant beneficial effect – simulated car never failed
- Adding a jacket, by itself, shows a significant beneficial effect
- Adding a jacket and thermal protection produces extended survival (> 1,000 minutes)