Fire Test Evaluation using the Kerosene and Aviation Fuel

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Introduction

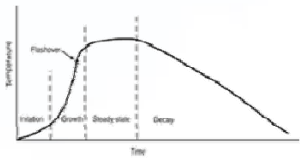
❖ NRC preformed an evaluation on a long duration fire
➔ TN-68, HI-STAR 100 & LWT Cask

❖ Greiner(Nevada University), Lopez (SNL) performed
➔ Research on fire accidents using Jet fuel

Compartment Fire

❑ Phase of Fire Development

- Initiation
- Growth
- Steady-state
- Decay



❑ Heat Transfer Mode

- Heat is generated by the fire source
  - Transfer from combustion zone to upper layer by convection and radiation
- This heat is transferred to
  - Adjacent wall by radiation and conduction
  - Compartment lower layer by radiation
  - Ambient atm. by convection through openings

❑ Description of Fire Test Facility

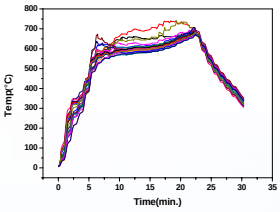
- Mat'l : Light Concrete
- Thickness : 10 cm
- Dimension : 4 m(W) X 4 m(L) X 4 m(H)
- Openings
  - Front & Rear side
    - 40 cm(H) X 70 cm(W)
    - 50 cm(H) X 80 cm(W)
  - Roof : 30 cm
- Thermocouples
  - K-type, Inconnel-sheathed
  - Total 63 T/C : Heights of 80 cm, 200 cm, 320 cm

Fire Test

❑ Fire Source

- Test 1 ~ Test 3 : Kerosene
- Test 4 ~ Test 6 : Jet-A-1

Test	Opening Size (cm)	Fuel (liter)
1	50 x 80	350
2	50x80 + 30	50
3	40x70 + 30	50
4	50 x 80	50
5	50x80 + 30	50
6	40x70 + 30	50



Test Results

❑ Engulfed Flame Temperature & Time

Fire Source		Engulfed Flame Temp. (°C)			Engulfed Flame Time(min.)
		Upper	Middle	Lower	
Kerosene	Test 1	561	-	-	120
	Test 2	675	-	-	15
	Test 3	611	-	-	23
Jet-A-1	Test 4	618	602	551	15
	Test 5	692	677	616	12
	Test 6	646	623	568	17

❑ Heat Release Rate & Mass Flow Rate

	Kerosene		Jet-A-1	
	Test 2	Test 3	Test 5	Test 6
Heat release rate (kJ/s)	1,714	1,155	2,160	1,524
Mass flow rate (kg/s)	0.040	0.027	0.050	0.035
Ventilation factor ($m^{5/2}$)	0.566	0.354	0.566	0.354
Density (kg/m^3)	820	820	797.6	797.6
Combustion time (s)	930	1380	720	1020

Conclusions

❑ Combustion time : Jet-A-1 < Kerosene
  ➔ Flame Temperature : Jet-A-1 > Kerosene
❑ Openings became bigger
  ➔ Fuel consumption rate became bigger
  ➔ Flame Temperature was higher
❑ In compartment fire
  ➔ Flame temperature gradually increased

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