

Class C Cargo Compartment ULD Suppression Agent Penetration



FAA William J Hughes Technical Center
Fire Safety Branch

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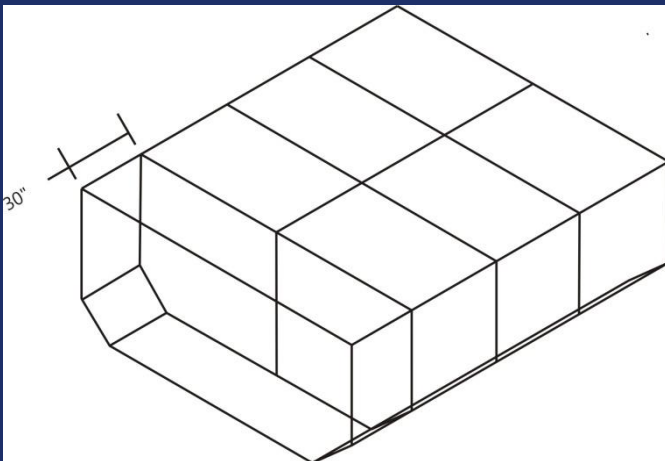
Federal Aviation
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Background

- Recent test results have shown the potential for vapors vented from lithium ion batteries in thermal runaway to produce flammable gas mixtures inside ULDs.
- Based on those results, questions arose about the ability of Class C cargo compartment Halon 1301 suppression agent to penetrate into ULDs to inert these flammable gas mixtures.
- FE-25 used as a surrogate gas for Halon 1301.

	Halon 1301	FE-25
Boiling Point (°F)	-72	-55
Vapor Pressure (psi)	208	200
Molecular Weight (g/mol)	149	120

DC-10 Test Article Aft Cargo Compartment



Compartment Volume: 1303 ft³

Four continuous gas analyzers calibrated for FE-25 are available to simultaneously record gas concentrations. The probes will be located inside and outside of the ULDs.

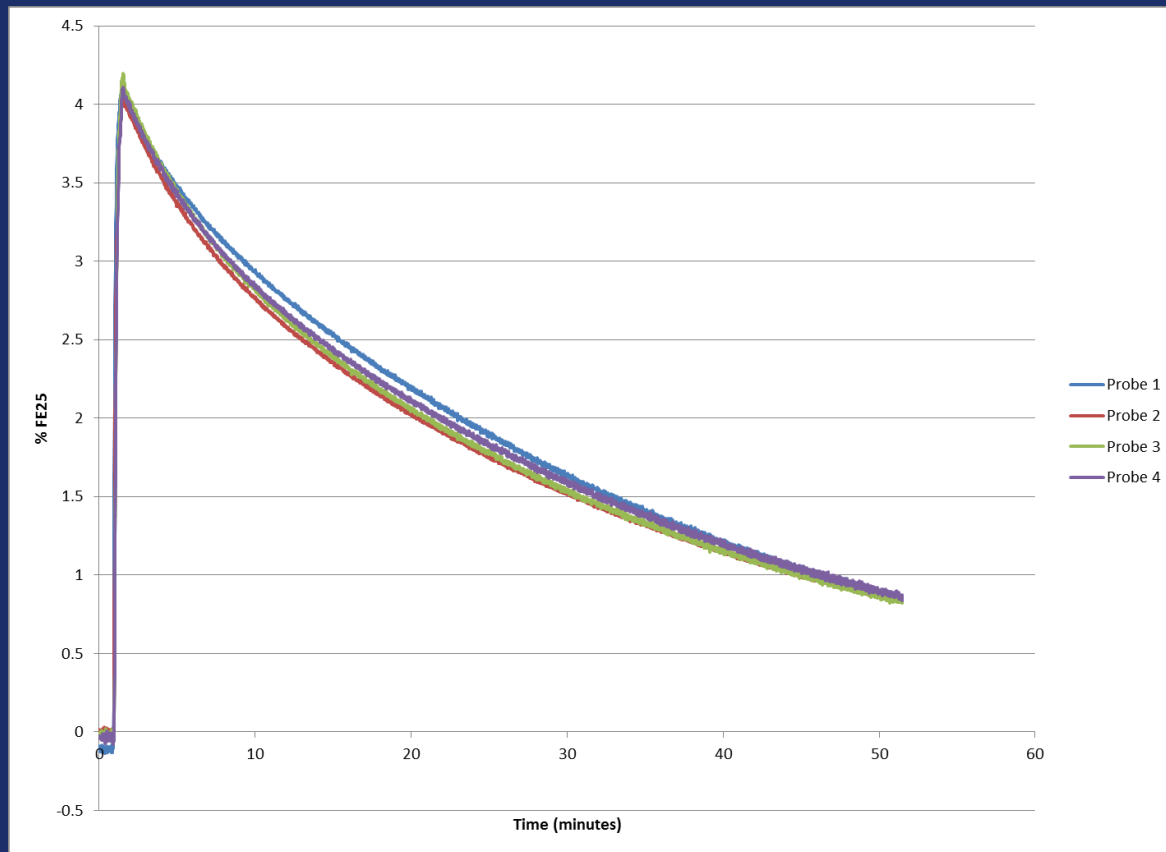


20 lbs FE25 discharged into empty compartment with mixing fans.

Gas probes spaced equidistant between floor and ceiling.

Cabin ventilation fan on.

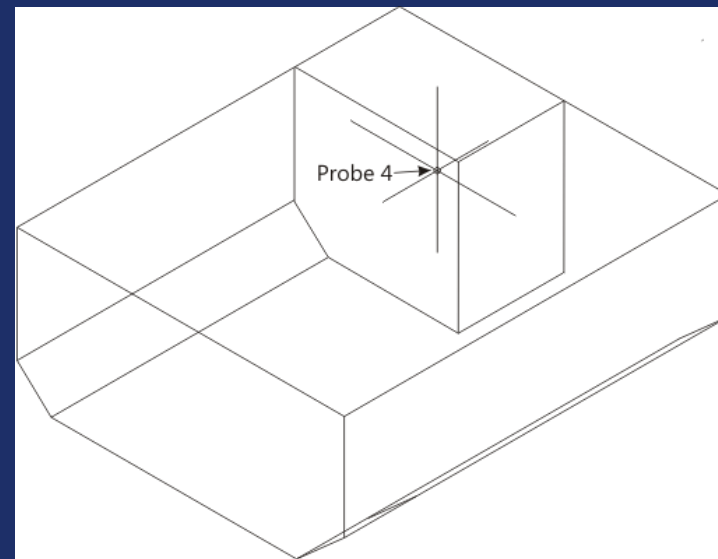
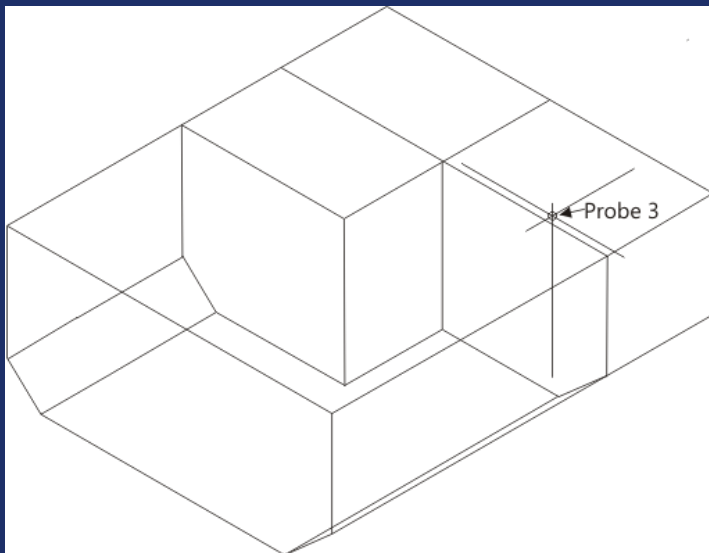
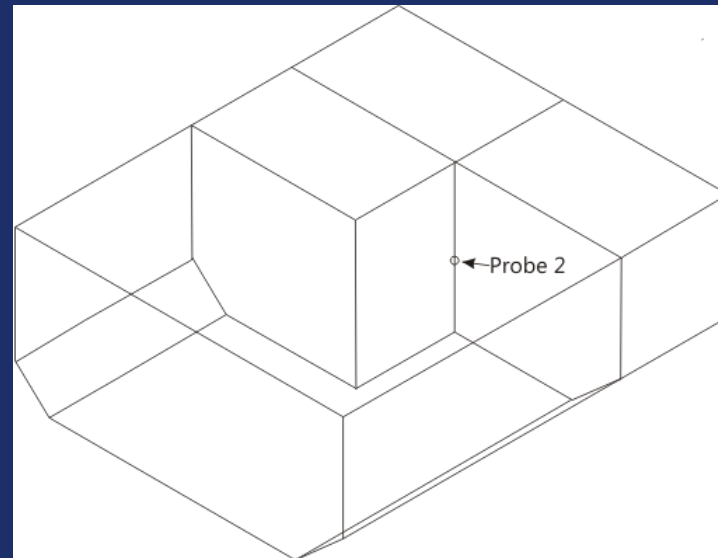
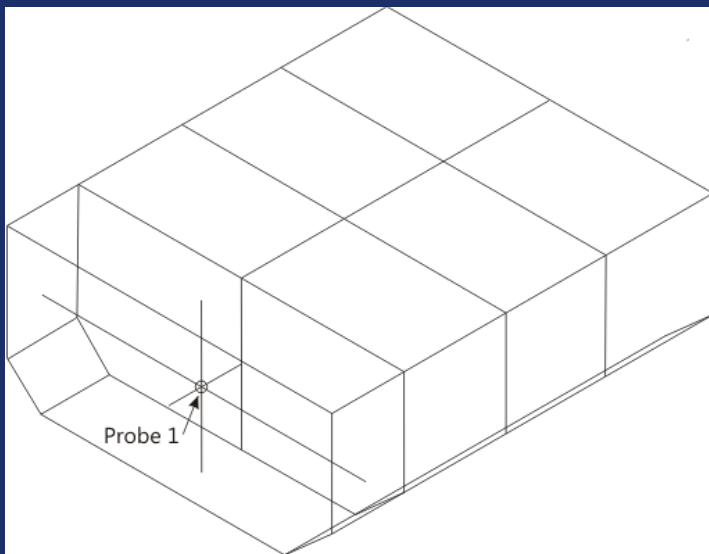
Leakage calculated from agent decay rate: 38.7 ft³/minute.



AKE Unit Load Devices (ULDs) with flexible fabric door covering. Filled to approximately 85% with cardboard boxes filled with bubble wrap plastic and taped closed.



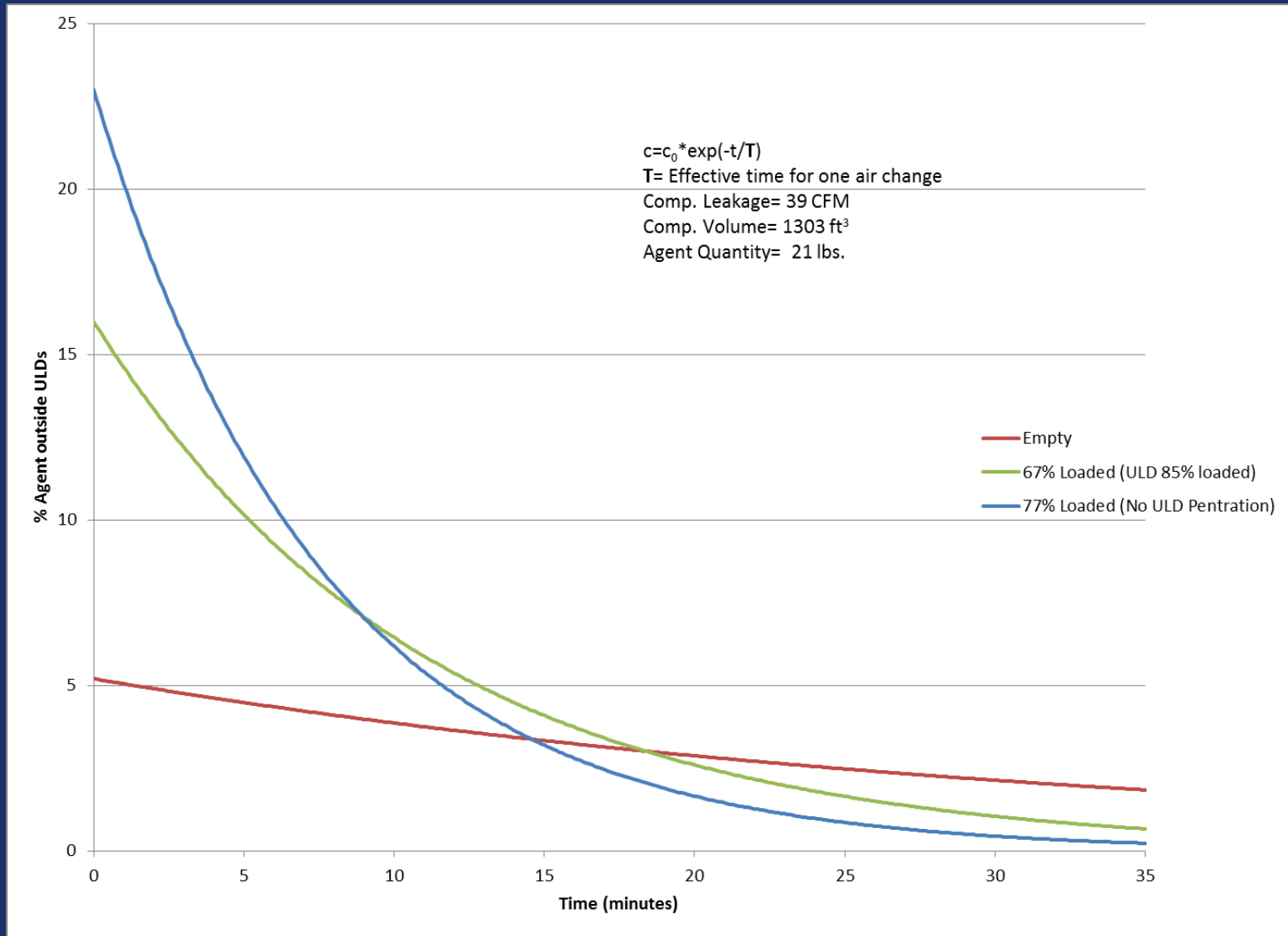
Initial Gas Probe Locations (Some ULDs removed from drawings for clarity)



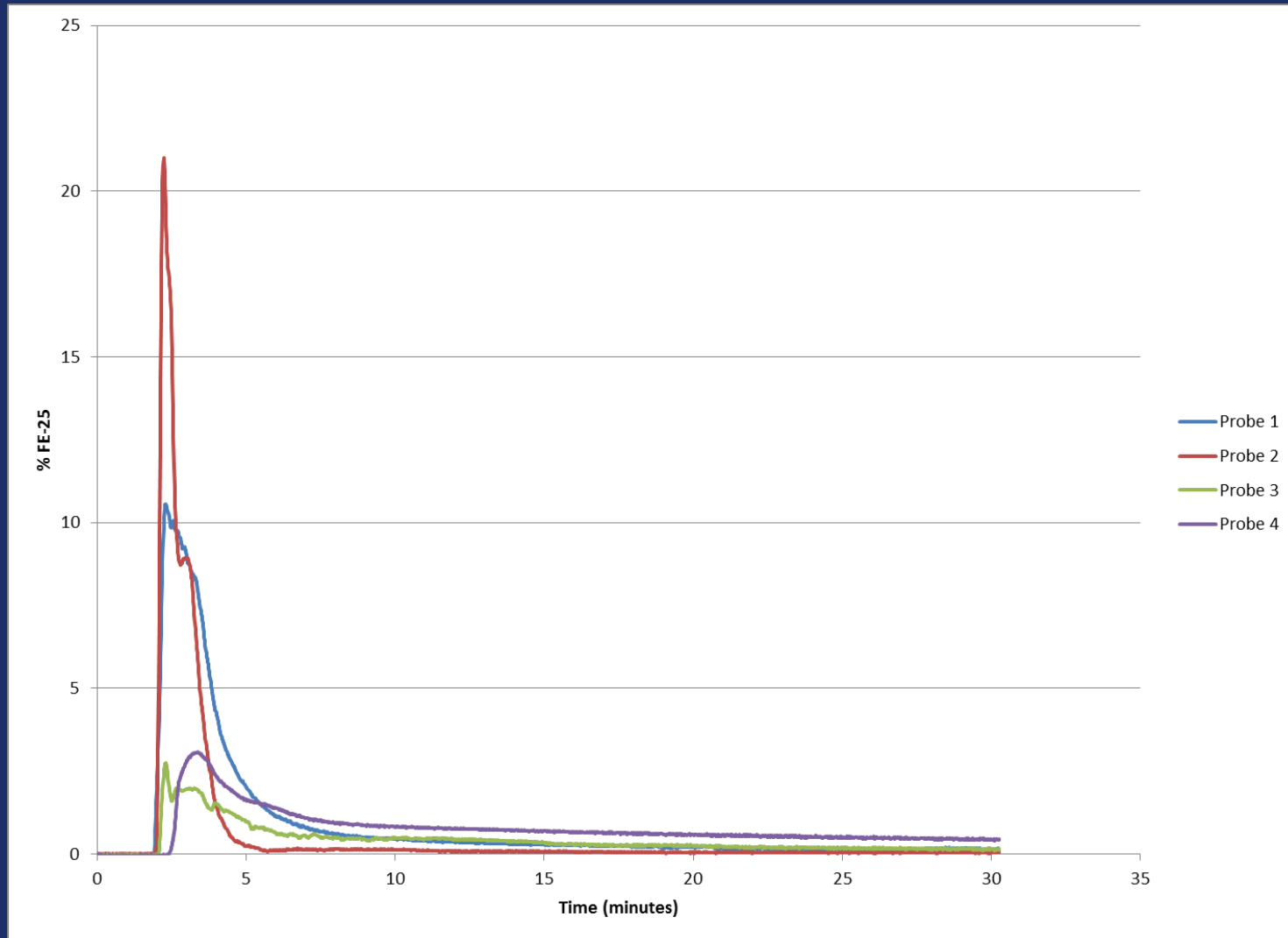
Interior Gas Probes 3 and 4



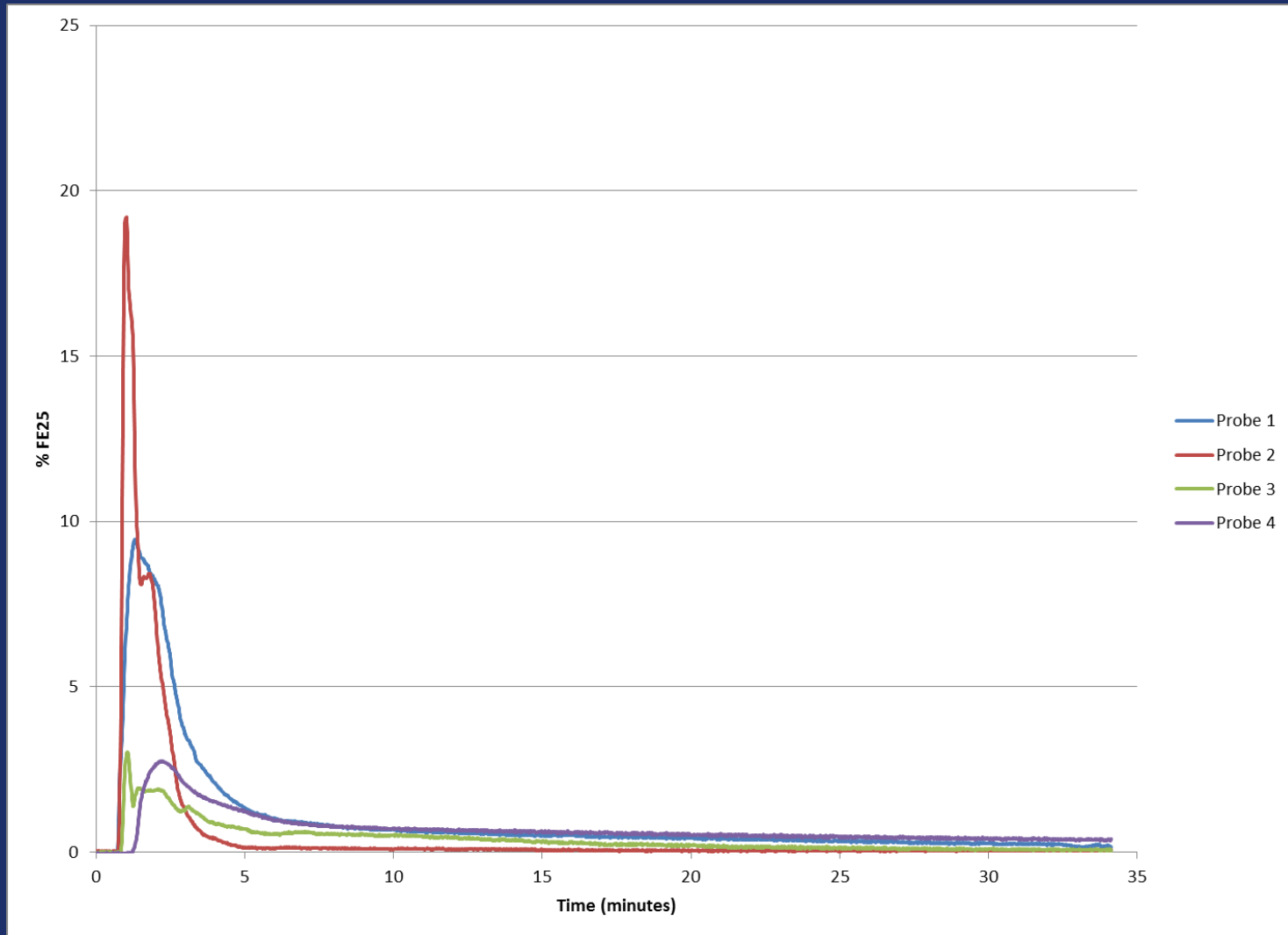
Theoretical Agent Exponential Decay Curves



Loaded Compartment Test 1. 24 lbs FE-25



Loaded Compartment Test 2. 21 lbs FE-25



- **Test results are very preliminary. No conclusions should be drawn at this point.**
- **Additional testing will be conducted to understand preliminary results.** (Installation of pressure transducers, sealing of pressure relief valves, etc.)
- **Probe locations will be varied after initial results are better understood.**
- **Input and test data from others is welcome.**

