Comments on Sensitive Electronics FAQ

<u>Attached sensitivity analysis</u>

The values came directly from NUREG-1934 for the uncertainty values associated with radiant heat flux (1.10, .17). Given their results the lowest predicated heat flux in the cabinet was 2.57. For this value there is a 5% chance of exceeding the threshold of 3kw/m^2. For the highest predicted temperature 2.91, there is a 22% chance of exceeding the critical heat flux value.

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$\delta = 1.1 \quad \tilde{\sigma}_m = 0.17$

$m = 2.57 \quad (2.91)$

$\mu = \frac{m}{\delta} = \frac{2.57}{1.1} = \overset{2.65}{2.34}\ kw/m^2$

$\sigma = \tilde{\sigma}_m \left(\frac{m}{\delta}\right) = 0.17(\overset{2.65}{2.34}) = \overset{0.45}{0.4}$

$P(>3) = \frac{1}{2}\,\mathrm{erfc}\left(\frac{\beta_c - \mu}{\sigma\sqrt{2}}\right)$

$= \frac{1}{2}\,\mathrm{erfc}\left[\frac{3 - \overset{2.65}{2.34}}{\underset{0.45}{0.4}\sqrt{2}}\right]$

$= \frac{1}{2}\,\mathrm{erfc}\,(\underset{0.55}{1.167})$

$= 0.05 \qquad 0.22$

$5\% \qquad 22\%$

Additional Comments

1) Fig 7, the initial temperature of 35 C drops back to 25 C in a few minutes. The authors have just initialized the gas temperature to 35 C. At the start of the cabinet, the hot gas just flows out and doesn't heat up again until the radiated heat penetrates the cabinet wall. In reality, the entire cabinet would be 35 C and it wouldn't cool off so readily.
    a. Possibly add an additional heat source in the form of another vent
2) One minor policy issue – you may not want this statement to set a precedent:
    a. Bottom of page 6: Since the model was not used outside of the limitations identified, it is concluded that the FDS predictions of heat flux is within experimental uncertainty.

       Within the V&V limits does NOT imply within experimental uncertainty.
3) Placing the fire in the same plane as the floor also does not match the scenario that the analysis claims to address. This decision affects fire entrainment and therefore could also affect the results.
4) The absence of a REAC input tells us that authors either failed to specify a fire source or consciously chose to use the default propane fire in FDS. While this probably won't change the results much, the model does not match the analysis.
5) The FDS model only considered the radiative heat flux on the inside of the cabinet instead of net, i.e., radiative plus convective. This probably would not affect the results.
6) The FDS model analyzed two locations inside the cabinet but nothing in between. It is possible that if the equipment is located closer to the surface of the cabinet, it would experience a higher exposure. Considering the uncertainty or sensitivity of the model, this could change the results unless it can be concluded that sensitive equipment is always located at the rear of the cabinet, for instance.