SOURCES OF VARIABILITY IN THE 14 CFR 25 HEAT RELEASE RATE TEST FOR AIRCRAFT MATERIALS

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INTRODUCTION

Materials for new aircraft cabin interiors must meet flammability requirements of Federal Aviation Administration Regulation, Part 25, Section 853 (FAR 25.853). The FAR 25.853 requirement includes a test for heat release rate of large area materials using a fire calorimeter originally developed at Ohio State University (OSU). In the standard FAR 25 procedure a sample is inserted into the combustion chamber of the OSU apparatus and subjected to a calibrated radiant heat flux of 35 kW/m^2 and an impinging pilot flame. Room temperature air is forced through the combustion chamber and exits through the exhaust duct at the top of the apparatus where a thermopile senses the temperature of the exhaust gases. Heat release rate (HRR) during the test is deduced from the sensible enthalpy rise of the air flowing through the combustion chamber using the temperature difference between the exhaust gases and the ambient incoming air to calculate the amount of heat released by burning after suitable calibration using a metered methane diffusion flame. Limits of 65 kW/m^2 and 65 kW/m^2-min for the peak HRR and the 2-minute total heat release (HR), respectively, are placed on large area materials used in passenger cabins of transport category airplanes carrying more than 19 passengers.

Results from a multi-laboratory study in which the same materials were tested according to FAR 25.853 in several OSU fire calorimeters at different locations, indicated that the reproducibility could be improved. There are many factors that can contribute to poor agreement between OSU results obtained in different laboratories (reproducibility), including the accuracy of the heat flux calibration, thermal inertia of the apparatus and its components, and changes in the convective environment in the combustion chamber caused by airflow and airflow distribution. The present study addresses each of these sources of error.