



# Technical Brief

## Methodologies for Studying Furniture Flammability

### Introduction

UL Chemical Safety and the group's University Research Partners conducted a three-year study on chemical exposure risk and flammability of upholstered furniture. The research report, "Human Health in the Built Environment: A Study of Chemical Exposure Risk and Flammability of Upholstered Furniture and Consumer Electronics," is available on UL Chemical Safety's [website](#).

UL Chemical Safety's basic fact sheet, "Research on Chemical Exposure and Flammability Risks of Upholstered Furniture and Consumer Electronics," provides background and key facts.

The research was designed to understand how volatile chemical and flame retardant exposures occur during everyday use of upholstered furniture and to measure the effectiveness of different flammability control technologies applied to the furniture.

### Methodologies

- Flammability performance of the chairs was tested following two techniques: 1) a cigarette smoldering procedure of the chair materials following California Technical Bulletin 117-2013 (TB 117-2013), and 2) an full scale open flame procedure with burn of the completely assembled chairs.
- Materials tested for TB117-2013 smolder resistance test



**California Technical Bulletin 117-2013 (TB 117-2013) smolder resistance test in triplicate.**

included upholstery textile (cover), barrier textile, resilient loose fiber, decking textile, and polyurethane (resilient) foams. The smoldering test was performed in triplicate to determine if the tested material passed or failed based on smoldering duration, the measured char length, and if the mock-up transitioned to flaming conditions. Testing was conducted by California's Bureau of Electronic & Appliance Repair Home Furnishings & Thermal Insulation (BEARHFTI).

- Two laboratory settings, the Furniture Heat Release Calorimeter and the ISO 9705 Test Room, equipped with a large scale heat release calorimeter were utilized for full scale open flame testing.



Furniture Heat Release Calorimeter (left) and ISO 9705 Test Room (right).

- While the Furniture Heat Release Calorimeter measured heat release under well-ventilated conditions, the ISO 9705 Test Room mimicked a realistic fire environment in a residential setting. Since airflow in the ISO 9705 Test Room is through a single doorway opening, available oxygen during the test changes with fire size and influences the combustion processes and hazards generated.

- The open flame tests used a match equivalent 35 mm flame ignition source based upon the European Norm (EN) 1021-2 test standard.

- Measurements of flammability included heat release rate, weight loss, effluent gas emissions, optical density and smoke yield.

- Gas emissions were evaluated for a range of chemicals including carbon monoxide, hydrogen cyanide, formaldehyde, and other volatile organic compounds (VOCs), aldehydes, and flame retardants.

- Measured data were compared across different chair construction types to assess their difference in flammability performance. Heat release rates were compared to the regulated flammability requirement of mattresses. Carbon monoxide, hydrogen cyanide, and other VOCs, aldehydes, and FRs were compared to regulatory threshold levels and/or daily consumer-use expectations.

Full details of all methodologies and references can be obtained from the report and associated Appendix H, “Fire Performance of Upholstered Furniture with Open Flame Ignition Source” on UL Chemical Safety’s [website](https://www.ulchemicalsafety.org).

Learn more about our initiatives at [ulchemicalsafety.org](https://www.ulchemicalsafety.org)