

## Flammability and Smoke Toxicity of Rainscreen Façades

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**Abstract :** Four façade systems were tested using a reduced height BS 8414-2 (5 m) test rig. An L-shaped masonry test wall was clad with three types of insulation and an aluminum composite panel with a non-combustible filling (meeting Euroclass A2). A large (3 MW) wooden crib was ignited in a recess at the base of the L, and the fire was allowed to burn for 30 minutes. Air velocity measurements and gas samples were taken from the main ventilation duct and also a small additional ventilation duct, like those in an apartment bathroom or kitchen. This provided a direct route of travel for smoke from the building façade to a theoretical room using a similar design to many high-rise buildings where the vent is connected to (approximately) 30 m<sup>3</sup> rooms. The times to incapacitation and lethality of the effluent were calculated for both the main exhaust vent and for a vent connected to a theoretical 30 m<sup>3</sup> room. The rainscreen façade systems tested were the common combinations seen in many tower blocks across the UK. Three tests using ACM A2 with Stonewool, Phenolic foam, and Polyisocyanurate (PIR) foam. A fourth test was conducted with PIR and ACM-PE (polyethylene core). Measurements in the main exhaust duct were representative of the effluent from the burning wood crib. FEDs showed incapacitation could occur up to 30 times quicker with combustible insulation than non-combustible insulation, with lethal gas concentrations accumulating up to 2.7 times faster than other combinations. The PE-cored ACM/PIR combination produced a ferocious fire, resulting in the termination of the test after 13.5 minutes for safety reasons. Occupants of the theoretical room in the PIR/ACM A2 test reached a FED of 1 after 22 minutes; for PF/ACM A2, this took 25 minutes, and for stone wool, a lethal dose measurement of 0.6 was reached at the end of the 30-minute test. In conclusion, when measuring smoke toxicity in the exhaust duct, there is little difference between smoke toxicity measurements between façade systems. Toxicity measured in the main exhaust is largely a result of the wood crib used to ignite the façade system. The addition of a vent allowed smoke toxicity to be quantified in the cavity of the façade, providing a realistic way of measuring the toxicity of smoke that could enter an apartment from a façade fire.

**Keywords :** smoke toxicity, large-scale testing, BS8414, FED

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