

## **Toxic Hazards of Hand Extinguishants used on Lithium Battery Fires in Flight Decks**

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Multiple-cell lithium-ion batteries are used to power laptop computers that are often operated in the flight deck by flight crews. The lithium-ion cells have the potential to undergo thermal runaway, resulting in a fire. The typical flight deck contains a Halon 1211 handheld extinguisher that can be used to fight a fire. In order to investigate the toxicity of Halon 1211 and other replacement agents during this scenario, a series of tests were conducted inside a 240 ft<sup>3</sup> enclosure. The study characterizes and compares the relative toxic hazards of Halon 1211 and 2-BTP hand extinguishants against a five-cell 18650 lithium ion battery fire forced into thermal runaway. A small fan was used inside the enclosure to provide mixing. The primary hazards of concern are the acid gas decomposition products of the agents and batteries. The acid gases HF, HCl, and HBr, as well as CO, CO<sub>2</sub>, O<sub>2</sub> and agent concentration histories were determined at 2 heights above floor: 3'6" and 5'6", the nose height of seated and standing crew, respectively. Acid gas samples were collected sequentially in specialized gas collection tubes and were analyzed by ion chromatography. In-line gas analyzers were used to measure the other gases.