**Abstract**

The past decades have seen an exponential growth of the lithium-ion battery (LIB) market as use of this high-energy storage has found applications in nearly every industry. The European Organization for Nuclear Research (CERN) is interested in implementing this technology within their underground network and this literature review is intended to assist with addressing fire and safety concerns. This review is broken into four parts. Part I of this review introduces basic background information about LIBs, internal components, cell structure, cell chemistry, and a hierarchal understanding of different installation levels for LIBS. Part II of this review presents the fire risk and hazard analysis. The critical safety consideration when analyzing LIBs is prevention of a thermal runaway event. The sources of abuse that can cause a thermal runaway event (thermal, mechanical, and electrical abuse) are defined within this part of the report, as with the general internal decomposition stages as a LIB approaches thermal runaway. This focus on thermal runaway is important because at the point a LIB cell enters thermal runaway the internal heat generation within the compromised cell exceeds the cooling effects surrounding the compromised cell. An internal exothermic reaction can be a consequence from this unbalanced transfer of heat energy resulting in one or a combination of fire and safety hazards (i.e., toxic and flammable gas generation, fire, explosions, jet flames/flaming projectiles, electrical, and reignition). The factors that impact the severity and probability of each risk and hazard are also detailed in this part of the report to better address incident preparedness. Part III takes the fire risk and hazard analysis from part II, applies it to tunnel installations at CERN, and review current fire and hazard detection, prevention, mitigation, suppression, and extinguishing technologies. Key recommendations on implementation of the reviewed technologies within the CERN underground facility conclude this part. Part IV of this report begins with identifying current research gaps affecting this review and ends with the conclusion of the findings from this literature review.

**Keywords**: lithium-ion battery, hazards, risks, thermal runaway, detection, fire protection