Methodology for Assessing the Impact of Smoke Dispersion from Energy Storage System Fires on Surrounding Areas

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Abstract:

Energy storage systems (ESS) predominantly consist of lithium-ion batteries, which, during fires, exhibit prolonged combustion durations and frequent reignition, releasing substantial volumes of hazardous smoke. This poses significant threats to human safety and environmental health. This study employs computational fluid dynamics (CFD) modeling to simulate the heat release rate (HRR) and the dispersion patterns during ESS fires. Additionally, calculation of thermal radiation intensity is crucial for assessing the potential heat impact on nearby structures and personnel. Key methodologies for evaluating smoke hazards include smoke dispersion modeling, toxicity analysis, and visibility assessment. DNV Phast software was utilized to simulate smoke dispersion, predicting its propagation direction and range under varying conditions. Visibility impairment caused by smoke is also a critical evaluation factor, particularly during emergency evacuation and firefighting operations. These assessment techniques not only support the development of more effective emergency response strategies but also drive safety-oriented improvements in ESS design to mitigate fire risks and associated impacts. This approach substantially enhances awareness and management capabilities concerning smoke hazards from ESS fires.