

VERIFYING FIRE SAFETY OF TOP-LOAD STORAGE AND RETRIEVAL SYSTEM: A CASE STUDY

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ABSTRACT

The Top-Load Automated Storage and Retrieval System (TL-ASRS) is an emerging storage system technology that has gained popularity in the previous years. It allows increasing the storage density in a warehouse. However, from a fire safety point of view, this cutting-edge technology introduces an unstudied hazard. Recently, experimental sets have been performed to validate the performance of sprinklers on this storage system. Therefore, coupling these studies with the high-consequence fire incident prompted an insurance company to release in 2017 a prescriptive guideline. In this regard, additional in-depth studies of the benefits, risks, pitfalls, and strategies are necessary before this system becomes ubiquitous. This thesis proposes a fire protection study on a TL-ASRS. A probabilistic risk assessment (PRA) methodology was used to evaluate an alternative fire safety design. The adequate safety level of the design was evaluated using a comparative acceptance criterion. The tolerability limit was based on the existing prescriptive guideline. After the alternative design was evaluated, a cost-benefit analysis (CBA) was prepared to compare both fire safety alternatives. It was demonstrated that following a PRA methodology to propose an alternative fire safety design for a cutting-edge warehouse technology gives the stakeholders a complete fire decision tool. However, there is not a clear methodology to establish a tolerability limit. Besides, a comparative acceptance criterion can be easily over-penalized by the models and assumptions used. Nevertheless, an alternative design based on smoke and heat control was found to be acceptable for the fire protection of a TL-ASRS. Additionally, the CBA concludes that the alternative design represents a better investment than the prescriptive one.