ABSTRACT

An uncontrolled fire in a nuclear facility can be a very energetic event. The majority of fire dynamics, fire risk evaluations will focus on electrical cables because of their thermal fragility.

Due to the importance of the cable spreading room (CSR) in Nuclear Power Plants (NPPs), the thesis is concerned with the early detection of fire in CSR and the protection of the CSR against fire spread. A fire modeling is applied to determine the transport of heat and smoke by simulating the fire in a standard cable spreading room in NPPs using a single-room two-zone model CFAST. The results from the simulation show that the response of the smoke detector in the room is very high, which is very dangerous for the cables and the plants in the room. Accordingly, a solution to the delay of the detection is proposed by forcing Mechanical Ventilation that should reduce the smoke and the temperature of the room after the smoke detector had triggered the alarm. The solution would hinder the fire from spreading so enough time will be available to fight the fire before real damages occur.

A new hybrid fast fire vision detection algorithm is proposed by using two optimizing back propagation algorithms to detect fire in the cable spreading room as early as possible. Each algorithm is evaluated and benchmarked. The new algorithms form real time implementation for recognizing any abnormal state in any room such as fire smoke. The proposed algorithm was compared with other similar ones and results are presented.

Comparison between results of modeling and the proposed fire vision detection algorithm are also provided.