

Fire and Explosion Consequence Modeling Using Fire Dynamic Simulator: A Case Study

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Abstract : Accidents involving fire occur frequently in recent times and their causes showing a great deal of variety which require intervention methods and risk assessment strategies are unique in each case. On September 4, 2020, a fire and explosion occurred in a confined space caused by a methane gas leak from an underground pipeline in Baitus Salat Jame mosque during Night (Esha) prayer in Narayanganj District, Bangladesh that killed 34 people. In this research, this incident is simulated using Fire Dynamics Simulator (FDS) software to analyze and understand the nature of the accident and associated consequences. FDS is an advanced computational fluid dynamics (CFD) system of fire-driven fluid flow which solves numerically a large eddy simulation form of the Navier-Stokes's equations for simulation of the fire and smoke spread and prediction of thermal radiation, toxic substances concentrations and other relevant parameters of fire. This study focuses on understanding the nature of the fire and consequence evaluation due to thermal radiation caused by vapor cloud explosion. An evacuation modeling was constructed to visualize the effect of evacuation time and fractional effective dose (FED) for different types of agents. The results were presented by 3D animation, sliced pictures and graphical representation to understand fire hazards caused by thermal radiation or smoke due to vapor cloud explosion. This study will help to design and develop appropriate respond strategy for preventing similar accidents.

Keywords : consequence modeling, fire and explosion, fire dynamics simulation (FDS), thermal radiation

Conference Title : ICFSSST 2021 : International Conference on Fire Safety Science and Technology

Conference Location : Sydney, Australia

Conference Dates : December 02-03, 2021