

Chaiyapruk Surittikul 2008: A Numerical Investigation of Smoke Spread Behavior in a Power Plant Fire. Master of Engineering (Fire Protection Engineering), Major Field: Fire Protection Engineering, Interdisciplinary Graduate Program. Thesis Advisor: Mr. Nathasak Boonmee, Ph.D. 148 pages.

This thesis presents a numerical study of smoke spread behavior in a power plant building fire. A computational fluid dynamics fire model called Fire Dynamics Simulator (FDS) developed by National Institute of Standards and Technology (NIST) was employed in the study. FDS uses Large Eddy Simulation (LES) for turbulence and a mixture fraction based infinitely fast chemical reaction for flame combustion. The simulation was performed for a typical power plant building installation layout in Thailand. The power plant building is 32 m wide 99 m long and 20 m height. Based on worst case scenario, a fire of 10, 50 and 131 MW was assumed to occur in a 3<sup>rd</sup> floor lubrication pump room.

The study was carried out for 3 cases: 1) a building without smoke ventilation system and 2) a building with natural smoke ventilation system and 3) a building with mechanical smoke ventilation system.

The study on the 10 and 50 MW show that when the smoke ventilation system is installed, smoke is continuously extracted from the building. The smoke layer always stays at about 5.73 and 6.04 m respectively. But the study on the worst case scenario 131 MW shows that when the smoke ventilation system is not installed, smoke can rapidly spread cover the 3<sup>rd</sup> floor (within approximately 240 seconds) blocking all the building exits. The average smoke temperature is about 690 °C. This hot smoke has potential to cause the building steel structure to collapse. When the smoke ventilation system is installed, smoke spreading time cover the 3<sup>rd</sup> floor expand to 450 s providing that people can safety exit from the building. The average reduced smoke temperature is about 620 °C.

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Thesis Advisor's signature