THE REAR PAN POOL FIRE LOCATION IN COMPARTMENT FIRES OF CFD

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Abstract

Fire is the most common and occurring accidental hazards that normally occurs in our homes, work places, factories, chemical and processing industries. The pool fires are the most and frequent huge loss of lives and property which are caused by arson and accidental fire in such that can be affected by other equipment of plants and the environment with severe consequences. Modelling of such phenomenon helps in the risk assessment analysis. The works that examine the model which predict the pool fires in the burning rate with fire ranging from 0.1m in diameter in an experimental scale compartment (centre). The fire location and compartment have a significant impact on the rate of heat release rather than in the transitional use of a simple derived equation with their full range of the impact of pool fire location in a computational fluid dynamics (CFD). Modelling allows greater knowledge of the pool fire that provides the ability to enable and understand the complex scenario. The research is outline in the evaluation of the fire dynamics (FDS) analytical modelling of pool fires burning rates

Keywords: pool fires, fire growth, FDS. Fire.

Introduction

The past decade in the fire safety engineer research and with the most recent performance base on the risk of compartment fire that lead to a possible cause loss of life and property within our environment and a fire development in a room. In particular, records of the modern furniture materials are presently available in our homes and other buildings are likely to produce an enormous volume of smoke and may contain an amount of fuel in the smoke layer whilst they burn. The dispersion of smoke, heat, and gasses in a confirmed environment can be dangerous to occupants with the recent improvement in the research of fires compartment in an area of computational fire modelling

The use of computational fluids dynamics (CFD), and the smoke view model are commonly used as a tool in a fire simulation environment which provide a significant advantage in fire model in general scenarios, however, some of the factors can hinder a fire development in a compartment are enclosure geometry, ventilation, fuel types, and properties. Given the explanation of pool fires in the study, it is well known that the effects of fire compartments were due to the ventilation and radiation which play an important role in the burning rate of pool fire in compartments. However, there is a significant effect on the fire dynamics and heat release rate with an enclosure, the compartment location can have a district effect on a fire dynamics development.

The paper examines the impact of fire location with a compartment upon the rate of heat release, a sequence of fire compartments on heptane pool fires located in three evenly distributed locations within a compartment (centre) are detailed and the result presented. The main goal of the research is to determine the impact of a compartment of fires that plays an important role in fires compartment.

The fire engineers are interested in the pool fire sizes, which means that the diameters greater than 0.2 m, the heat transfer is administered by the radiation back of the surface. The pool fires with diameters must be between 0.2 m and 1 m where the flame is considered by the optically slim and whereas the pool fires are even greater than 1 m in diameter flame is optically thick. The pool fire burning rate is greater than 0.2 m, which can be estimated using the semi-theoretical expression:

$$q' = \Delta hc\ m f = \Delta hc\ \dot{m}_{\circ} \lceil 1-\exp(-k\beta D)] A\rho$$

The size of the pan for heptane is 0.2 m square in the free burning heat release rate which is expected to be 100KW using typical values for the heptane:- ($\dot{m}$=0.101kg/s.m^2, kβ=1.1m^{-1},=Δhc=44.6MW)

The heat release rate is expected in an enclosure sufficient enough to cause a flashover which can be derived from the calculation using the following expression:

There are differences in ventilation geometries represented by this study in which most of the ventilation is limited in a small door opening of 0.2m wide by 0.98m high. The geometry of the pool fire represents the difficult scenario in terms of the radiation that enhances the mass-loss rate. The whole fuel surface perceives the hot upper layer and the boundaries surface. More complex fuels such as the furniture will be partially protected from the compartment environment as well the fuel radiation will reach the fuel surface.

Simulation and Procedure of FDS

The simulation was conducted using the fire dynamics simulator Version 6.0 to perform thirteen simulations showing multiple pan locations as described in this paper. The simulations were executed in 1.42m long by 0.98m wide by 0.95m high compartments designed in the fire dynamic simulator.

Heptane pool fires were used in all the experiments, with 1.42 m by 0.98 m wide and 0.95 m long the pan can be positioned in 2 different locations within the room for every corresponding change in the opening ventilation. These locations are as follows (based on the dimensions of the pan centreline)

1. Front location: The pan in the rear location was position was located 0.3m from the front of the compartment

2. Centre location: The pan in the centre location position was located 0.13m from the front of the compartment.

FDS-SMV version 6 which was installed and downloaded on a of laptop 64 bits window operating system, a minimum of 2GB of RAM, the FDS, and calculation which create a lot of sub-files directories, FDS, wrote a command prompt to explain the characteristics including the fuel properties and material properties, Run the CMFDS application to stimulate the ventilation of the pool and the impact of the location of the fire in the compartment using the command already created, insert the file "sample. fds") enter and the desktop that show a command FDS, then the input FDS files will be created, cd desktop, enter, cd room files, enter and fds. Files name, the job will start running thereby gaining a good understanding of the impact of fire located in compartment fires.

Figure 1: A sketch of a fire simulation arrangement compartmental showing the three pool fire locations

Figure 2.: Rear Pan fire Location for a compartments for using FDS-SMV version 6

Figure 3: Rear Pan Simulation

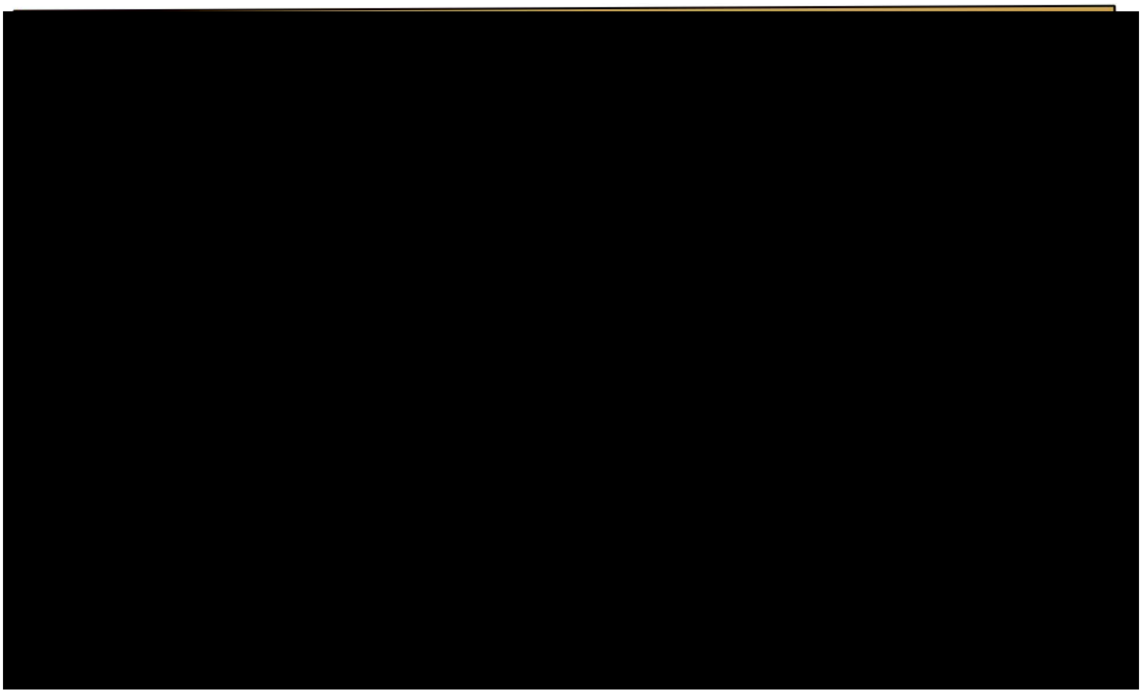

Figure 4: Rear pan location displaying the pool fire temperature at its peak.

Figure 3: The simulation represents the pan at Rear pan location from the figure which illustrated as a successful as the pool reaches a certain point of the combustion that due to proximity to the ventilation windows the fire quickly dissipated as expected

Figures 4: The door show the vent geometries for Rear pan location of a pool fire in a compartment with the procedure of FDS -SMV version 6 simulation with the centre pan showing a significant impact due to the radiation feedback in a room compartment.

Results and discussion

Figure 5: The three pan location (Rear, Centre and Rear)

Figure 4: The above graph

shows temperature of the analysis for each of the pan locations in the room compartments for rear pan locations graph starting at 0.01sec at 7000^{o} C and stopping at 50sec which is the second highest from the graph for the full vent geometry.

Conclusions

1. From the research of the analysis results, it is clear fire location has a significant effect on a pool fires compartments, it shows clearly that the pan simulation in the fire compartment of the simulation occurred in the fire stages

2. The Temperature was constituent for all the three pan locations with the full vent opening from the centre location during the simulation.

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