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ACCEPTED MANUSCRIPT

Effect of tank diameter on thermal behavior of gasoline and diesel storage tanks fires

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Highlights

- Storage tanks fires experiments: diameters ranging from 0.04 m to 4.28 m
- Fuels burned: regular gasoline (blend of gasoline and ethanol) and diesel oil S-500
- Main objective: relate temperature profiles adjacent to the tanks with the diameters

ABSTRACT

Studies on fire behavior are extremely important as they contribute in a firefighting situation or even to avoid such hazard. Experimental studies of fire in real scale are unfeasible, implying that reduced-scale experiments must be performed, and results extrapolated to the range of interest. This research aims to experimentally study the fire behavior in tanks of 0.04 m, 0.20 m, 0.40 m, 0.80 m and 4.28 m diameter, burning regular gasoline or diesel oil S-500. The following parameters were here obtained: burning rates, burning velocities, heat release rates, flame heights, and temperature distributions adjacent to the tank. Such parameters were obtained for each tank diameter with the purpose of correlating the results and understanding the relationship of each parameter for the different geometrical scale of the tanks. Asymptotic results for larger tanks were found as (regular gasoline and diesel oil S-500, respectively): burning rates 0.050 kg/(m²·s) and 0.031 kg/(m²·s), burning velocities 4.0 mm/min and 2.5 mm/min, heat release rates per unit area 2200 kW/m² and 1500 kW/m², normalized averaged flame heights (H_i/D, where H_i is the average flame height, D is the tank diameter) 0.9 and 0.8. Maximum temperatures for gasoline pools were higher than for diesel oil pools, and temperature gradients close to the tanks were also higher for the former fuel. The behavior of the maximum temperature was correlated as a function of the tank diameter, the heat release rate of each fuel and the dimensionless distance from the tank.

Keywords: Industrial fire; storage tank; gasoline; diesel oil; reduced-scale experiment.

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