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TEERAPAT PETCHUAY : SIMULATION OF TEMPERATURE DISTRIBUTION IN THE CASE OF HOT WATER DISCHARGED INTO A WATER STREAM.
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A three-dimensional temperature distribution in the case of hot water discharged into a water stream was simulated by using computational fluid dynamics (CFD) technique. The governing equations consist of continuity equation, momentum equations, energy equation and $k-\varepsilon$ turbulence model which includes buoyancy effect. A computer program called PHOENICS was adopted to solved these equations under a finite-volume method. To verify the accuracy of the mathematical model, the temperature distributions obtained from the simulation were compared with experiment results in the case of hot water discharged into a rectangular duct (0.2m x 3.35m x 0.1m), with water moving inside. The flow rates of the hot water are 0.013, 0.028, 0.046 liter/sec and the temperature different between the hot water and the moving water are 20, 25, 30 Celsius. It is found from the comparison that the different between calculated and measured temperature were in the range of 0.1-0.7 Celsius.

The validated model was used to simulate a case assuming that the cooling water from 1,000 MW power plant was discharged into the Chaopraya river. The simulation was conducted in order to study the effect of water flow rate in the river, diameter of a discharge pipe, temperature difference between cooling water and the river temperature, and heat transfer at the river surface, on temperature distribution in the Chaopraya river in which the water discharged rate is fixed through out all cases. Result of the simulations show that the temperature increase in the river is higher when the flow rate of water in the river decreased. Considering the effect of discharged pipe diameter, a pipe of small diameter causes the temperature increase of the river less than those affected from large pipe due to high rate of mixing. Increasing the temperature difference between cooling water and the river temperature significantly increases the temperature of the river in the near field of the mixing point. Finally, heat loss through the water surface causes further decreasing in the mixing temperature downstream of the discharge location.

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