SEMINEAR

Thursday, October 24, 2002 4:30 p.m.
(refreshments at 4:15 p.m.)

366 Hollister Hall

Mixing and Dilution Problems: A Buoyant Jet in a Small Crossflow

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Environment Seminar Series (CEE 601)
School of Civil and Environmental Engineering, Cornell University

Abstract

With stringent environmental laws on pollution, the study of the disposal of effluents through outfalls into lakes and oceans has become increasingly important. The ocean has long been considered as the receiving body for water-borne waste products resulting from human activities due to its assimilative capacity for large quantities of biodegradable pollutants. To increase dilution, disposal usually occurs via a large pipeline on the ocean floor ending with a number of side outlets, called a diffuser. A number of models have been developed in the past years, which are able to make reasonable prediction of the behavior of such flows. While the available models for buoyant jets have achieved significant success in predicting the spreading pattern and concentration distribution, there are still shortcomings. These include accurate modeling of the transition regions in the flow and a description of the read time concentration fluctuations. Accurate prediction of the behavior of the transition flow region is of considerable practical importance because the transition occurs a short distance from the diffuser outlets in the common situation of a wastewater discharge into a large receiving body of water.

The entrainment into buoyant jets in a weak crossflow is investigated using a particle image velocimetry (PIV) technique to obtain a detailed picture of the entrainment velocities. The experiments show that the entrainment velocities can be superimposed in the irrotational region. This implies that, given the entrainment velocity for a buoyant jet in a still medium, the entrainment velocity in a moving medium can be calculated by adding the crossflow velocity to the entrainment velocity in a still medium. The implications of this lead to an additional term in the integral momentum equations and show how the normal entrainment changes naturally into the forced entrainment formulation at higher crossflows.

Further information on the Environment Seminar Series as well as a list of future speakers can be found at: http://ceeserver.cee.cornell.edu/eac20/cee601/

or contact Prof. Edwin (Todd) Cowen (eac20@cornell.edu).