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Flow turbulence characterization in a large scale bubble plume facility CARLOS GARCIA, MARCELO GARCIA, University of Illinois at Urbana-Champaign — The objective of the study consists of characterizing the flow turbulence in a large scale bubble plume facility based on a set of water velocity measurements conducted in a large tank (diameter = 15m) at a wastewater treatment plant. The tank was filled to a depth of 7m above the diffuser and six different air discharges were analyzed. Six acoustic Doppler velocimeter probes were placed on a down rod and arranged vertically at different distances above the diffuser. Data were collected during a period of 20 minutes at each of the more than ten radial locations. A hydrodynamic analysis of the generated bubble plume was performed first in order to characterize the frequency of the swinging motion of the plume. This information was used to remove this low frequency oscillation component by filtering the recorded velocity signals. Turbulence parameters such as turbulent kinetic energy, turbulence time and length scales, and dissipation rate of turbulent kinetic energy were then computed based on the processed signals. The results help to understand the bubble phenomenon and provide basis for the validation of numerical models of bubble plume systems used in the design of combined-sewer-overflow reservoirs. These reservoirs are being built by the Metropolitan Water Reclamation District of Greater Chicago as part of the Chicago land Tunnel and Reservoir Plan.

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