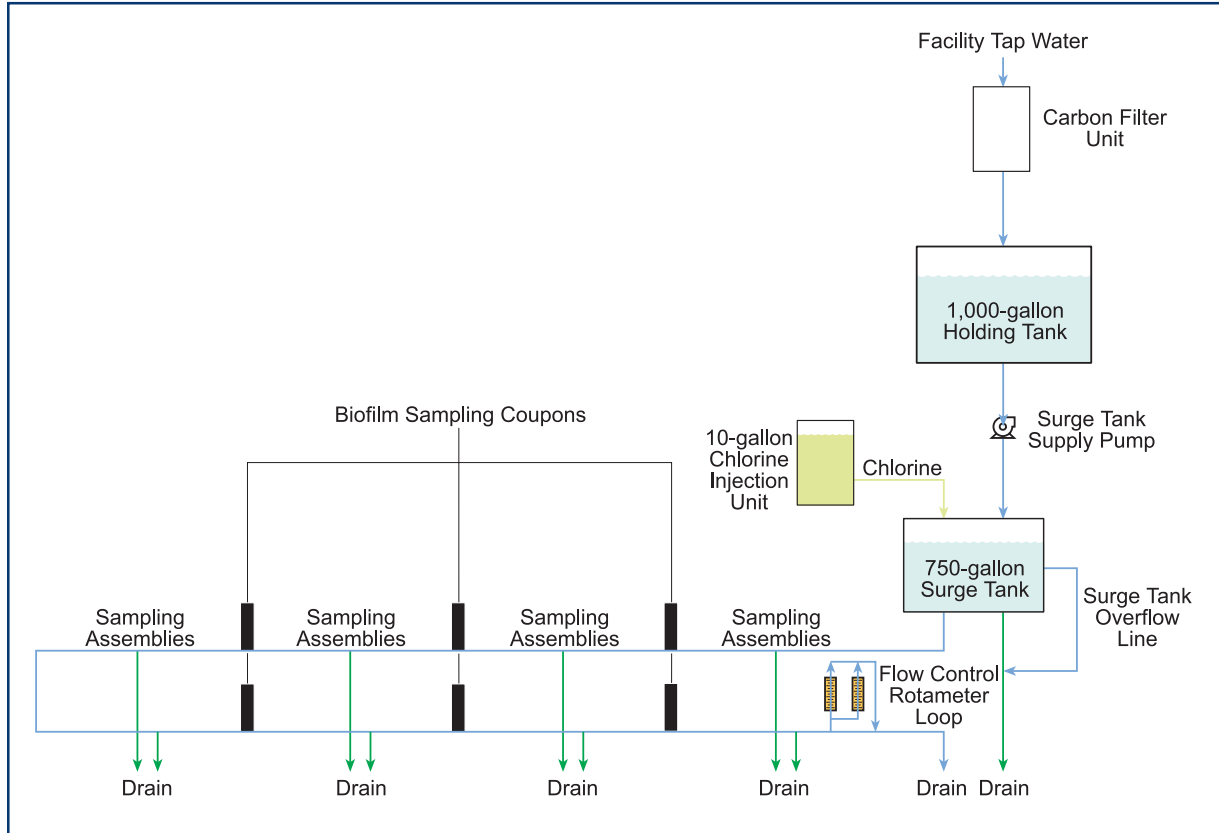


Chlorine Consumption in Dead-End Pipes: Roles of Dynamic Flow Conditions

U.S. EPA Test and Evaluation Research Facility



Schematic of Dead-End Pipe System

Objectives:

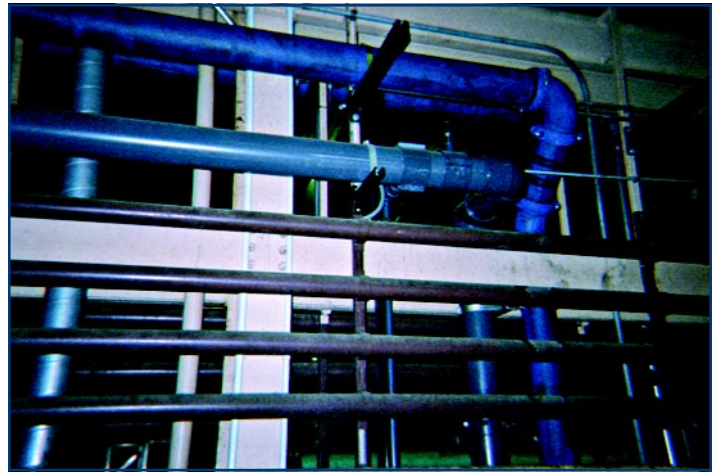
The dead-end pipe system is designed to simulate conditions encountered in a typical drinking water distribution system. Residual chlorine in drinking water reduces the occurrence of water-borne pathogens and diseases. Chlorine, however, is a nonselective oxidizing agent that will react with numerous organic and inorganic substances. The purpose of this project is to determine the fate and

transport of chlorine in the dead-end zone of a water distribution system and the consequential impact on water quality. The primary focus is to determine the effect of dynamic flow patterns on pipe wall consumption of chlorine. A secondary objective is to monitor the impact on general water quality parameters resulting from various flow conditions.

Dead-End Pipe System Overview:

The dead-end pipe system consists of two individual pipe systems, one is constructed of polyvinyl chloride (PVC); the second system is constructed of cement-lined steel pipe. Each main pipe is 6 inches inside diameter and approximately 350 feet long. The main pipes are positioned approximately 20 feet above the floor level of the T&E Facility high bay, supported in a pipe rack.

Several 1-inch pipes extend vertically from the main pipe to the facility drain, which runs north/south in the center of the high bay. These 1-inch lines are designed to simulate water distribution service lines. They are fitted with valves for draining and sampling. Feed water for both pipe systems is passed through a carbon filtration unit to remove chlorine (and other residuals) and is stored in a surge tank for use in the system.



The PVC and Cement-Lined Steel Main Dead-End Pipes

Experimental Approach:

During a test, the chlorine concentration of the feed tank is set in the range of 0.1 to 50 mg/L (as free chlorine). The flow rate through the system is set in the range of 0 to 20 gallons per minute (gpm). The duration of each test is commonly one to four weeks. A series of tests are typically conducted sequentially by varying the flow rate through the pipe at a constant free chlorine concentration. The biofilms that grow on the main pipe wall during simulated test conditions are sampled using "coupons". Coupons are circular metallic pieces attached to metal rods that are inserted through several openings (coupon ports) in an individual pipe wall. These coupons, once inserted properly in the coupon port, are flush with the inside wall of the pipe. After completing a study (or during a study), these coupons are removed and the biofilm is analyzed to evaluate the biofilm accumulation under different experimental conditions.



Sampling Assembly and Other Components of the Dead-End Pipe System

EPA Contacts:

Mark C. Meckes
U.S. EPA Microbial Research Center
Microbial Contaminants Control Branch
26 West Martin Luther King Drive
Cincinnati, Ohio 45268
Phone: **(513) 569-7348**
Fax: **(513) 569-7185**
E-Mail: meckes.mark@epamail.epa.gov

IT Contacts:

Majid A. Dosani
IT Corporation
11499 Chester Road
Cincinnati, Ohio 45246
Phone: **(513) 569-7062**
Fax: **(513) 569-7707**
E-Mail: mdosani@theitgroup.com

E. Radha Krishnan, PE
IT Corporation
11499 Chester Road
Cincinnati, Ohio 45246
Phone: **(513) 569-7063**
Fax: **(513) 569-7707**
E-Mail: krishnan.radha@epamail.epa.com

