

## Reactor Characteristics

### Introduction

Chemical, biological and physical processes in nature and in engineered systems usually take place in what we call "reactors." Reactors are defined by a real or imaginary boundary that physically confines the processes. Lakes, segments of a river, and settling tanks in treatment plants are examples of reactors. Most, but not all, reactors experience continuous flow (in and out). Sequencing batch reactors have a sequence of states including fill, react, and empty. It is important to know the mixing level and residence time in reactors, since they both affect the degree of process reaction that occurs while the fluid (usually water) and its components (often pollutants) pass through the reactor.

Chlorine contactor tanks are designed to maximize the contact time between chlorine and pathogens before the water is delivered to consumers. Thus the design objective is to maximize the time that it takes for water to travel from the tank influent to the effluent. Tracer studies can be used to determine the hydraulic characteristics of a reactor such as the disinfection contact tanks at water treatment plants. The results from tracer studies are used to obtain accurate estimates of the effective contact time. In this laboratory students will experiment with different reactor designs with the goal of maximizing the contact time.

### Reactor Classifications

#### Dispersion

Mixing levels give rise to three categories of reactors; completely mixed flow (CMFR), plug flow (PFR) and flow with dispersion (FDR). The plug flow reactor is an idealized extreme not attainable in practice. All *real* reactors fall under the category of FDR or CMFR.

#### Boundary Conditions

The reactor inlet and outlet boundary conditions significantly affect the reactor response to the addition of a pulse of tracer. If dispersion is possible across a boundary, then the boundary is open. An example of a reactor with open boundaries is a section of a river. If a tracer is added to a section of a river it is possible for some of the tracer to move upstream, illustrating that an arbitrary section of a river is an open reactor (Figure 5-1). This is equivalent to letting the reactor be

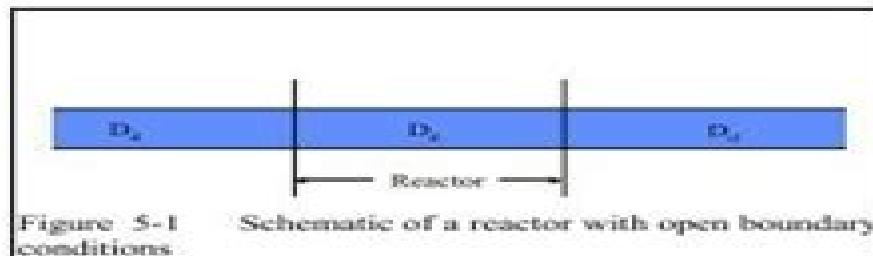


Figure 5-1 Schematic of a reactor with open boundary conditions

# Environmental Lab Manual In Civil Engineering

**M. A. Karim**



## **Environmental Lab Manual In Civil Engineering:**

**Lab Manual for Environmental Engineering** Baranitharan B, 2016-08-12 This manual introduces the application of basic chemistry and chemical calculations to measure physical chemical and bacteriological parameters like turbidity and colour dissolved oxygen hardness pH alkalinity organic content Sulphates Fluorides Iron Total Settle able solids chloride Suspended and Dissolved Solids Ammonical Nitrogen Bacteriological Analysis chemical and biochemical oxygen demand of water and wastewater Laboratory methods and interpretation of results with regard to environmental engineering applications such as design and operation of water and wastewater treatment processes and to the control of the quality of natural waters are also explored As a result of these tests various remedies can be suggested to reduce the environmental pollution The purpose of this laboratory manual is to make the people aware of the dangerous effects of environmental pollution

Environmental and Hydraulic Engineering Laboratory Manual Gang Chen, Simeng Youneng, 2017-08 This laboratory manual is comprised of 14 laboratory experiments covering topics of water quality water treatment groundwater hydrology liquid static force pipe flow and open channel flow These experiments are organized with a very logical flow to cover the related topics of environmental and hydraulics engineering within university level courses This state of the art manual is divided into two sections environmental engineering experiments and hydraulic engineering experiments with seven experiments for each section It provides the basic hands on training for junior year civil and environmental engineering students In each experiment fundamental theories in the topic area are revisited and mathematic equations are presented to guide practical applications of these theories Tables figures graphs and schematic illustrations are incorporated into the context to give a better understanding of concept development experimental design and data collection and recording Each experiment ends with discussion topics and questions to help students better understand the content of the experiment This manual mainly serves as a textbook for an environmental and hydraulics engineering laboratory course Professionals and water wastewater treatment plant managers may also find this manual of value for their daily jobs In addition students in related areas can use this manual as a reference and the general public may use it to educate themselves on water quality testing and water flow

**Environmental Engineering Laboratory Manual** Robert L. Sanks, Montana State University (Bozeman, Mont.). Department of Civil Engineering and Engineering Mechanics, 1974

**Lab Manuals**, 2022-12-28 This laboratory manual is designed to acquaint the student with essential civil engineering experimentation works and various tests to be carried out on and offsite which is required by every civil engineer when he or she enters in a professional set up This lab manual covers various subjects like Mechanics of Solids in which compressive flexure and tensile strength testing is done Engineering Geology where geological properties important from civil engineering point of view are studied Building Material and Concrete Technology lab where testing of material is done Fluid Mechanics lab which is designed to examine the types and various parameters of fluid flow Applied Hydraulics lab where students study on the

models of hydraulic machinery Surveying lab where students get to know about field surveying like chain and compass survey Theodolite Survey and Total Station Survey Transportation lab where bitumen and testing of aggregates used for road work construction is done Geotechnical lab where properties and the strength parameters of the soil are studied Environmental lab where the quality of water and waste water is checked various tests on solid waste samples are done and noise levels at various places are checked Each experiment starts with objectives to be achieved the experimental set up and the materials that are needed to perform the experiment and a stepwise procedure for conducting the experiment and a set of MCQ s at the end The students will note down their observations measurements and or calculations on the Results Sheets provided at the end of the experiment

**Laboratory Manual for Groundwater, Wells, and Pumps** Rohitashw Kumar,Vijay P. Singh,Munjid Maryam,2023-05-23 The over exploitation of groundwater and marked changes in climate over recent decades has led to unacceptable declines in groundwater resources Under the likely scarcity of available water resources in the near future it is critical to quantify and manage the available water resources With increasing demand for potable water for human consumption agriculture and industrial uses the need to evaluate the groundwater development management and productivity of aquifers also increases Laboratory Manual for Groundwater Wells and Pumps serves as a valuable resource and provides a multi disciplinary overview for academics administrators scientists policymakers and professionals involved in managing sustainable groundwater development programs It includes practical guidance on the measurement of groundwater flow soil properties aquifer properties wells and their design as well as the latest state of the art information on pumps and their testing and groundwater modeling Features Covers basics of groundwater engineering advanced methodologies and their applications and groundwater modeling Examines groundwater exploration planning and designing and methods for formulating strategies for sustainable management and development Serves as a reference for practitioners on practical applications and frequently occurring issues of groundwater investigations development and management

*Water and Wastewater Engineering I* State University of New York at Buffalo. Department of Civil Engineering,1982

**Gulf Conference on Sustainable Built Environment** Ali Bumajdad,Walid Bouhamra,Osamah A. Alsayegh,Hasan A. Kamal,Salem Falah Alhajraf,2020-04-07 This volume brings together outstanding contributions to the Gulf Conference on Sustainable Built Environment held at the Marina Hotel Kuwait near Kuwait City The Proceedings collects 29 papers on a range of engineering and materials challenges and best practices addressing development of new sustainable building materials performance improvement of structures and tall buildings developing monitoring and analysis techniques and frameworks for existing infrastructure under environmental effects development of long term sustainability plans for building stock and development of energy efficient buildings in the gulf region The Conference was organized by the Kuwait Foundation for the Advancement of Sciences KFAS the Massachusetts Institute of Technology the Kuwait Institute for Scientific Research and Kuwait University

*Water and Wastewater Engineering II* State University of New York at Buffalo.

Department of Civil Engineering,1979      *Interdisciplinary Teaching About Earth and the Environment for a Sustainable Future* David C. Gosselin, Anne E. Egger, J. John Taber, 2018-12-13 Interdisciplinary Teaching about the Earth and Environment for a Sustainable Future presents the outcomes of the InTeGrate project a community effort funded by the National Science Foundation to improve Earth literacy and build a workforce prepared to tackle environmental and resource issues The InTeGrate community is built around the shared goal of supporting interdisciplinary learning about Earth across the undergraduate curriculum focusing on the grand challenges facing society and the important role that the geosciences play in addressing these grand challenges The chapters in this book explicitly illustrate the intimate relationship between geoscience and sustainability that is often opaque to students The authors of these chapters are faculty members administrators program directors and researchers from institutions across the country who have collectively envisioned implemented and evaluated effective change in their classrooms programs institutions and beyond This book provides guidance to anyone interested in implementing change on scales ranging from a single course to an entire program by infusing sustainability across the curriculum broadening access to Earth and environmental sciences and assessing the impacts of those changes      Resources in Education ,1978-12      **Environmental Science & Engineering Laboratory Manual** Daniel Meeroff, 2017      **Environmental Engineering Lab Manual** M. A. Karim, 2014-08-01      **Environmental Engineering Laboratory Manual for First Year Engineering Students (common to All Branches)** R. C. Gaur, 2008      **Compendium of Contributions** American Society for Engineering Education. Committee for Laboratory Oriented Studies and Experimentation, 1977      *Solid Waste Engineering Laboratory Manual* P. Aarne Vesilind, 1974      *Report summaries* United States. Environmental Protection Agency, 1983      *Wet-Weather Flow in the Urban Watershed* Richard Field, Daniel Sullivan, 2002-08-27 According to the National Resources Defense Council stormwater runoff rivals or exceeds discharges from factories and sewage plants as a source of pollution throughout the United States The Environmental Protection Agency identifies urban stormwaters as the second largest source of water quality damage in estuaries and a significant contributor to      **Water Quality Instructional Resources Information System (IRIS)** ,1979      **Selected Water Resources Abstracts** ,1987      *On-site Wastewater Treatment* Dennis M. Sievers, 1998

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