

Distribution System Disinfection American Water College

The project goal of this research report was to assess the impact of dynamic water quality conditions in distribution systems on the inactivation of microorganisms, particularly organisms in suspension in the bulk fluid. The research specifically focused on factors affecting the maintenance of a secondary disinfectant residual and the benefits of maintaining various target levels. Using existing data, literature was reviewed, a model was attempted, and a survey was conducted along with an analysis of the data. The project and approach assessed the ability of a disinfectant residual to serve as an indicator for distribution system microbial integrity.

Jointly sponsored by: U.S. Environmental Protection Agency and AWrrF.

New edition covers the latest practices, regulations, and alternative disinfectants. Since the publication of the Fourth Edition of White's Handbook of Chlorination and Alternative Disinfectants more than ten years ago, the water industry has made substantial advances in their understanding and application of chlorine, hypochlorite, and alternative disinfectants for water and wastewater treatment. This Fifth Edition, with its extensive updates and revisions, reflects the current state of the science as well as the latest practices. Balancing theory with practice, the Fifth Edition covers such important topics as: Advances in the use of UV and ozone as disinfectants; Alternative disinfectants such as chlorine dioxide, iodine, and bromine-related products; Advanced oxidation processes for drinking water and wastewater treatment; New developments and information for the production and handling of chlorine; Latest regulations governing the use of different disinfectants. For each disinfectant, the book explains its chemistry, effectiveness, dosing, equipment, and system design requirements. Moreover, the advantages and disadvantages of each disinfectant are clearly set forth. References at the end of each chapter guide readers to the primary literature for further investigation. Authored and reviewed by leading experts in the field of water and wastewater treatment, this Fifth Edition remains an ideal reference for utilities, regulators, engineers, and plant operators who need current information on the disinfection of potable water, wastewater, industrial water, and swimming pools.

Following the events of 9/11, the Administrator of the US Environmental Protection Agency created the Water Protection Task Force (WPTF), which identified water and wastewater systems as a major area of vulnerability to deliberate attack. The WPTF suggested that there are steps that can be taken to reduce these vulnerabilities and to make it as difficult as possible for potential saboteurs to succeed. The WPTF recommended that be scrutinized with renewed vigor to secure water and wastewater systems against these possible threats. It also recommended that water and wastewater systems have a response plan in place in the event an act of terrorism occurs. The WPTF identified water distribution networks as an area of special vulnerability and highlighted the need for rapid on-line detection methods that are accurate and have a wide detection range. As a result of these recommendations novel technologies from various fields of science and engineering are now addressing water security issues and water and wastewater utilities are looking for innovative solutions. Once such technologies are available, there will be a rapid implementation process that will present many business opportunities for the private sector. However, in addition to terrorist threats water and wastewater systems are inherently vulnerable to natural disasters such as earthquakes and floods. This volume will address the problems associated with both intended terrorist attacks and natural disasters affecting water or wastewater systems. The book is divided into parts based on the kinds of threats facing water and wastewater systems: (1) a direct attack on water and wastewater infrastructure storage reservoirs, and distribution and collection networks; (2) a cyber attack disabling the functionality of the water and wastewater systems or taking over control of key components which might result in system failures; and (3) a deliberate chemical or biological contaminant injection at one of the water distribution system's nodes. It will examine unique plans, technological and managerial innovations for protecting such systems, and includes descriptions of projects that were implemented to respond to natural disasters. Case studies are presented that discuss existing projects and evaluate their performance, with an emphasis on providing guidelines and techniques that can be implemented by water and wastewater planners and managers to deal with natural and manmade disasters should they occur.

Describes the types of organisms often present in drinking water distribution system biofilms, how biofilms are established and grow, the public health problems associated with having biofilms in the distribution system, and tools that water treatment personnel can use to help control biofilm growth. Glossary of terms, and list of additional resources. Charts, tables and photos. This study has shown that higher levels of carbon supported greater biofilm growth and planktonic populations on the materials that were tested, although the effect was most pronounced on iron pipe. Utilities with significant amounts of iron pipe in their distribution systems may be faced with the greatest regrowth potential. For utilities that also distribute water that is high in natural carbon, this problem may be compounded. Therefore, reducing the organic carbon in the finished water may be effective for any utility wishing to reduce regrowth problems in their distribution system. Other alternatives for utilities wishing to reduce biofilms in the distribution system can include any or all of the following: replacing or relining iron pipe in the system, increasing disinfectant, and implementing effective corrosion control.

Concise and readable, Drinking Water Security for Engineers, Planners and Managers provides an overview of issues including infrastructure planning, planning to evaluate vulnerabilities and potential threats, capital improvement planning, and maintenance and risk management. This book also covers topics regarding potential contaminants, available water security technologies, analytical methods, and sensor technologies and networks. Other topics include transport and containment of contaminated water, treatment technologies and the treatability of contaminants. Threat and vulnerability risk assessments and capital improvement Identification and characterization of potential contaminants and clean up Application of information assurance techniques to computerized systems

With an increasing population, use of new and diverse chemicals that can enter the water supply, and emergence of new microbial pathogens, the U.S. federal government is faced with a regulatory dilemma: Where should it focus its attention and limited resources to ensure safe drinking water supplies for the future? Identifying Future Drinking Water Contaminants is based on a 1998 workshop on emerging drinking water contaminants. It includes a dozen papers that were presented on new and emerging microbiological and chemical drinking water contaminants, associated analytical and water treatment methods for their detection and removal, and existing and proposed environmental databases to assist in their proactive identification and regulation. The papers are preceded by a conceptual approach and related recommendations to EPA for the periodic creation of future Drinking Water Contaminant Candidate Lists (CCLs--produced every five years--include currently unregulated chemical and microbiological substances that are known or anticipated to occur in public water systems and that may pose health risks).

The definitive water quality and treatment resource--fully revised and updated Comprehensive, current, and written by leading

experts, *Water Quality & Treatment: A Handbook on Drinking Water, Sixth Edition* covers state-of-the-art technologies and methods for water treatment and quality control. Significant revisions and new material in this edition reflect the latest advances and critical topics in water supply and treatment. Presented by the American Water Works Association, this is the leading source of authoritative information on drinking water quality and treatment. NEW CHAPTERS ON: Chemical principles, source water composition, and watershed protection Natural treatment systems Water reuse for drinking water augmentation Ultraviolet light processes Formation and control of disinfection by-products DETAILED COVERAGE OF: Drinking water standards, regulations, goals, and health effects Hydraulic characteristics of water treatment reactors Gas-liquid processes and chemical oxidation Coagulation, flocculation, sedimentation, and flotation Granular media and membrane filtration Ion exchange and adsorption of inorganic contaminants Precipitation, coprecipitation, and precipitative softening Adsorption of organic compounds by activated carbon Chemical disinfection Internal corrosion and deposition control Microbiological quality control in distribution systems Water treatment plant residuals management

Hydroinformatics addresses cross-disciplinary issues ranging from technological and sociological to more general environmental concerns, including an ethical perspective. It covers the application of information technology in the widest sense to problems of the aquatic environment. This two-volume publication contains about 250 high quality papers contributed by authors from over 50 countries. The proceedings present many exciting new findings in the emerging subjects, as well as their applications, such as: data mining, data assimilation, artificial neural networks, fuzzy logic, genetic algorithms and genetic programming, chaos theory and support vector machines, geographic information systems and virtual imaging, decision support and management systems, Internet-based technologies. This book provides an excellent reference to researchers, graduate students, practitioners, and all those interested in the field of hydroinformatics. Contents: .: Vol. I: Keynote Addresses; Numerical Methods; Hydrodynamics, Ecology and Water Quality Modelling; Experiences with Modelling Systems; Data Acquisition and Management; Geographic Information Systems and Virtual Imaging; Optimization and Evolutionary Algorithms; Vol. II: Decision Support and Management Systems; Forecasting and Data Assimilation; Artificial Neural Networks; Fuzzy Logic; Chaos Theory and Support Vector Machines; Data Mining and Knowledge Discovery; Uncertainty and Risk Analysis; Integration of Technologies and Systems; Internet-Based Technologies and Applications. Readership: Graduate students, academics, researchers and practitioners in civil engineering, artificial intelligence, optimization, and probability and statistics

The development of pressurized pipe networks for supplying drinking-water to individual dwellings buildings and communal taps is an important component in the continuing development and health of many communities. This publication considers the introduction of microbial contaminants and growth of microorganisms in distribution networks and the practices that contribute to ensuring drinking-water safety in piped distribution systems.

In response to current and anticipated disinfection by-product (DBP) regulations, many utilities have begun to use chloramines as a secondary disinfectant. Chloramination produces DBPs such as haloacetic acids (HAAs), trihalomethanes (THMs), and haloacetonitriles (HANs) in lower concentrations than chlorination. Previous research has demonstrated that dihalogenated haloacetic acids (DXAAs) are the most commonly formed HAAs during chloramination. Some utilities may have difficulty meeting the new maximum contaminant level (MCL) for HAAs because chloramination does not limit the formation of DXAAs to the same extent as it does other DBPs. The objectives of this project were to: 1. better understand the reactivity of key natural organic matter (NOM) fractions and the effects of treatment processes with respect to dihaloacetic acid (DXAA) formation, 2. better delineate the influence of pH and Cl₂/N ratio on DXAA formation, 3. characterize DXAA formation kinetics and the impact of treatment processes on the kinetics, especially the impact of prechlorination, 4. calculate the rate and extent of DXAA formation at elevated summer water temperatures, and 5. determine the effect of bromide concentration on DXAA speciation and kinetics. The research consisted of laboratory experimentation, mathematical modeling, and sampling of selected treatment plants and distribution systems. The first phase consisted of batch screening experiments on two water sources of differing water quality, Lake Austin, Texas and Metedeconk River, New Jersey. The selected waters were subjected to various treatments and NOM fractionations. Overall, 12 different waters were studied. Additional batch experiments were undertaken to further study the most important variables that were identified in the initial batch screening experiments. DXAA formation kinetics were studied in four waters by measuring DXAA concentrations over chloramination contact times of 0.5 to 72 hours. Prechlorination times of 5 and 20 minutes were tested. Mathematical models were developed to predict DXAA formation during chloramination based on water quality and chloramination conditions.

Impact of Distribution System Water Quality on Disinfection Efficacy American Water Works Association

This AWWA manual of practice provides information on the factors that influence pipe corrosion, assessing corrosion-related impacts, water quality and implementation, and maintenance of an effective corrosion control program.

Reports on a project that identifies pathogen routes of entry into water distribution systems and develops monitoring and control strategies for protecting the system. Contains chapters on pathogens and pathways, existing control strategies, transient surge modeling, pressure monitoring, field monitoring, recommended control strategies, and recommendations to utilities. The project was completed by a multi-disciplinary team of engineers and practitioners with funding from the American Water Works Association Research Foundation and the Environmental Protection Agency. The book is not indexed. Annotation c. Book News, Inc., Portland, OR (booknews.com)

Hidden problems, buried deep in the pipe networks of water distribution systems, are very serious potential threats to water quality. *Microbial Quality of Water Supply in Distribution Systems* outlines the processes and issues related to the degradation of water quality upon passage through networks of pipes, storage reservoirs, and standpipes on its way to the consumer. The risks associated with biofilm accumulation, bacteria, and other contaminants are discussed in great detail. In addition to its excellent microbiological coverage of organisms in drinking water and biofilms in distribution systems, *Microbial Quality of Water Supply in Distribution Systems* provides clear treatments of the technical and public communication issues most commonly affecting the quality of water and water supply systems. The inclusion of numerous case histories in this new book makes it a complete reference source for anyone concerned with water quality and water distribution systems.

Handbook of Water and Wastewater Treatment Plant Operations the first thorough resource manual developed exclusively for water and wastewater plant operators has been updated and expanded. An industry standard now in its third edition, this book addresses management issues and security needs, contains coverage on pharmaceuticals and personal care products (PPCPs), and includes regulatory changes. The author explains the material in layman's terms, providing real-world operating scenarios

with problem-solving practice sets for each scenario. This provides readers with the ability to incorporate math with both theory and practical application. The book contains additional emphasis on operator safety, new chapters on energy conservation and sustainability, and basic science for operators. What's New in the Third Edition: Prepares operators for licensure exams Provides additional math problems and solutions to better prepare users for certification exams Updates all chapters to reflect the developments in the field Enables users to properly operate water and wastewater plants and suggests troubleshooting procedures for returning a plant to optimum operation levels A complete compilation of water science, treatment information, process control procedures, problem-solving techniques, safety and health information, and administrative and technological trends, this text serves as a resource for professionals working in water and wastewater operations and operators preparing for wastewater licensure exams. It can also be used as a supplemental textbook for undergraduate and graduate students studying environmental science, water science, and environmental engineering.

Provides guidelines for developing a water quality monitoring program specific to the distribution system of a water utility. The report identifies monitoring objectives, addresses common program design issues, and develops protocols for monitoring programs. Topics include nitrification, booster chl

An American Water Works Association-sponsored study that focuses on locating areas promising as candidates for future disinfection byproduct epidemiological studies. The locations are identified on the basis of the joint ability of such areas to have levels and types of health data required, along with their ability to provide disinfection byproduct related exposure profiles of interest to researchers. Chapters cover data needs for research; promising locations for cancer, adverse development, and reproductive outcome research; availability of health data; and matching water systems with desired exposure profiles. Annotation c. Book News, Inc., Portland, OR (booknews.com)

Updated throughout for this new edition, Water Distribution System Monitoring describes the latest water quality monitoring approaches, techniques, and equipment that will assist water utilities for compliance with the "Lead and Copper Rule" as well as address numerous other water quality issues. Water quality data are obtained using the appro

The Water Science and Technology Board has released the first report of the Committee on Public Water Supply Distribution Systems: Assessing and Reducing Risks, which is studying water quality issues associated with public water supply distribution systems and their potential risks to consumers. The distribution system, which is a critical component of every drinking water utility, constitutes a significant management challenge from both an operational and public health standpoint. This first report was requested by the EPA, as the agency considers revisions to the Total Coliform Rule with potential new requirements for ensuring the integrity of the distribution system. This first report identifies trends relevant to the deterioration of drinking water quality in distribution systems and prioritizes issues of greatest concern according to high, medium, and low priority categories. Of the issues presented in nine EPA white papers that were reviewed by the committee, cross connections and backflow, new or repaired water mains, and finished water storage facilities were judged by the committee to be of the highest importance based on their associated potential health risks. In addition, the report noted that two other issues should also be accorded high priority: premise plumbing and distribution system operator training. This first report will be followed in about 18 months by a more comprehensive final report that evaluates approaches for risk characterization and identifies strategies that could be considered to reduce the risks posed by water-quality deteriorating events.

This comprehensive reference for engineers, consultants, and public administration officials is recognized as the most complete, practical guide to water pipe corrosion, its health effects, and how to control it.

The report of multi-disciplinary team of engineers and practitioners from a research project commissioned by the Association to create a resource to help water utilities operate and maintain water distributions systems to prevent water quality from deteriorating. They look at prevention programs, qu

This brand new manual was written because of the increased use of chloramine as a residual disinfectant in drinking water distribution systems and the ubiquitous presence of nitrifying bacteria in the environment. Chapters cover background information on the occurrence and microbiology of nitrification in various water environments and provide current practical approaches to nitrification prevention and response. This manual provides a compendium of the current state-of-the-art knowledge, however with quickly developing new advances in nitrification, more writings will be forthcoming. Each chapter can be read independently.

The most recent volume in the Drinking Water and Health series contains the results of a two-part study on the toxicity of drinking water contaminants. The first part examines current practices in risk assessment, identifies new noncancerous toxic responses to chemicals found in drinking water, and discusses the use of pharmacokinetic data to estimate the delivered dose and response. The second part of the book provides risk assessments for 14 specific compounds, 9 presented here for the first time.

Hydroinformatics addresses cross-disciplinary issues ranging from technological and sociological to more general environmental concerns, including an ethical perspective. It covers the application of information technology in the widest sense to problems of the aquatic environment. This two-volume publication contains about 250 high quality papers contributed by authors from over 50 countries. The proceedings present many exciting new findings in the emerging subjects, as well as their applications, such as: data mining, data assimilation, artificial neural networks, fuzzy logic, genetic algorithms and genetic programming, chaos theory and support vector machines, geographic information systems and virtual imaging, decision support and management systems, Internet-based technologies. This book provides an excellent reference to researchers, graduate students, practitioners, and all those interested in the field of hydroinformatics.

CD-ROM contains chapter 4 and appendices A & B.

This book contains the lectures given in the International Course "Improving efficiency and reliability in water supply systems", hosted and sponsored by the Menendez Pelayo International University (U.I.M.P.) and co-sponsored by Aguas de Valencia, the British Council and the EC Cornett and Erasmus programmes. The short course took place in Valencia (Spain) in November 1994, with an attendance of more than one hundred delegates. We must not only acknowledge and thank Dr. Joaquin Azagra, as UIMP Director, but also his collaborators D. Luis Moreno and Lidia Lopez for their support in the preparation of the Course and during the course taking place. UIMP sponsorship allowed us to assemble in Valencia an eminent cadre of lecturers coming from all over the world, that covered in an ordered and precise fashion some of the more relevant aspects on efficiency and reliability in water supply systems. We are very thankful to all these leading lecturers for their invaluable cooperation. The publication of this book and the Spanish edition as well, have been made possible thanks to the sponsorship of both Polytechnic University of Valencia througout its Chancellor, Justo Nieto, and Aguas de Valencia throughout its General Director Alvaro Aguirre. We must also thank Kluwer Academic Publishers and especially their Publisher Petra van Steenberg for her assistance, careful presentation and production of the book.

"TECHNEAU, an integrated project funded by the European Commission, challenges the ability of traditional system and technology solutions

for drinking water supply ..."--P. [3].

Pathogenic microorganisms exploit a number of different routes for transmission and this book demonstrates how the spread of disease can be prevented through the practices of disinfection and controlling microbial growth. The book is organized into four sections.

Water distribution systems are made up of pipe, valves and pumps through which treated water is moved from the treatment plant to homes, offices, industries, and other consumers. The types of materials and equipment used by each water system are usually governed by local conditions, past practices, and economics. Consequently, drinking water professionals must be knowledgeable about common types of equipment and operating methods that are available. Completely revised and updated, Water transmission and distribution includes information on the following: distribution system design and operation and maintenance ; piping materials ; valves, pumps, and water meters ; water main installation ; backfilling, main testing, and installation safety ; fire hydrants ; water storage ; water services ; cross-connection control ; motors and engines ; instrumentation and control ; information management and public relations.--Cover page [4].

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