

SUMMARY OF AVAILABLE REFERENCE MATERIAL FOR ADVANCED WATER TREATMENT OPERATOR CERTIFICATION PROGRAM

The reference materials listed in this document include a summary of the most comprehensive and relevant training materials available for the development of an advanced treatment operator certification program. Because many of these technologies have not been included in certification programs in the past and because they represent cutting edge and evolving technologies, these reference materials do not fully represent the full range of information available on the advanced treatment technologies. Journal articles, results of recent research, symposium presentations and manufacturer's training materials also include a significant body of information that is not included in the table, but could be used to develop an advanced treatment certification. Other technical information provided by committee members was added to the Basecamp website.

2018 additions:

White's Chlorine Chemistry: <https://www.wiley.com/en-us/White%27s+Handbook+of+Chlorination+and+Alternative+Disinfectants%2C+5th+Edition-p-9780470180983>

NWRI UV Guidelines: <http://www.nwri-usa.org/documents/UVGuidelines3rdEdition2012.pdf>

UV AOP: <https://www.iwapublishing.com/books/9781780407180/advanced-oxidation-processes-water-treatment-fundamentals-and-applications>

WateReuse book published in 2007: <https://www.barnesandnoble.com/w/water-reuse-metcalf-eddy-inc-an-aecom-company-inc/1115281151>

Technology	Reference Material Available	Summary of suitability and content included in reference materials
<p>Membrane Filtration</p>	<p>California State University, Sacramento, Office of Water Programs (Dr. Ken Kerri education materials) for overall / basic content</p> <p>AWWARF Now WRF</p> <p>Commercial RO Training modules (www.dhptraining.com)</p> <p>Membrane Operator Certification (MOC) through South East Desalting Association, South Central Membrane Association and South West membrane Operators Association and American Membrane Technology Association.</p> <p>AWWA Manuals of Practice M46 for RO and NF (2007) and M53 for MF and UF (2016)</p>	<p>MOC materials were developed for the specific purpose of training and certifying membrane operators</p> <p>AWWA Manuals are industry based materials with a high level of applicability for operator training.</p> <p>M53 explores the use of membranes in varied applications, operations and system designs. It focuses on membrane science and theory, system concepts, membrane manufacturers, applications and pilot testing, residuals management and future trends.</p> <p>M46 includes information about RO and NF from theory, applications, and design to equipment, installation, operation, and maintenance.</p>

	Membrane Filtration Guidance Manual (EPA 815-R-06-009) 2005	This USEPA guidance manual provides technical information on the use of membrane filtration and application of the technology for compliance with the Long Term 2 Enhanced Surface Water Treatment Rule
Reverse Osmosis	See membrane Filtration	
Membrane Bioreactors	See Membrane Filtration	
Biologically Activated Carbon	Activated Carbon Solution for Improving Water Quality, Chowdhury, et al 2013 AWWA WE&RF 15-11	Coverage includes utilities experiences and applications plus various design and procurement approaches. Appendices include case studies and life cycle assessments
Advanced Oxidation (General)	Advanced Oxidation Handbook, James Collins, James R. Bolton AWWA, 2016 White, Chlorine Chemistry	This handbook provides the fundamentals of the design and operation for advanced oxidation technologies.
Advanced Oxidation – UV	The Ultraviolet Disinfection Handbook, James R. Bolton, Christine A. Cotton, AWWA 2008 Equipment manufacturer specific training materials	See Below
Advanced Oxidation – Ozone	Ozone in Drinking Water Treatment, Kerwin Rakness 2015	This is a resource on the application, design, operation, control, and optimization of ozone facilities in drinking water plants and is written primarily from an operations perspective. Coverage includes instrumentation quality control, quality assurance guidelines, precautions for implementation, maintenance considerations, and explains the theory and practice of ozone operation and how ozone disinfection performance

		is measured, calculated, reported, and optimized.
UV Disinfection	<p>The Ultraviolet Disinfection Handbook, AWWA</p> <p>Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (2012), NWRI in collaboration with WRF</p> <p>Ultraviolet Disinfection Manual for the Long Term 2 Enhanced Surface Water Treatment Rule (EPA 815-R-06-007, November 2006)</p> <p>Equipment manufacturer specific training materials</p> <p>IUVA training materials</p> <p>McGraw Hill publication (Austa)</p>	<p>The Ultraviolet Disinfection Handbook provides a practical introduction to the subject of UV disinfection and UV reactors. It is of value to engineering and scientific consultants, water treatment operators and managers, government regulatory staff, and students and faculty in engineering programs</p> <p>The UV Disinfection guidelines provide guidance to state and federal regulatory agencies who review applications for the use of ultraviolet (UV) disinfection systems in drinking water and water reuse, and water utilities using UV for disinfection purposes. There is a focus on UV reactor design, dosing and performance testing.</p> <p>This guidance manual provides technical information on the application of ultraviolet light for the disinfection of drinking water by public water systems.</p>
Ozone Disinfection	Utility Specific Training Materials and Workshop training materials from IOA and CA-NV AWWA operator training workshops	PowerPoint slides targeted at operator training are available, as well as utility specific training guidelines, but a general

	Ozone in Drinking Water Treatment, Kerwin Rakness 2015	reference written for operator training is not available. The reference by Kerwin Rakness is targeted more for design and optimization of ozone systems and is a very technical reference.
Adsorption/Ion Exchange	Ion Exchange Treatment for Drinking Water (2004) AWWA	This handbook provides scientific theory, technical data, system design, operating parameters and processes, and costs for ion exchange in water treatment. It is intended as a reference for water treatment professionals, and as a teaching textbook. Coverage includes fundamentals of chemistry, ion exchangers, softening and demineralization techniques, and removal of nitrates, arsenic and radioactivity.
Source Water Control	While this is an important part of potable reuse it is not being included in the advanced treatment certification.	Source water control does not need to be included in an advanced operator certification program because it is already addressed through the Environmental Compliance Inspector and Industrial Pretreatment certifications.
Brine/Waste Stream management	Management of Desalination Concentrate (Nickolay Voutchkov) Brine-Concentrate Treatment and Disposal Options Report (Part 1 and 2) (USBR 2009)	On line training materials on management of desalination concentrate Technical information on various brine disposal technologies and methods and their associated costs.
Post Treatment Conditioning (assumed to be most related to corrosion control)	AWWA M58 Internal Corrosion Control in Water Distribution Systems	This manual provides an explanation of the factors that influence corrosion, assesses corrosion-related impacts, and discusses the development of a strategy to implement and maintain effective corrosion

	<p>AWWA M27 External Corrosion Control for Infrastructure Sustainability (2013)</p> <p>Optimal Corrosion Control Treatment Evaluation Technical Recommendations for Primacy Agencies and Public Water Systems (EPA 816-B-16-003 March 2016)</p> <p>Example WRF Projects: Secondary Impacts of Corrosion Control on Distribution System and Treatment Plant Equipment (WRF, EPA 2010)</p> <p>Controlling Lead in Drinking Water (WRF,AWWA 2015)</p> <p>Distribution System Water Quality changes following Corrosion Control Strategies (2000)</p> <p>Role of Phosphate Inhibitors in Mitigating Lead and Copper Corrosion (2001)</p> <p>Impact of Chloride: Sulfate Mass Ratio (CSMR) Changes on lead leaching in potable water (2010)</p> <p>Etc.</p>	<p>control in the water distribution system.</p> <p>This manual explains: how and why corrosion occurs, how to evaluate the corrosion potential of an environment, and how prevention and control measures operate</p> <p>This document provides technical recommendations to primacy agencies and public water systems (PWSs) in determining the most appropriate treatment for controlling lead and copper and complying with the corrosion control treatment (CCT) requirements of the Lead and Copper Rule (LCR).</p> <p>The Water Research Foundation has completed 40 projects/studies related to corrosion control and lead and copper between 1990 and 2015. The relevance of each WRF depends on the water quality associated with proposed advanced treatment process and the distribution system materials and quality. Examples of some of relevant studies have been listed. These can provide a basis for the type of operator certification range of knowledge association with post treatment conditioning.</p>
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<p>SCADA and Instrumentation*</p>	<p>Automation of Water Resource Recovery Facilities, WEF 2013</p> <p>AWWA M2 Instrumentation and Control, 2001</p> <p>WSO: Instrumentation and Control DVD, AWWA 2016</p> <p>Additional Information</p> <p>WE&RF 13-03 Critical Control Points, Troy Walker</p>	<p>Introduces technological advancements and the elements and standards of a complete automation design</p> <p>This manual describes the automatic control and instrumentation of water distribution, treatment, and storage systems.</p> <p>Operators learn basic principles of automation, control instrumentation, and SCADA in water treatment and distribution.</p> <p>Symposiums are offered by the International Society of Automation in conjunction with WEF and AWWA.</p> <p>Local Community Colleges, AWWA and WEF offer courses in instrumentation and SCADA. CWEA offers three levels of certification in Electrical/Instrumentation and is described in their Plant Maintenance Certification Handbook (2009)</p>
<p>Regulatory</p>	<p>CA & NV State Regulations <u>INVESTIGATION ON THE FEASIBILITY OF DEVELOPING UNIFORM WATER RECYCLING CRITERIA FOR DIRECT POTABLE REUSE</u></p> <p>EPA Regulations <u>2017 Potable Reuse Compendium</u></p> <p>Dr. George Tchobanoglous, <u>The Future of Direct Potable Reuse</u></p>	

Safety	First Aid Emergency Notifications Federal regulations	