

A WHITE PAPER

Potable Reuse Operator Training and Certification Framework

Revised February 2016



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CALIFORNIA URBAN WATER AGENCIES

Executive Summary

A regulatory framework for potable reuse is key to increasing statewide reuse and meeting the State Water Resources Control Board’s (SWRCB’s) goal of 1.5 million acre-feet/year (AFY) of recycled water by 2020 and at least 2.5 million AFY by 2030. Successful training and certification of potable reuse operators is a critical element of a comprehensive program to maintain high-quality reuse supplies that are protective of public health.

This paper summarizes existing standard practices for certification and training of operators at water, wastewater, and potable reuse facilities, explores additional skills and experience needed for operating potable reuse advanced treatment plants, outlines remaining challenges to implementation, and recommends a standardized potable reuse certification framework to the DDW.¹ This white paper can serve as a foundation for further development of actual training and certification requirements by DDW, along with pending DDW regulations for permitting and operation of reuse facilities. Individual agencies may also augment with additional, site-specific requirements as needed to protect public health and the environment.

Background

In California, indirect potable reuse (IPR) projects involve either the application of unrestricted non-potable recycled water through surface spreading, or the application of full advanced treated purified water for groundwater recharge or for surface water augmentation upstream of a water treatment plant. IPR uses the aquifer or reservoir as an environmental buffer to provide added treatment and response time. In the future, direct potable reuse would further expand potable reuse (PR) to include systems where the purified water is added directly upstream or downstream of a water treatment plant (WTP)—where there is no environmental buffer. The challenge for state regulators and municipalities implementing PR is to determine the best way to verify that operators assigned to operate a PR plant have an adequate level of experience and training to operate these complex and critically important systems.²

This white paper is a collaborative effort with CUWA and its partners:

- [WaterReuse California \(WRCA\)](#)
- [California-Nevada Section of the American Water Works Association \(CA-NV Section AWWA\)](#)
- [California Water Environment Association \(CWEA\)](#)
- [California Association of Sanitation Agencies \(CASA\)](#)
- [State Water Resources Control Board, Division of Drinking Water \(DDW\)](#)

¹ A graphic illustrating the certification program development process is included in Attachment 1.

² This white paper is concerned with application of PR with the exception of groundwater recharge relying on percolation from spreading basins, which does not require AWT as defined in the Groundwater Recharge Regulations.



Current California Operator Certification Programs

“Certification” is a formal process to identify and acknowledge individuals who have met an established standard of competency for a defined job. Attachment 1 provides an illustration of a certification program development process.

Wastewater and drinking water operators are certified by the State Water Resources Control Board Office of Operator Certification (OOC). The wastewater and water operator programs were developed separately and are operated separately through the Wastewater Operator Certification Program (WW-OCP) and the Drinking Water Operator Certification Program (DW-OCP), respectively.

There are five grades for both wastewater and drinking water treatment certification. To receive a certificate, a candidate must:

- 1** Meet minimum experience and education requirements.
- 2** Pass a written test.
- 3** Apply for certification.

The grade level required for the chief plant operator and designated operator-in-charge depends upon the “classification” level of the wastewater treatment plant (WWTP) or WTP, which is a function of both its capacity and its complexity.

The specific educational and experience requirements for wastewater operator and for water treatment operator certifications vary. Additionally, a person certified by the OOC as a WTP operator may also operate a water recycling treatment plant³ at a grade level appropriate for the class of WWTP being operated.

Gaps in Advanced Water Treatment (AWT) Operator Skill Needs from Conventional WTP and WWTP Operations

Except some applications where percolation basins are used for groundwater recharge, California potable reuse systems that supplement drinking water sources are expected to be advanced water purification facilities (AWPFs). Such systems use complex treatment trains centered on reverse osmosis (RO) and advanced oxidation processes (AOPs) not present in conventional WWTPs and WTPs. The reason for this sophisticated, multi-barrier AWT train is the need to achieve both a high level of log removal of pathogens and to remove organic and inorganic microcontaminants. The difficulty with applying only the existing California wastewater or drinking water treatment operator certification requirements to operators of PR plants is that the existing exams do not cover advanced water treatment or potable reuse-specific regulations and concerns (e.g., operation and monitoring of advanced technologies).



Existing exams do not cover advanced water treatment or potable reuse regulations and concerns.

³ “Water recycling treatment plant” means a treatment plant that receives and further treats secondary and/or tertiary effluent from a wastewater treatment plant. –CCR Title 23, Division 3, Chapter 26, Article 1§ 3671.



Potable reuse system operation for groundwater recharge and surface water augmentation is different from conventional wastewater and water treatment operations in a number of important ways:

- 1** Potable reuse requires multiple barriers using a variety of technologies and a more complex treatment train than conventional water and wastewater treatment processes.
- 2** Given that source water is treated secondary or tertiary wastewater effluent, it is critical that all components are operated and maintained as intended.
- 3** Feedwater quality (both raw wastewater into the WWTP and secondary or tertiary effluent feedwater to the AWT process) can vary significantly, which can impact the daily operation of the advanced treatment plant and potentially the purified water quality.
- 4** Potable reuse is not regulated under any one existing Federal program.

Existing Operator Training Opportunities

Many training opportunities are available for existing wastewater and water treatment operator certification exams through community colleges, universities, and professional association-based organizations, but not for AWT. If a WTP or WWTP wants to train operators on AWT(s), it must be conducted largely in-house. Existing AWPFS have developed internal programs site-by-site that combine hands-on training under supervision with some combination of in-house training manuals and exams, standard operational plans, and consultant- and/or treatment process vendor-supplied supplemental instruction. Similar efforts have also been made by WTP and WWTPs with AWT systems. In order to create a substantial pool of potential AWPFS operators, training available for PR would need to be expanded beyond the existing opportunities.

Exploring Possible Paths Forward

Operators that currently run AWT processes for potable water reclamation must be either water treatment- or wastewater-certified. Training program content and tests have historically been site-specific and developed in-house.

Potable Reuse Operator Certification Survey: Utility Preferences

As one of the collaborative partners on this joint certification effort, WaterReuse California distributed a survey to their membership, including a wide range of California municipal water and wastewater agencies. It was used to identify gaps in the existing DW-OCP and WW-OCP with respect to AWT practices for potable reuse facilities. Sixty-four agencies answered the survey.

California representatives of the water and wastewater sector responding to our survey prefer new certification options to fill the “holes” in existing programs and allow water treatment and wastewater operators to obtain advanced treatment certification for potable reuse. A minority of survey respondents preferred one type of existing operator certification program, typically based on the method used within their facilities—i.e., water purveyors were more likely to state that potable reuse systems should be operated by water treatment operators, and wastewater agencies were more likely to state that potable reuse systems should be operated by wastewater operators. However, over 70% of respondents agreed that one certification process for all potable reuse water system types (both indirect and direct) should be developed. Workshop participants



of survey respondents agree that one certification process for all potable reuse water system types should be developed.







were largely in agreement that it is important to draw on the knowledge and experience of both water and wastewater operators to operate reuse facilities successfully.

Potential approaches to developing an advanced potable reuse treatment certification program

A number of different paths could be taken to develop a potable reuse operator certification program. It could be developed as an independent, stand-alone program (option 1 below), or incorporated under an existing certification program or programs (i.e., under wastewater or water, or as a supplement to both)—such as options 2-4 below. The ideas presented here reflect thinking and discussion from different individuals and groups looking at the potable reuse operator certification question, particularly the CA-NV Section AWWA’s Advanced Water Treatment Certification Workgroup, which is comprised of utility members (including some CUWA member agencies), California and federal regulators, and consultant potable water experts. This list is not intended to be a reflection of the ideas of any one group or person, but rather is an effort to capture and reflect some of the current avenues of thought and discussion on the topic.

While the growth of AWWPs may be the most pressing factor driving the need for AWT certification, there is also a desire for operator training and certification in other AWT facilities. For this reason, both a general AWT program and a PR-specific program are being considered.

Four potential potable reuse operator certification program options include:

 1	 2	 3	 4
SEPARATE POTABLE REUSE OPERATOR CERTIFICATION PROGRAM	PR or AWT OPERATOR CERTIFICATION PROGRAM SUPPLEMENT TO EXISTING DW CERTIFICATION	PR OR AWT OPERATOR CERTIFICATION PROGRAM SUPPLEMENT TO EXISTING WW CERTIFICATION	PR OR AWT SUPPLEMENT TO EITHER LICENSE
Exclusively for potable reuse system operators, certifying that an individual has a defined level of potable reuse system-specific knowledge, skill, and experience.	Verifies that a certified WTP operator has a defined level of specific knowledge, skill, and experience in AWT and related drinking water, wastewater and potable reuse rules and practices.	Verifies that a certified wastewater operator has a defined level of specific knowledge, skill, and experience in AWT and related drinking water, wastewater, and potable reuse rules and practices.	Certifies that a certified water treatment or wastewater operator has a defined level of specific knowledge, skill and experience in AWT and related drinking water, wastewater, and potable reuse rules and practices.

Selecting the program location and focus of a new stand-alone or supplemental certification program must balance two key necessities: covering knowledge elements necessary for operating indirect

and direct potable reuse systems, which by their nature straddle the wastewater and drinking water fields, while also developing a program that will be economically viable and draw a large enough pool of certified operators to meet utility hiring needs.

Recommendations and Conclusions

New training and certification programs are needed to provide AWT and potable reuse skill-specific operator endorsements. In a workshop facilitated by CUWA, a wide range of utility and State regulatory agency representatives came together and achieved consensus on the basic structure of the future certification program and a strategy for moving it forward. The CUWA workshop participants and the survey respondents both agreed that a special AWT or PR module to enhance existing certification (Option 4 on the previous page) is the best choice. The workshop participants developed a number of strategic recommendations:

- 1** The certification program should be centered on AWT technologies used in purification of wastewater effluent for potable reuse with a clear focus on protection of public health and should include risk management concepts.
- 2** It should be a certification “add on” available to both wastewater and water treatment operators with an acceptable level of training and experience.
- 3** One test for each level of certification should be given regardless of the qualifying background of the candidate. Training must be developed to address any gaps in background knowledge or experience associated with advanced treatment or potable reuse concepts for either water or wastewater candidates.
- 4** The program should provide an adequate population of certified operators from which utilities can hire new PR treatment plant operators and be broad enough to draw a large enough testing population to be financially viable.

Creating a certification program that is open to both water and wastewater operators offers the benefit of combining critical background knowledge from existing certification programs while enabling a broader pool of candidate operators for this additional training and certification. With increasing levels of certification, candidates must demonstrate their competence in increasingly complex potable reuse concepts beginning with an understanding of AWT basics and progressing into more critical aspects of potable reuse such as advanced monitoring, emergency response, and regulatory concepts.

The water/wastewater community has yet to reach consensus on one primary point: whether the ultimate target audience for the certification program should be centered on potable reuse with AWT specifically, or serve as a more general AWT program with water and wastewater elements. This decision is dependent upon: 1) what State regulators need to feel comfortable with the certification program, and 2) how broad the program needs to be to serve water sector needs and be economically viable for the certifying agency or agencies.

Regardless of the selected strategy, legislation and/or an update to the operator certification regulations will likely be needed to address the proposed new certification requirements. Additional work will also be needed to determine the details on the range of knowledge and criteria for qualifications.



This framework establishes a foundation for further development of a potable reuse training and certification program. A critical question to be resolved is what organization or organizations will create and maintain the program. At the workshop, there was general recognition that both water and wastewater perspectives are needed to develop the proper training and certification program to prepare and verify a minimum skillset for AWT/potable reuse operators. An effort is underway through the CA-NV Section AWWA AWT Operator Certification Committee to explore the possibility of developing an AWT- or PR-focused certification program. At the CUWA Workshop, representatives from CA-NV Section AWWA and CWEA agreed that collaboration would make good sense. It was also recognized that each organization would need to further explore with their leadership how such a partnership could work. As of publication, conversations between these groups are on-going, but no formal agreements have been made. An entity or entities will need to step forward and commit to developing training and certification programs for an AWT or PR supplement to create such a program.

It is important to note that while potable reuse training and certification is critically important, it is just one part of a comprehensive program required to ensure the protection of public health and safety amidst more widespread adoption of potable reuse. To have the greatest benefit, potable reuse operator training and certification must be accompanied by a regulatory framework as well as customized, agency-specific training and Operations, Monitoring, and Maintenance Plans (OMMPs).



Introduction

California utilities are working hard to maximize beneficial use of all available water sources to enhance the resilience and reliability of their water supply portfolios. As noted in CUWA’s Water Supply Reliability Report, demand management and water supply diversification are critical elements of establishing resilience to meet future challenges and uncertainties. Water reuse is a critical element of California’s water supply portfolio, and the drought has elevated awareness of potable reuse as a locally controlled, drought resistant, high-quality drinking water supply source. Increased interest in and accelerated development of water purification projects for potable reuse is tempered by the commitment to proceed deliberately to ensure that potable reuse is fully protective of public health and the environment.

A regulatory framework for potable reuse is key to increasing statewide reuse and meeting the State Water Resources Control Board’s (SWRCB) goal of 1.5 million acre-ft/year (AFY) of recycled water production by 2020 and at least 2.5 million AFY by 2030. Successful training and certification of potable reuse operators is a critical element of a comprehensive program to maintain high-quality reuse supplies that are protective of public health; it will also be an important piece of successful large-scale implementation of direct potable reuse (DPR).

Operator certification has been identified as a major issue for consideration by the Expert Panel providing recommendations to the SWRCB on surface water augmentation regulations and the feasibility of establishing DPR criteria. It has been similarly cited by the Advisory Group to the Expert Panel on DPR issues and by the DDW. Good operator training and certification programs will be an intrinsic element of successful widespread implementation of AWT-based PR in California—this white paper is concerned with application of PR with the exception of groundwater recharge that relies on percolation from spreading basins, which does not require AWT as defined in the Groundwater Recharge Regulations.

This white paper is a collaborative effort with CUWA and its partners:

- [WaterReuse California \(WRCA\)](#)
- [California-Nevada Section of the American Water Works Association \(CA-NV Section AWWA\)](#)
- [California Water Environment Association \(CWEA\)](#)
- [California Association of Sanitation Agencies \(CASA\)](#)
- [State Water Resources Control Board Division of Drinking Water \(DDW\)](#)



Background

Potable reuse is inclusive of indirect potable reuse and direct potable reuse. In California, IPR projects involve either: 1) the application of unrestricted non-potable recycled water through surface spreading, or 2) the application of full advanced-treated purified water for groundwater recharge or surface water augmentation upstream of a water treatment plant (WTP), using these environmental buffers as treatment and for response and retention time.

DPR is defined as “[introduction of] purified water⁴... directly into a potable water supply distribution system or into the raw water supply immediately upstream of a WTP” (Tchobanoglous et al., 2011). The water purification process involves the use of an advanced water treatment (AWT) train consisting of a series of advanced treatment processes designed to collectively provide a robust, multi-barrier purification approach for the protection of public health. As a result, advanced water purification facilities (AWPF) use additional treatment processes than those used in conventional wastewater treatment plants (WWTPs) and WTPs (Figure 2-1).

As with any treatment train, good operator knowledge and skill is critical to the proper control of an AWT process. Because potable reuse is not widely practiced, existing operator certification programs are based on conventional WWTP and WTP operations. Potable reuse requires knowledge of advanced treatment technologies, additional regulatory requirements, AWT train water quality monitoring, and additional drinking water distribution requirements. An understanding of both wastewater and water operations is valuable. However, operating a PR plant generally carries a greater level of risk and complexity associated with its proper operation than most WWTPs and WTPs.

The challenge for state regulators and municipalities implementing potable reuse is to determine the best way to verify that the operators assigned to operate an AWPF have an adequate level of experience and training to operate these complex and critically important systems to consistently produce a high-quality drinking water supply protective of public health.

Purpose

The intent of this white paper is to summarize current water and wastewater operator certification programs, describe existing standard practices for required certification and training of operators at potable reuse facilities, explore additional skills and training opportunities needed for operating potable reuse advanced treatment plants, review potential strategies for creating such a program, and make a recommendation to DDW on a standardized potable reuse certification approach. This was accomplished through a two-phased process:

- **Phase 1**, performed in collaboration with WaterReuse CA, consisted of a literature review and utility survey that set the foundation for a preliminary white paper. The initial draft was used as the basis of discussion for a facilitated workshop in Phase 2.
- **Phase 2** involved a 2-day facilitated workshop attended by our collaborative partners (WaterReuse CA, CA-NV Section AWWA, CWEA, and CASA), and several key stakeholders including DDW and agencies currently involved in or planning for potable reuse. Workshop participants collaborated to prioritize previously reviewed certification strategies and gain agreement on which approach to recommend to DDW. Participants also identified implementation issues that will need to be addressed moving forward.

⁴ Where “purified water” refers to highly treated reclaimed wastewater.



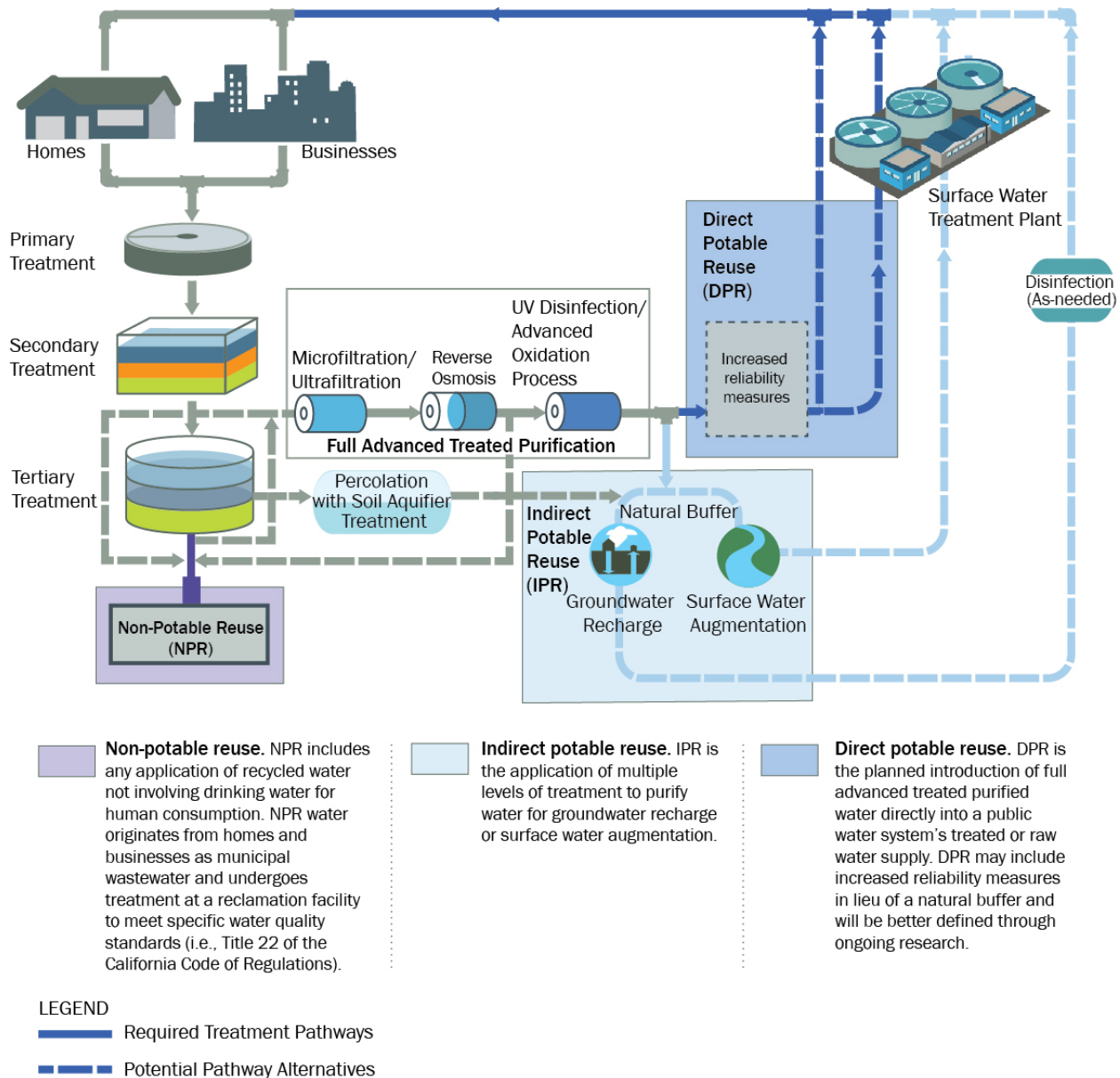


Figure 2-1. The water treatment process alternatives typical of non-potable and indirect potable reuse systems, and the basis for future direct potable reuse systems

While AWP staff needs may be the most pressing AWT certification need at this time, there is also a need for operator training and certification in other AWT facilities. For this reason, both a more general AWT program and potable reuse (PR)-specific program are being considered. This white paper includes discussion of both general AWT training and certification needs and PR-specific training and certification needs as there is a great deal of overlap and it is unclear which path (AWT-based or PR-based) future operator training and certification programming will take.



SECTION 3

Operator Certification Survey

As one of the collaborative partners on this joint certification effort, WaterReuse California distributed a survey to their members, which includes a wide range of California municipal water and wastewater agencies. The survey aimed to identify gaps in the existing water and wastewater operator certification programs compared to the needs at an AWT facility for potable reuse water.

CUWA staff collaborated with the WRCA to develop a nineteen-question survey on potable reuse practices and preferences. Ninety-one respondents from 64 agencies answered the survey, covering a range of perspectives, as shown in Figures 3-1, 3-2, and 3-3. The respondents included water, wastewater, and combined utilities and represented diverse roles within their agency (i.e., upper management, operations, and others), providing a statewide snapshot of current utility thinking on reuse. Representatives from outside water/wastewater agencies also participated (i.e., a contract operator, wholesalers and groundwater management agencies, and a regulator). This white paper highlights survey results that capture key water and wastewater sector preferences on this topic.

These questions offered the option to select from a list of responses or manually enter an alternate descriptor. Some responses have been described within each figure. Other results from the survey are discussed later in this document.

The full survey instrument is provided in Attachment 2. The full suite of survey responses can be requested from WRCA.



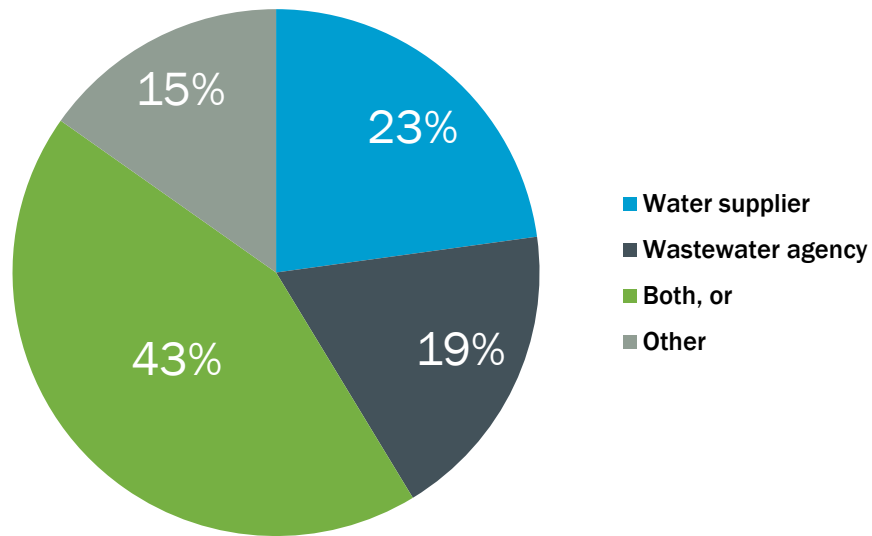


Figure 3-1. Type of agency providing survey responses (“Other” includes write-in respondents from similar groups such as plant supervisors, operations and maintenance supervisors, plant technicians).

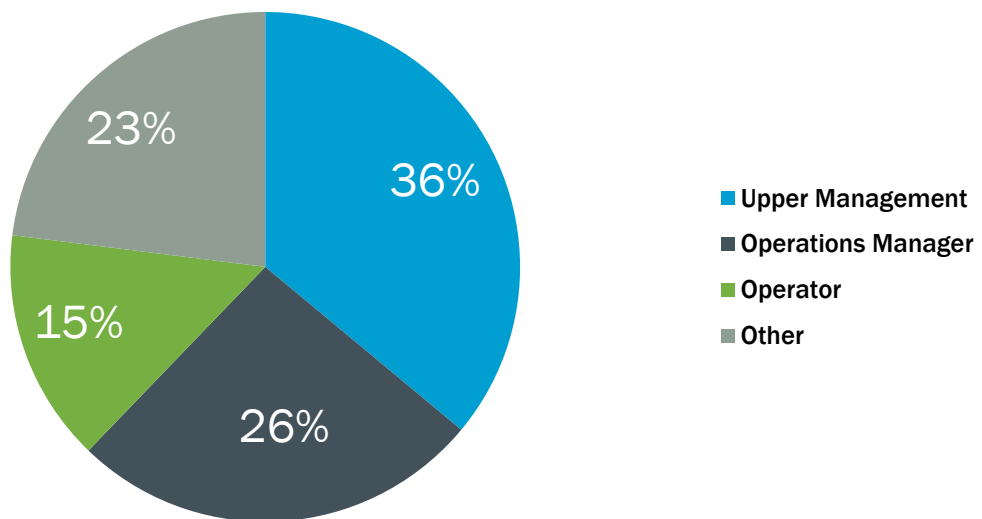


Figure 3-2. Survey respondents' roles at their respective agencies (“Other” includes write-in respondents from similar groups such as plant supervisors, operations and maintenance supervisors, and plant technicians).



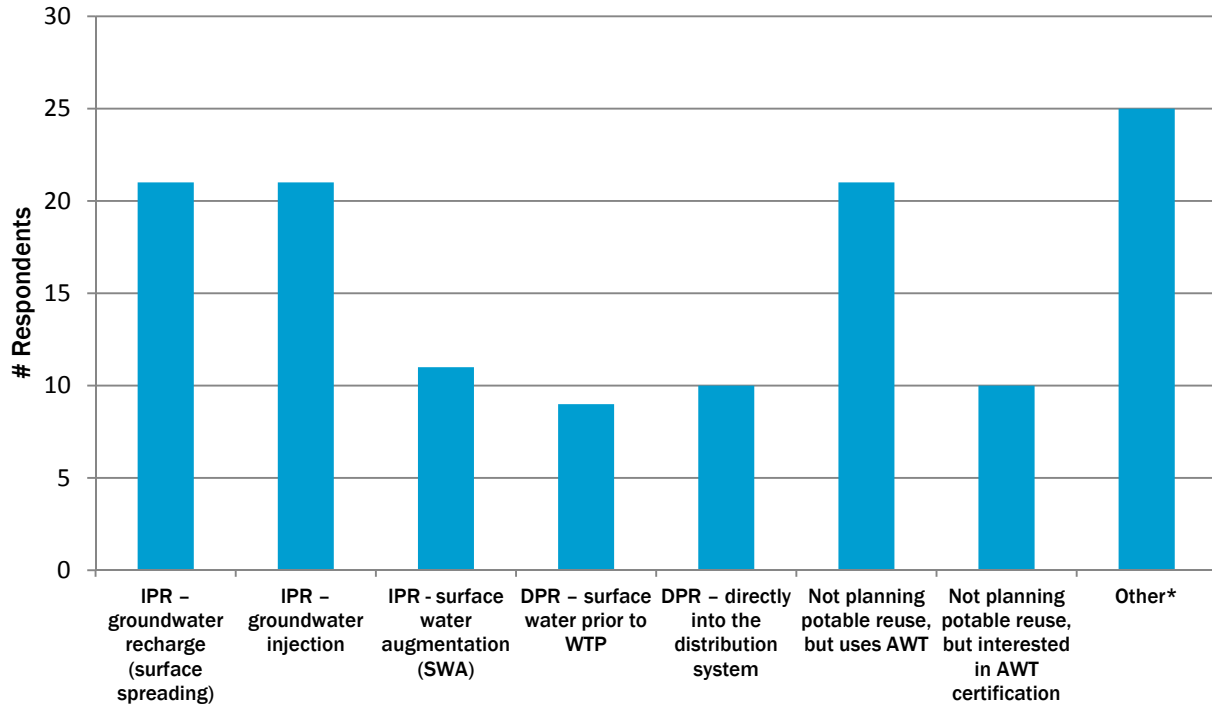


Figure 3-3. Types of potable reuse being performed or planned for by responding agencies

“Other” includes agencies looking at all types of potable reuse, those that have only unrestricted non-potable reuse water, and wholesalers.



Current Operator Certification Practices

“Certification” is a formal process to identify and acknowledge individuals who have met an established standard of competency for a defined job using a psychometrically valid test. This process typically involves obtaining education and on-the-job experience, and passing an exam that measures job-critical knowledge and skills. When the individual has met these requirements, the certifying body “certifies” that the individual has the required level of skill and ability for the defined job. More information on the certification process is provided in Attachment 1.

Current California Operator Certification Programs

Wastewater and drinking water certification programs were developed separately and are operated through the Wastewater Operator Certification Program (WW-OCP) and the Drinking Water Operator Certification Program (DW-OCP), respectively. With the merger of the Drinking Water Program into the State Water Resources Control Board, both water and wastewater operator certification programs now operate under the State Board’s Office of Operator Certification (OOC). The current management structure can help facilitate any solutions involving both programs.

Wastewater Operator Certification Program

The requirements for wastewater operator certification in California are contained in Title 23, Division 3, Chapter 26 of the California Code of Regulations (CCR, 2015b). These regulations were adopted pursuant to the California Water Code Section 13625 et seq. (included in Appendix A) and apply to wastewater treatment facilities used in the treatment or reclamation of sewage or industrial wastes. The Federal Water Pollution Control Act (i.e., the Clean Water Act) also includes provisions for support of operator training programs. There are five grades of operator certification (Grades I – V). To receive a certificate, a candidate must:

1. Meet minimum experience and education requirements,
2. Pass a written test, and
3. Apply for certification.



Certificate application must be within four years following an examination for Grade I and within four years following an examination for Grades II, III, IV, and V. WWTP classifications and operator requirements for each classification are summarized in Figure 4-1 and Table 4-1, respectively. It is illegal to operate a public or private WWTP regulated by the Public Utilities Commission without a valid certificate. The Grade level required for the chief plant operator and designated operator-in-charge depends upon the classification level of the WWTP, which is a function of both its capacity and complexity.



Examination + Education Requirements		Certification + Qualifying Experience Requirements	
GRADE I			
Path 1	High school diploma or equivalent and 6 educational points	1 year of full-time qualifying experience	
GRADE II			
Path 1	High school diploma or equivalent and 9 educational points	18 months of full-time qualifying experience as a Grade I operator	
or			
Path 2	High school diploma or equivalent and 12 educational points	2 years of full-time qualifying experience	
or			
Path 3	Associate's degree, a higher degree, or a minimum of 60 college semester units, including a minimum of 15 semester units of science courses	1 year of full-time qualifying experience	
GRADE III			
Path 1	High school diploma or equivalent and 12 educational points	3 years of full-time qualifying experience as a Grade II operator	
or			
Path 2	High school diploma or equivalent and 18 educational points	4 years of full-time qualifying experience	
or			
Path 3	Associate's degree or a minimum of 60 college semester units, including a minimum of 15 semester units of science courses	2 years of full-time qualifying experience	
or			
Path 4	Bachelor's degree or a higher degree, including a minimum of 30 semester units of science courses	1 year of full-time qualifying experience	
GRADE IV			
Path 1	High school diploma or equivalent and 32 educational points	6 years of full-time qualifying experience as a Grade II operator	
or			
Path 2	Associate's degree or a minimum of 60 college semester units, including a minimum of 15 semester units of science courses	4 years of full-time qualifying experience	
or			
Path 3	Bachelor's degree or a higher degree, including a minimum of 30 semester units of science courses	3 years of full-time qualifying experience	
or			
Path 4	Valid registration as a chemical, civil, or mechanical engineer issued by the California Board for Professional Engineers and Land Surveyors or by another state, territory, or Indian tribe	2 year of full-time qualifying experience	
GRADE V			
Path 1	High school diploma or equivalent and 48 educational points	10 years of full-time qualifying experience as a Grade II operator	
or			
Path 2	Associate's degree or a minimum of 60 college semester units, including a minimum of 15 semester units of science courses	6 years of full-time qualifying experience	
or			
Path 3	Bachelor's degree or a higher degree, including a minimum of 30 semester units of science courses	5 years of full-time qualifying experience	
or			
Path 4	Valid registration as a chemical, civil, or mechanical engineer issued by the California Board for Professional Engineers and Land Surveyors or by another state, territory, or Indian tribe	4 year of full-time qualifying experience	

Figure 4-1. California Wastewater Operator Certification Requirements (Source: §3687(c))



Qualifying experience may be acquired in two ways:

1. Individuals may work part- or full-time performing operator duties while holding an Operator-in-Training⁵ certificate or a wastewater certificate at a lower grade level. Part-time experience is prorated, e.g., two years of half-time work equals one year of qualifying experience.
2. Individuals may use wastewater experience gained outside California, provided they are a certified wastewater operator from another State or U.S. Territory and performing duties comparable to the requirements for certification in California.

The general topics covered by the wastewater certification exams include:

1. Source waters (domestic and industrial),
2. Wastewater treatment processes:
 - a. Racks, screens, and grit removal, sedimentation and flotation, trickling filters, rotating biological contactors, activated sludge, oxidation ditches, ponds, sludge digestion, solids handling, and disinfection
3. WWTP operation and maintenance,
4. Collection system operation and maintenance,
5. Laboratory procedures, and
6. Wastewater regulatory requirements and administrative duties.

Table 4-1. WWTP Classification Table		
<i>Source: §3675(a)</i>		
WWTP Classification	Wastewater Treatment Process	Design Flow (mgd)
I	Primary	≤1.0
	Conventional Treatment Pond	All
II	Primary	>1.0 - 5.0
	Biofiltration	≤1.0
	Modified Treatment Pond	All
III	Primary	>5.0 - 20.0
	Biofiltration	>1.0 - 10.0
	Activated Sludge	≤5.0
	Sequencing Batch Reactor	≤1.0
	Tertiary	≤1.0
IV	Primary	>20.0
	Biofiltration	>10.0 - 30.0
	Activated Sludge	>5.0 - 20.0
	Sequencing Batch Reactor	>1.0 - 10.0
V	Tertiary	>1.0 - 10.0
	Primary	>30.0
	Activated Sludge	>20.0
	Sequencing Batch Reactor	>10.0
	Tertiary	>10.0

⁵ The Operator-in-Training (OIT) certificate is a valid temporary certificate allowing someone to obtain experience as an operator. The regulations define an OIT as “any person who operates a WWTP under the direct supervision of a certified operator while gaining experience to qualify for an operator certificate.” An owner may employ or train an OIT at any grade level, provided the OIT is under the direct supervision of an operator at the same or a higher grade level as the OIT and performing the duties at the grade level for which the certificate was issued. An OIT may not supervise operators or other OITs. An OIT may not be a chief plant operator, designated operator-in-charge, or lone operator.



Drinking Water Operator Certification Program

In 1999, the Environmental Protection Agency (EPA) published guidance, as required by the Safe Drinking Water Act Amendments of 1996, establishing minimum requirements for state operator certification programs (EPA, 1999). Also in 1999, the California State legislature amended the Health and Safety Code to conform to the federal statute and guidelines (Chapter 755, 1999 statutes). These regulations have been adopted pursuant to that statute (Health & Safety Code §106875 et. seq.; included in Appendix B) in the CCR Title 22, Division 4, Chapter 13 (CCR, 2015a).

Unlike the wastewater certification process, the Drinking Water Operator Certification Program (DW-OCP) has two certification tracks: one for work “inside the fence” and one for work “outside the fence.” It offers five levels of *water treatment plant* operator certification (“T” grades) for plant operators and five levels of *distribution system* operator certification (“D” grades) for those who work outside the plant in the transmission system. Treatment operator certification and distribution operator certification programs are independent of one another. Drinking water treatment certification requirements are described in this section.

Drinking Water Treatment Operator Certification

To receive a certificate as a Drinking Water Treatment Plant Operator, as with WWTP operator certification, a candidate must meet the minimum experience and education requirements and pass a written test (within the last three years for each level). A summary of the experience and education necessary for each treatment plant operator grade is presented in Figure 4-2.

For the most part, all public water systems with water treatment facilities require certified WTP operators. The only exception is water systems using disinfection facilities for groundwater where no *Giardia* or virus reduction is required. These systems can meet the operator certification requirements with a certified distribution operator. All community and non-transient, non-community public water systems with or without water treatment facilities must have certified distribution operators.

The Grade level required for the chief plant operator and designated shift operator-in-charge depends upon the classification level of the WTP, which is a function of both its capacity and its complexity. WTPs are classified using a points system based on source water type, influent microbial water quality and turbidity, influence water contaminants with primary maximum contaminant limits, and treatment and disinfection types (CCR §64412.1 and §64413.1). Operator requirements for each classification are summarized in Table 4-2.

Similar to WWTP operators, qualifying experience may be acquired in two ways:

1. Individuals may work either part-time or full-time performing operator duties; part-time experience is prorated, e.g., two years of half-time work equals one year of qualifying experience.
2. The Board can grant certification through reciprocity to operators holding a valid water treatment or distribution certificate issued by another state. Reciprocity is offered for Grades 1–3 for both water treatment and distribution.

“Operator experience” means the daily performance of control or oversight activities of any process or operation at a water treatment facility or in a distribution system that may affect water quality or quantity. Many operators perform both water treatment and water distribution duties, and the operator must provide the State with a letter from their immediate supervisor or chief operator to determine how much time he or she spends performing each function.



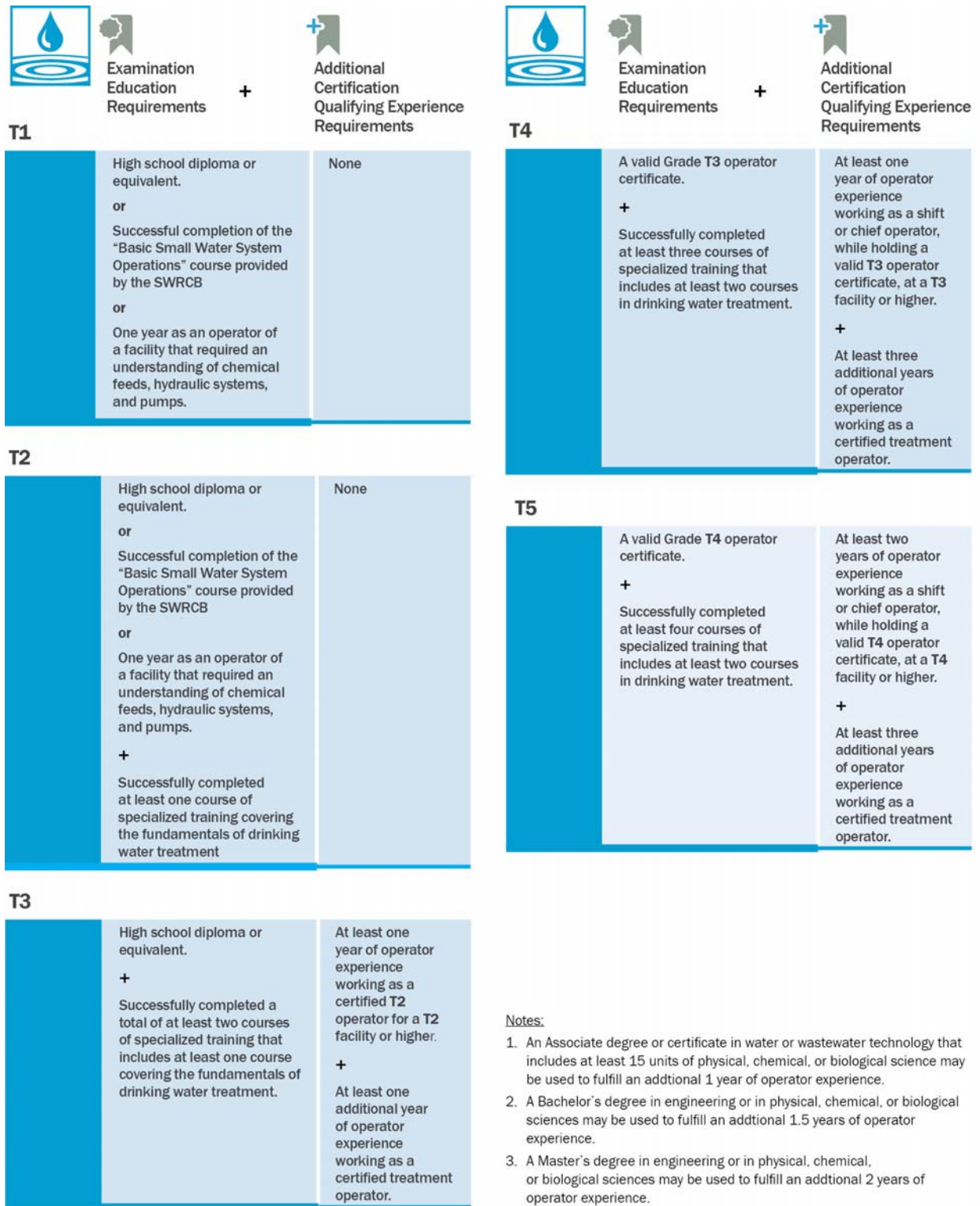


Figure 4-2. California WTP Operator Certification Requirements
(Sources: §63775 and §63800)



General topics covered by the water treatment certification exams include:

1. Source waters (surface and groundwaters),
2. Water treatment processes:
 - a. Coagulation/flocculation/ sedimentation, filtration, disinfection, demineralization, corrosion control, iron and manganese removal, fluoridation, water softening, solids handling, and Best Available Technologies (BATs)
3. WTP operation and maintenance,
4. Laboratory procedures, and
5. Drinking water regulatory requirements and administrative duties.

Both certified WTP and distribution system operators must receive ongoing training to ensure that their knowledge of treatment, operations, and public health issues remains current. Water treatment and distribution certificates must be renewed every three years. Continuing education units (CEUs) are required for renewal. The number of hours needed depends on the level of certification.

These contact hours must be obtained between the certificate's renewal dates.

Water Distribution Operator Certification

All community and non-transient, non-community public water systems are required to have certified distribution system operators. Like WWTP and WTP operators, to receive a distribution operator certificate a candidate must meet minimum experience and education requirements, pass a written test, and apply for certification. Also like wastewater operators, the grade level required for the chief distribution system operator and designated distribution system operator-in-charge depends upon the classification level of the distribution system.

The general topics covered by the water distribution certification exams include:

1. Disinfection,
2. Distribution system design and hydraulics,
3. Equipment operation/maintenance/inspections,
4. Water regulations, management and safety,
5. Water mains and piping, and
6. Water quality/water source.

Table 4-2. Certificate Requirements for Water Treatment Plants

Source: §63765(a) Table 63765-A

WTP Classification	Minimum Chief Operator Certification	Minimum Operator-in-Charge Certification
T1	T1	T1
T2	T2	T1
T3	T3	T2
T4	T4	T3
T5	T5	T3

Table 4-3. Certificate Requirements for Water Recycling Treatment Plants

Source: §3670.1.(b)(1)

WWTP Classification	WTP Operator Certificate	WWTP Operator Certificate
I	T1	Grade I
II	T2	Grade II
III	T3	Grade III
IV	T4	Grade IV
V	T5	Grade V



Water Recycling Plant Operation

Water recycling treatment plants are defined as WWTPs “that receive and further treat secondary and/or tertiary effluent from another [WWTP] for the purpose of meeting [recycled water regulations] for the use of recycled water.” An individual certified by the SWRCB as a Water Treatment operator may also operate a water recycling treatment plant at a Grade level appropriate for the class of WWTP as set forth in CCR sections §3680 and §3680.1. A WTP operator certificate is equivalent to a WWTP operator certificate as outlined in Table 4-3.

Differences in Water and Wastewater Operator Certification

Historically, water operator certification and wastewater operator certification programs were managed by separate agencies. Water operator certification (for treatment and distribution) was under the California Department of Public Health (CDPH) until CDPH was merged into the State Water Resources Control Board in the Division of Financial Assistance in 2014. At that time, drinking water operator certification was moved under the OOC. The following explains some of the important differences between the two programs:

1. While both water treatment and wastewater licenses require a combination of written testing and experience for each level of certification, and both have five levels of certification, they are not identical from level-to-level in terms of requirements. For example, Grade I wastewater certification requires a year of experience, whereas level 1 and level 2 in water treatment (T1 and T2 licenses) do not. The wastewater program has an OIT certificate serving a function similar to a T1 or T2 license in the water program.
2. A wastewater certificate allows you to operate WWTPs and water recycling plants. The certification requirement for collection system operation is administered by the California Water Environment Association (CWEA). On the water side, two separate licenses are needed to operate the WTP (a “T” license) and distribution system (a “D” license), although many operators have both.
3. Water treatment and water distribution licenses require operators to earn CEUs for renewal. Wastewater licenses do not.
4. Bases for WWTP and WTP classifications (that determine required certification levels) are different. Wastewater classification is based on design flow and what treatment processes are used. Water plant classification is based on influent water quality characteristics, treatment processes, and system size.



Existing Operator Training Opportunities

For a certification program to be successful, adequate training programs must be in place to provide potential applicants with reasonable opportunities to acquire required knowledge. Extensive training programs are available for wastewater and water treatment operator certification through community colleges, universities, and water/wastewater association-based organizations (e.g., CWEA and CA-NV Section AWWA). Training available for an AWT or PR program could be an expansion of existing training opportunities.

The basic purpose of training is to give individuals a knowledge base in the fundamental concepts associated with tasks for a defined job. They can then use this knowledge on the job as they gain experience. The level of knowledge (i.e., number of credit hours) is defined by the certification agency (see Figure 4-1 and Figure 4-2 for California wastewater operator and water treatment operator requirements, respectively).

Programs providing CEUs are intended to serve as a supplement to basic training programs to enhance operator knowledge on a particular topic and keep individuals up-to-date on advances in technology, regulations, and operational practices. This type of training is less intensive than training courses for preparing for certification tests; such education is typically gained through attendance at workshops and conferences hosted by CA-NV Section AWWA, CWEA, WRCA, and similar organizations.

Existing Sources of Training

Many training opportunities are available for existing wastewater and water treatment operator certification exams through community colleges, universities, and association-based organizations (e.g., CWEA and CA-NV Section AWWA). Some of the more well-known organizations offering courses and/or full training programs are listed in Table 5-1.



Table 5-1. Existing Wastewater and Water Treatment Operator Certification Programs

Training Entity	Offers Water Courses	Offers Wastewater Courses
Community and Junior Colleges, For-Profit Colleges		
American Water College	X	
Antelope Valley College	X	
Bakersfield College	X	X
Citrus College	X	
College of the Canyons	X	X
College of the Redwoods	X	
College of the Sequoias	X	X
Columbia College	X	
Cuesta College	X	
Cuayamaca	X	
Folsom Lake College	X	X
Fresno City College	X	
Gavilan College	X	
Glendale Community College	X	
Hartnell College	X	X
Imperial Valley College	X	X
Los Angeles Trade Technical College	X	X
Mendocino College	X	
Merced College	X	X
Mesa College	X	
Mt. San Antonio College	X	
Mt. San Jacinto College	X	
Ohlone College	X	
Palomar College	X	X
Sacramento City College	X	X
San Bernardino College	X	X
San Jose/Evergreen Community College	X	
Santa Barbara City College	X	X
Santa Rosa Junior College	X	X
Santiago Canyon College	X	
Shasta College	X	X
Solano Community College	X	X
Ventura College	X	X
Yuba College	X	
4-Year Colleges and Universities		
California State University, Sacramento	X	X
San Jose State University	X	
UC Davis	X	
Water/Wastewater Associations		
CA-NV Section AWWA Water College	X	
CWEA	X	X
Water Environment Federation		X
Water Operator Association	X	
California Rural Water Association Academy of Water Education	X	X



Table 5-1. Existing Wastewater and Water Treatment Operator Certification Programs		
Training Entity	Offers Water Courses	Offers Wastewater Courses
Others		
OCT Water Quality Academy	X	X
Golden State Water Company	X	

Note: The programs cited above are included in the master list from the OOC. It is likely not all inclusive.

As discussed in Section 8, the current approach to AWT operator training is defined on a site-by-site basis. It combines hands-on training under supervision with some combination of in-house training manuals and exams, standard operational plans, and consultant- and/or treatment process vendor-supplied supplemental instruction. Some formalized training opportunities also exist on membrane processes from various water sector organizations and individuals, including the American Membrane Technology Association (AMTA), Southwest Membrane Operator Association (SMOA), and Southeast Desalting Association (SEDA).

Advanced Water Treatment Processes Used in Potable Reuse

As illustrated in Figure 2-1, when permitted in California, except for some cases when spreading basins are used (where AWT is optional), potable reuse systems supplementing drinking water sources are expected to use complex treatment trains centered on reverse osmosis and advanced oxidation processes. These AWT processes are also used in some WTPs with challenging raw water qualities, and to a lesser extent in WWTP applications where meeting effluent discharge goals can be difficult without advanced treatment.

Water Quality Goals

In developing the regulations for Groundwater Replenishment Using Recycled Water (CDPH [now DDW], 2014), the State adopted a pathogenic microorganism control based on a goal of achieving a pathogen de minimus risk of annual infection ($<10^{-4}$ assuming a sewage influent of $10^5/L$ – i.e., a waterborne disease outbreak) via multibarrier treatment. This is expected to extend to Reservoir Augmentation IPR and eventually to DPR. This rule states:

“A project sponsor shall design and operate a GRRP [Groundwater Replenishment Reuse Project] such that the recycled municipal wastewater used as recharge water for a GRRP receives treatment that achieves at least 12-log enteric virus reduction, 10-log *Giardia* cyst reduction, and 10-log *Cryptosporidium* oocyst reduction. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e., virus, *Giardia* cyst, or *Cryptosporidium* oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0-log reduction.” - §60320.208, Pathogenic Microorganism Control.

A secondary goal is removal of microcontaminants that could pose a chronic health risk and degrade the environment. Treatment credits are awarded in the WWTP and recycled water purification process. If injected into the ground (and very likely if added to a reservoir or other drinking water



source), the water must also receive “full advanced treatment” (or an alternative equally protective of public health), defined as three-part (or more) multibarrier treatment⁶ including reverse osmosis (RO) and advanced oxidation (AOP). AWT systems for indirect potable reuse are typically designed and operated to provide disinfection and microcontaminant removal in excess of the baseline statutory requirements.

The DDW is expected to propose Draft Surface Water Augmentation (IPR) rules in 2016. A report from the National Water Research Institute (NWRI)-sponsored expert panel on the feasibility of developing uniform criteria for DPR in California is also anticipated in late 2016.

Characteristics of Advanced Unit Processes

Advanced technologies currently being used in direct injection potable reuse projects are briefly summarized in Table 6-1, with key operating parameters highlighted. Other processes, like chemical pretreatment, post-treatment water conditioning, and brine minimization may also be used, but are not AWT processes and not included here. Most treatment processes listed are also used in other water treatment facilities. The treatment selected depends on source water quality and requirements to meet drinking water standards. Current water treatment certification testing requirements do not incorporate many of these treatment processes and are focused on chlorination, conventional surface water treatment trains (coagulation–sedimentation–filtration–disinfection), and other common treatment processes.

In DPR, it is critical that processes used begin with a wastewater treatment facility followed by advanced treatment processes. Furthermore, good performance of each subsequent process is dependent upon receiving acceptable water quality from the previous process. For example, wastewater effluent quality must be consistent to ensure proper performance of the downstream microfiltration (MF) system. Good performance of the MF system is essential to avoiding quick fouling of the downstream RO membranes.

Table 6-1. Advanced Water Treatment Processes Commonly Used in Potable Reuse

Process Description
<p>Soil Aquifer Treatment (SAT)</p> <p>SAT is a passive process where water is introduced into the groundwater through soil percolation under controlled conditions. Water is introduced into a permeable pond where it percolates through the infiltration zone and the vadose zone on its way to aquifer storage. Natural treatment and attenuation occurs as it moves through the soil. In California, the water is later withdrawn after it has traveled through the aquifer for at least two months.</p>
<p>Ozone/Biologically Active Carbon (BAC)</p> <p>Ozonation: Ozone is added to the water to oxidize contaminants present in the water, particularly organic compounds and microorganisms. Ozone is the strongest oxidant of the common disinfecting agents.</p> <p>Biologically Active Carbon: BAC uses a stationary bed (typically granular activated carbon) on which biofilms of indigenous bacteria are allowed to develop. Biological filters remove contaminants by three main mechanisms: biodegradation, micropollutant adsorption, and suspended solids filtration. The microbial growth attached to the filter media (biofilm) consumes organic matter.</p>
<p>Membrane Filtration</p> <p>Low-pressure membrane systems use semi-permeable membranes to separate out suspended solids, turbidity and microbiological organisms from the feed water. Low-pressure membranes (microfiltration and ultrafiltration) do not remove appreciable amounts of dissolved organic materials, total dissolved solids (TDS), or viruses.</p>

⁶ A requirement included in the GRRP regulations for IPR groundwater injection projects.

Table 6-1. Advanced Water Treatment Processes Commonly Used in Potable Reuse

Process Description

Reverse Osmosis

RO systems use semi-permeable membranes to separate out contaminants from the feed water. The applied pressure must be in excess of the osmotic pressure of the dissolved constituents to allow flow through the membrane. It differs from low-pressure membranes in that: 1) it removes appreciable amounts of dissolved organic materials and TDS, 2) it is a physical-chemical removal process, as opposed to a size exclusion process. Rejected salts are concentrated into a small percentage of the flow (15 – 20% of the feed volume) and exit the system as a concentrated waste stream.

UV/AOP

Ultraviolet (UV) light can be used as an advanced oxidation process with the addition of hydrogen peroxide or chlorine. In these applications, a high dose of UV light (on the order of 400 – 1,000 millijoules per square centimeter, mJ/cm²) is applied to catalyze the formation of hydroxyl radicals from the peroxide. These free radicals subsequently oxidize the microorganisms and organic contaminants present, including both synthetic and naturally-occurring organic chemicals of concern.



Gaps in AWT System Operator Skill Needs

Applying only existing California wastewater or drinking water treatment operator certification requirements to AWT and PR plant operators does not address all current skill assessment needs, as existing exams do not cover advanced water treatment or potable reuse regulations and concerns.

Certification exams are regularly updated based on reassessments of what a “water/wastewater treatment plant operator” job requires at different grade levels. Periodically, surveys are sent to operators across the state to query them on aspects of their jobs. If a specific job task is not identified by at least 60% of the survey respondents, it is not added to the job description. Given that AWT processes are relatively rare, even in surface water treatment plants (WTPs), questions on advanced water treatment (AWT) processes have not yet been added to the test.

Potable reuse system operation is different from conventional wastewater and water treatment operations in a number of important ways:

1. The need to treat water from wastewater quality to drinking water quality requires multiple barriers using a variety of technologies and a more complex treatment train than conventional water and wastewater treatment processes.
2. Given that the feed water to the wastewater treatment plant (WWTP) is wastewater containing high levels of pathogens and trace levels of various chemical contaminants that will be treated to drinking water standards through the AWT treatment train, it is critical that all components are operated and maintained as intended.
3. Feedwater quality (both raw wastewater into the WWTP and secondary or tertiary effluent feedwater to the AWT process) can vary. This can impact daily operation of the advanced treatment plant as well as the purified water quality.
4. Regulations exist in California for IPR through groundwater recharge applications and the State is actively working toward similar regulations for surface water augmentation and DPR. However, potable reuse (PR) water is not clearly regulated under any one existing Federal program. In the course of making recycled water for potable use, it could be interpreted to be regulated under the California Water Code (Porter-Cologne) jurisdiction (to produce an acceptable effluent) and under the State and Federal Safe Drinking Water Act jurisdiction to produce an acceptable drinking water source and provide treatment to potable water standards. Neither operator certification program covers both wastewater and drinking water regulations.



There is an additional problem with the application of the Water Treatment (T-license) experience credit under the existing Operator Certification structure. Because the recycled water certification program was initially developed under the umbrella of the wastewater certification program to produce water almost exclusively for non-potable applications (typically relying on tertiary treatment only), there are problematic rules for Water Treatment operators to earn equal experience credit working at advanced treatment facilities producing water for non-potable applications using advanced treatment like membrane and oxidation systems similar to potable applications. Water Treatment Operators working at an AWT facility can only accrue Water Treatment Operator-qualified experience at half time because the plant is not technically a potable water treatment facility (i.e., for every year a Water Treatment Operator works at an advanced recycled water facility, he/she only accrues six months of experience credit for their Water Treatment Operator’s certificate.) This reduced credit for experience does a disservice to the operators, who run these sophisticated and complex advanced treatment systems.

The lower experience credit allowance for Water Treatment operators working at AWT facilities for recycled potable-quality water (as opposed to AWT facilities for drinking water) has become an issue at the Santa Clara Valley Water District’s (SCVWD’s) Silicon Valley Advanced Water Purification Center (SVAWPC), which processes tertiary effluent from a nearby water reclamation plant. At the SVAWPC, operators are Water Treatment-certified at Grade T3 or higher, when hired at the journey level. Although all job openings are available to both Water Treatment and Wastewater operators, at this time all staff are T-operators. Because of the way current

Table 7-1. Aspects of current operator training or certification program(s) considered essential for potable reuse operations by respondents

Answer Choice	Percent Respondents
Wastewater treatment processes	77%
Drinking water regulatory requirements	72%
Wastewater treatment plant operation/maintenance	67%
Wastewater regulatory requirements	66%
Water treatment processes	63%
Laboratory procedures	57%
Water treatment plant operation/maintenance	52%
Distribution system operation/maintenance	52%
Source water	43%
Administrative duties	30%
Collection system operation/maintenance	28%
Other (list)	11%

operator certification regulations are written, staff receive only six months credit for operating the AWT facility each year, whereas the same type of job would earn 12 months of credit if the plant’s water source was characterized as a potable water source. This issue must be considered in the development of a new potable reuse operator certification strategy.

Many survey respondents reported that knowledge of both water treatment and wastewater treatment processes was important (Table 7-1). Advanced processes were the most common certification deficiencies identified by those who had potable reuse facilities, although other related topics, like emergency response and monitoring, were also commonly cited (Table 7-2).



Table 7-2. Gaps in existing certification programs needed for potable reuse facility operation identified by respondents

Answer Choices	Percent Respondents
UV-advanced oxidation	44%
Microfiltration	39%
Reverse osmosis	39%
Ozone	36%
Unified approach to failure analysis, prediction, and avoidance	36%
Automation and process control	30%
Other (list)	30%
Monitoring (e.g., contaminant and TOC detection) protocol	25%
UV disinfection	23%
Biologically active filters	18%
Emergency response	18%
Drinking water regulatory requirements	18%
Multiple discharge requirements	18%
Control of discharges to sewer system	18%
Monitoring of wastewater quality	7%



Exploring Possible Paths Forward

To date, managers of advanced water treatment (AWT) and potable reuse (PR) plants have had to develop their own internal training programs. A formal AWT/PR certification program defining and verifying skill and knowledge needs for PR system operators could follow a number of different paths. The ideas presented here reflect thinking and discussion from different water sector individuals and groups considering the PR operator certification question. They were captured prior to the CUWA Operator Certification Workshop discussed in Section 9 and represent the range of possibilities explored by workshop participants.

Existing Potable Reuse Operator Training Practices

Given that PR and AWT plants do not have a formal certification process to verify that operators have a minimum skill and knowledge level of AWT, utilities have had to develop their own internal programs⁷. As with advanced processes for standard drinking water or wastewater treatment, operators that currently run AWT processes for potable water reclamation can be water- or wastewater-certified. Training program content and tests have historically been site-specific and developed in-house.

For example, at the **Orange County Water District (OCWD) Groundwater Replenishment System (GWRS)**, the AWT system, employing MF, RO, and UV-AOP, is operated mostly by wastewater operators. Due to its size (100 MGD), the GWRS must have 50% or more of its operators certified at least a Grade 2 or higher. These plants do not fall neatly into the categories referenced in Table 4-1, but are closest to Grade V tertiary facilities.

⁷ It is expected that all PR facilities will retain some internal, on-the-job training specific to each facility's process train and operational plan. In this section, "training" refers to uniform, basic instruction regarding how AWT processes work and what related training (e.g., regulations, monitoring) is included in the formal PR/AWT job description similar to that already in place for conventional drinking water and wastewater treatment certification programs.



OCWD's job descriptions have the following requirements:

- Shift supervisors are required to have Grade IV or V certification.
- Leads and operators at a Plant Operator III level are required to have minimum Grade III certification.
- Operators at a Plant Operator II level are required to have minimum Grade II certification.
- Operators at a Plant Operator I level are required to have minimum Grade I certification.

OCWD has also created an internal training and testing program. This program involves a combination of internal trainers and external experts engaged periodically to provide additional theoretical and hands-on training. Operators are encouraged to also obtain their water treatment operator's license, but it is not required.

City of Los Angeles Sanitation (LASAN) has an AWT train at their Terminal Island facility including MF and RO plus lime stabilization. Product water has been sent to a seawater intrusion barrier for the past eight years. They are currently in the process of expanding the facility to include UV AOP. Their permit calls for wastewater operators. Similar to OCWD, LASAN has instituted its own formal internal training program above and beyond state requirements. LASAN has developed a detailed operators training manual covering all aspects of the advanced treatment system, from the MF feedwater wet well to the outfall dechlorination system. Both process-specific operations and safety training is included.

Other facilities have less formalized training programs, but in essence do the same type of training on an individual-by-individual basis. **Santa Clara Valley Water District** holds extensive internal hands-on training for the personnel working at their Silicon Valley Advanced Water Purification Center (SVAWPC), where they operate an AWT process with MF, RO, and UV disinfection (with addition of UV-AOP planned). At SVAWPC, operators can be either water treatment- or wastewater-certified and must be Grade III wastewater or Grade T3 or higher. At this time, all SVAWPF staff are water treatment operators.

The approaches in use to train and verify competence of operators at advanced recycled water treatment facilities such as those cited above are in line with approaches reported by survey respondents for developing advanced treatment expertise. As would be expected given the lack of formal training and certification requirements, the primary means of gaining potable reuse advanced treatment system experience is on-the-job (Figure 8-1).

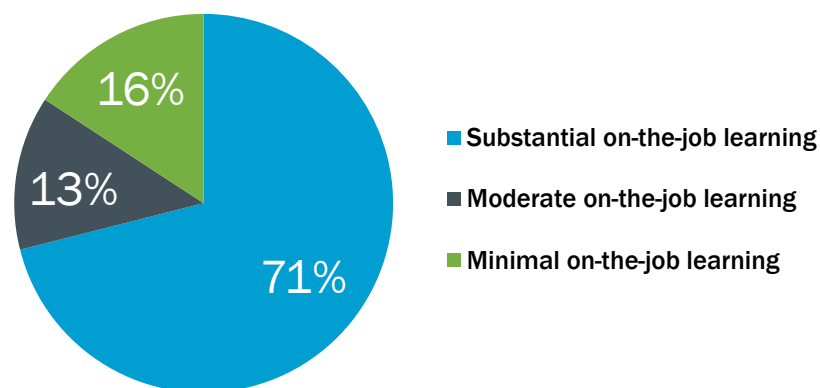


Figure 8-1. Contribution of on-the-job experience to potable reuse facility operators' knowledge of AWT




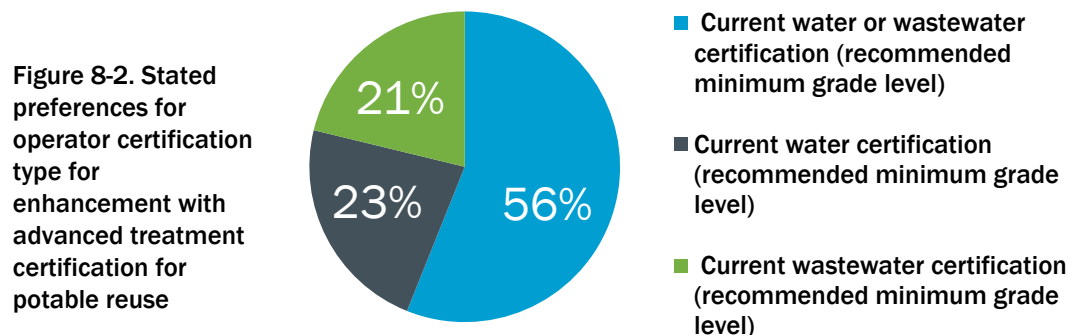
As potable reuse becomes more prevalent, the need for a potable reuse operator certification program grows to ensure continued delivery of high-quality reuse water from a wide range of agencies. This white paper provides a framework for development of a certification program to facilitate an appropriate alignment between the risk/criticality of the application and the knowledge/experience of the operators. In initial discussions, some individuals suggested that, given AWPFS are often co-located with a WWTP and the flexibility to operate both would be beneficial to some municipal agencies, PR facilities could be certified as wastewater systems with wastewater operators. PR operators and managers also highlighted the importance of good (educated) communication with WWTP operators to manage the source water quality and maintain AWT system performance.

However, DPR produces potable water supply with limited to no environmental buffer, so it needs to be held to the standards and regulations that apply to potable water and a drinking water treatment operator’s skills and knowledge will be needed. Current operator certification programs do not adequately verify the level of skill and knowledge operators need to successfully run these systems and therefore pose a potential obstacle to implementation of potable reuse programs more widely. Individual utilities must develop their own training and education programs. This collaborative effort, led by CUWA, is intended to reach agreement on operator certification that will instill public confidence that operators meet a basic standard of expertise by providing a concrete demonstration of operator proficiency. It will also help overcome the current challenge that municipal agencies face in recruiting and training future operators.

Utility Needs and Preferences

Representatives of the water and wastewater sector responding to our survey in California prefer new certification options to fill the “holes” in the existing programs and allow both water treatment and wastewater operators to obtain advanced treatment certification for potable reuse (Figure 8-2). A minority preferred one type of existing operator certification over another, depending on the operator type used within their facilities—i.e., water purveyors were more likely to state that potable reuse systems should be operated by water treatment operators and wastewater agencies were more likely to state that potable reuse systems should be operated by wastewater operators. This indicates an area of some disagreement that might need to be addressed in the certification program development process. However, over 70% of respondents agreed that whatever certification process is developed, it should be one approach for all potable reuse water system types (both indirect and direct).

 **70%**
of survey respondents agree that one certification process for all potable reuse water system types should be developed.



Potential Approaches to Developing an AWT or PR Certification Program

A certification program that helps define and verify skill and knowledge needs for potable reuse system operators could be developed as an independent, stand-alone program, or incorporated under an existing certification program. A number of different paths could be taken to develop an advanced water treatment/potable reuse (AWT/PR) operator certification program. The ideas presented here reflect thinking and discussion from different water sector individuals and groups looking at the potable reuse operator certification question, particularly the CA-NV Section AWWA's Advanced Water Treatment Certification Workgroup, comprised of utility members (including some CUWA member agencies), California and federal regulators, and consultant potable water experts. This list is not intended to reflect the ideas of any one group or person, but rather capture and reflect some of the avenues of thought and discussion on the topic considered prior to the October 2015 CUWA Operator Certification Workshop. The options presented below represent the range of possibilities explored by workshop participants.



1 Separate Potable Reuse Operator Certification Program

With this approach, a separate certification program would be developed exclusively for PR system operators to validate an individual has a defined level of PR system-specific knowledge, skill, and experience. This would incorporate advanced treatment material along with water and wastewater topics critical to the operation of an AWP. This concept is illustrated in Figure 8-3.

DW-OCP	PR-OCP	WW-OCP
• T1 • D1	• PR1	• Grade I
• T2 • D2	• PR2	• Grade II
• T3 • D3	• PR3	• Grade III
• T4 • D4	• ...	• Grade IV
• T5 • D5		• Grade V

Figure 8-3. Illustration of potential PR certification program Option 1, a stand-alone program; where DW-OCP = Water Treatment Operator Certification Program, PR-OCP = PR Operator Certification Program, and WW-OCP = Wastewater Operator Certification Program; PR_i = PR Operator Certification Level *i*.



2 & 3

DPR or AWT Operator Certification Program Supplement

With this approach, a PR or more general AWT⁸ certification program would verify that an individual has a defined level of advanced treatment-specific knowledge, skill, and experience. It might also include water or wastewater topics critical to the operation of an AWP and missing from the operator’s standard certification exams.

As a WW-OCP Supplement

If a supplemental certification program was developed under the WW-OCP, its content would enhance the existing wastewater certification requirements. In this scenario, it is assumed that DPR plant operators would need WW-OCP + PR or AWT supplement certification. This concept is illustrated in Figure 8-4.

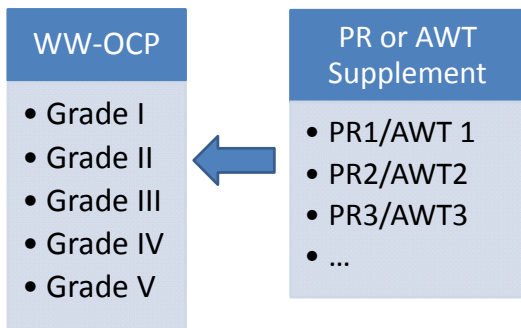


Figure 8-4. Illustration of potential PR or AWT certification program Option 2, as a supplement to wastewater certification; where WW-OCP = Wastewater Operator Certification Program; PR_i/AWT_i = PR or AWT certification level *i*.

As a DW-OCP Supplement

If a supplemental certification program was developed under the DW-OCP, its content would enhance existing water treatment certification requirements. In this scenario, it is assumed that DPR plant operators would need DW-OCP + PR or AWT supplement certification. This concept is illustrated in Figure 8-5.

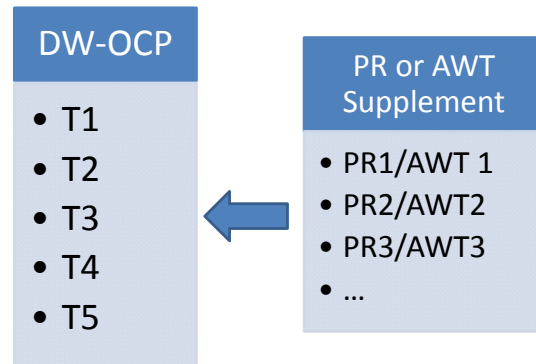


Figure 8-5. Illustration of potential PR or AWT certification program Option 3, as a supplement to drinking water treatment certification; where DW-OCP = Drinking Water Treatment Operator Certification Program; PR_i/AWT_i = PR or AWT certification level *i*.

³ A more general AWT program would include all standard PR technologies (e.g., MF/UF, RO, UV-AOP) plus other advanced technologies like ion exchange. A general AWT certification could be used to certify operators running advanced systems in conventional drinking water plants, as well as in PR facilities. This would both expand opportunities for recruiting high enough numbers of participants to support a certification program through CA-NV Section AWWA, or similar organization and provide utilities with the opportunity to raise their formal standards for AWT operators.





4

DPR or AWT Hybrid Added on to Either License

With this approach, either a separate PR or more general AWT⁴ supplemental certification program would be developed under the Operator Certification Program to certify that a WWTP or WTP operator has a defined level of advanced treatment-specific knowledge, skill, and experience. This approach might have different components for water treatment-certified and wastewater-certified operators to fill in their different knowledge gaps.⁹ This concept is illustrated in Figure 8-6.

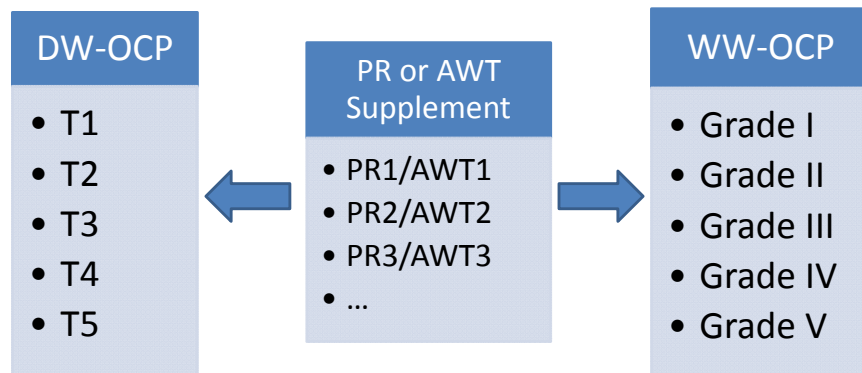


Figure 8-6. Illustration of potential PR or AWT certification program Option 4, as a hybrid supplement that can be used with either water treatment certification or wastewater certification; where DW-OCP = Water Treatment Operator Certification Program, and WW-OCP = Wastewater Operator Certification Program; PR_i = PR Operator Certification Level *i*.

When queried as to which approaches would be preferred, a large majority of survey respondents ranked a special potable reuse or AWT module to enhance existing certifications highest among the options. However, respondents were again split on which program should offer the module (water treatment, wastewater, or both, as shown in Figure 8-7). Definitions for what would comprise the certification module were not provided with the survey.

⁹ This would be the case if it was determined that direct PR operators should have knowledge of both water and wastewater topics.



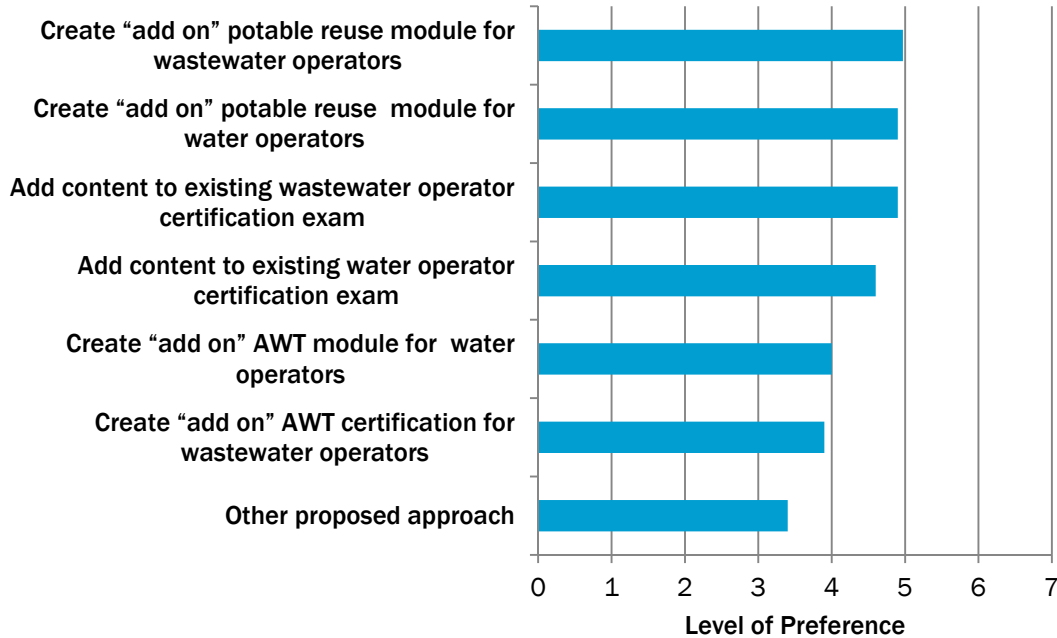


Figure 8-7. Preferences for modifying water and wastewater certification programs to advance PR, ranked in order of preference, where 7 is most preferred and 1 is least preferred.

Benefits and limitations of these approaches are presented in Table 8-1. Whichever certification path is selected, there will be a number of questions and issues to consider and settle. The most critical questions identified prior to the workshop included:

- What key elements must be covered in the job description for this test?
- How will training to prepare candidates be handled? Who might be able to offer the needed training?
- Is there a large enough market for the AWT/PR certification program to support its development (expense question)?
- Could the selected approach limit the available pool of existing PR operators (availability of workers question)?
- What type of experience would be acceptable to operate a potable reuse facility and sit for the proposed certification exam (WTP operation, WWTP operation, or either/both)?
- Would this approach result in unacceptable knowledge and/or experience gaps to some parties?
- How would the State/plant managers address knowledge and/or experience gaps?
- If the program developed is not explicitly for PR, would this negatively impact public perception regarding the safety of potable reuse to supplement drinking water?
- If both drinking water treatment and wastewater operators are used, would senior supervisors be experienced enough to effectively manage a diversity of staff backgrounds?



Selecting the location and focus of a new add-on certification program will need to balance two primary needs: covering knowledge elements necessary for operating potable reuse systems—which by their nature straddle the wastewater and drinking water fields—and developing a program that will draw a high enough number of participants that it is economically viable to maintain and creates a large enough pool of certified operators to meet utility hiring needs.

Table 8-1. Summary of Potential Potable Reuse/AWT Operator Certification Approaches

Certification Approach	Description	Benefits	Limitations
Separate DPR Operator Certification Program	A separate certification program developed solely for potable reuse system operators. A wastewater or water treatment operator with some pre-specified Grade level (perhaps Grade-II or T3) would start a new program and get everything he/she needs to operate an advanced potable reuse plant.	<ul style="list-style-type: none"> – Would be specifically tailored to the needs of the job of operating a potable reuse plant. 	<ul style="list-style-type: none"> – Would likely result in a very small pool of qualified operators. – Would not cover other water/wastewater systems with advanced technologies.
Add-on to WWTP Certification	A supplemental certificate for existing wastewater operator certification that verifies a defined skill level in potable reuse/AWT.	<ul style="list-style-type: none"> – Would allow wastewater agencies to use internal staff in new potable reuse projects. 	<ul style="list-style-type: none"> – Might not require knowledge of drinking water-specific treatment, rules and protocols. – Would preclude WTP operators from operating potable reuse systems.
Add-on to WTP Certification	A supplemental certificate for existing water treatment operator certification that verifies a defined skill level in potable reuse/AWT.	<ul style="list-style-type: none"> – Would staff potable reuse plants with individuals that are well-versed in potable water requirements and protocols. 	<ul style="list-style-type: none"> – Might not require knowledge of wastewater-specific treatment, rules and protocols. – Would preclude WWTP operators from operating potable reuse systems.
Hybrid that can be added on to either license	A supplemental certification program that supplements both WW-OCP and the W-OCP that verifies a defined skill level in PR/AWT. A wastewater or water treatment operator with some pre-specified Grade level (perhaps Grade-II or T3) would acquire this certification as a supplement or rider to their existing license.	<ul style="list-style-type: none"> – Would allow potable reuse plants to hire a diverse staff. 	<ul style="list-style-type: none"> – If focused solely on advanced treatment, WTP operators would potentially miss exposure to wastewater topics and vice versa. There might be inevitable knowledge gaps for all operators (wastewater- or water-related). – If focused solely on potable reuse, it might not draw enough potential applicants



Potential Future Sources of Training

In order to create a substantial pool of potential AWP operators, training available for an AWT or PR program would need to be expanded beyond existing opportunities. This could include new training programs developed under the same sorts of entities as have developed conventional DW and WW operator training courses. Historically, initial (and for some topics relatively exclusive) sources of training for many operator certification topics has come from CA-NV Section AWWA and CWEA for water and wastewater training, respectively.

Some similar effort may be needed for AWT training. The WaterReuse Research Foundation is preparing to issue RFP 15-05, *Developing Curriculum and Content for Operator Training* to help address this shortfall. This WaterReuse project will develop recommendations on what content is needed to train operators in AWT processes and to impart critical knowledge about the operations and management of a potable reuse system. This effort could serve as the foundation for the development of new curricula in AWT and potable reuse.



CUWA Potable Reuse Operator Certification Workshop Outcomes

CUWA facilitated a workshop on October 19 and 20, 2015 at the Orange County Water District to provide an opportunity for collaborative partners and stakeholders to reach agreement on a framework for advanced water treatment (AWT) and potable reuse (PR) operator training and certification for recommendation to DDW. The results of this workshop are summarized below.

There is much ongoing work related to the development of PR operator training and certification in California by a few motivated entities. CUWA hosted a workshop to bring many of these stakeholders together, including collaborative partners WRCA, CA-NV Section AWWA, CWEA, and CASA, representatives of several water and wastewater agencies from across the state engaged in or planning to implement PR, and representatives from the SWRCB, DDW and OOC. The intent was to provide a forum to advance the AWT or PR certification dialog and set the stage for further collaboration. In this two-day workshop, CUWA Executive Director Cindy Paulson facilitated a series of presentations, group discussions, and break-out sessions designed to reach agreement on a proposed strategy for PR operator training and certification. Topics included current practices and certification rules and requirements, training and certification gaps as they relate to PR and AWT, options for implementing a new certification program, and implementation needs, challenges, and alternatives.

By coming together face-to-face, the group was able to make great progress and reach agreement on a number of critical issues and questions. At the conclusion of the workshop, the group had achieved consensus on the basic structure of the future certification program and a strategy to move it forward. The group also identified key foundational needs for the new certification program and explored a wide range of institutional, financial, and technical issues related to implementing an AWT and/or PR operator certification program. The following sections summarize the key findings and remaining challenges that emerged from the workshop.



Strategic Approach for Developing a Certification Program

Key elements of the strategy include the following:

1. The certification program should be a robust training and testing program centered on AWT technologies used in the purification of wastewater effluent for potable reuse and should include risk management concepts (e.g., emergency response and Critical Control Points protocols).
2. It should be a stand-alone certification “add on” or “supplement” to an existing certification available to both wastewater and water treatment operators with an acceptable level of training and experience (e.g., Grade II wastewater operators and T3 water treatment operators¹⁰).
3. Those with a qualifying background in either wastewater or water treatment should be evaluated on the same competencies and therefore take the same certification test.
4. The program should provide an adequate population of certified operators from which utilities can hire new PR treatment plant operators and be broad enough to draw a large enough testing population to be financially viable.

Foundational Needs for a New AWT/Potable Reuse Certification Program

The essential elements to a new AWT/PR certification program center around three main categories: fielding enough candidates, implementation strategy, and technologies.

Fielding Enough Candidates

In order to be supportable, and to provide utilities with enough qualified job applicants to be able to fill their future AWPf needs, the Certification Program should be founded on the following elements:

1. Provides a clearly outlined path to certification.
2. Is inclusive of water treatment and wastewater operators.
3. Offers career mobility and bridging to and from the AWT/PR track and between Water and Wastewater Operator Certification Programs, as it would be advantageous for recruiting.
4. Grandfathers in existing PR plant operators for a period of time or unless facility treatment or purpose changes is needed.
5. Focuses on the operator role, accountability, and end use rather than get overly focused on technologies, as they can change.
6. Requires a minimum level of water treatment operator and wastewater operator certification. The group did not officially settle on the most appropriate level, but a suggestion of Grade II (wastewater) or T3 (water) was made.

¹⁰ The difference in recommended certification grade level reflects differences in experience requirements between the wastewater certification and water treatment certification programs. While both have five grades of certification, the requirements for each grade are not identical.



Facilitating Program Development

Timely development of training and certification is needed for direct potable reuse (DPR) to move forward. To achieve this goal, the water sector will have to address a number of critical implementation needs.

1. The structure developed must be manageable and enforceable by the State Water Resources Control Board (SWRCB).
2. It must be accepted by regulators, decision makers, operators and the public.
3. There must be a test-able, viable mechanism for training. This will need to be association-led.
 - a. The State could allow for certification through CA-NV Section AWWA, CWEA, or a joint CA-NV Section AWWA—CWEA effort in the near term. Draft regulations for potable reuse could maintain flexibility to allow for this approach. There is precedence set for Association-led training and certification evolving to a State-led program on both the water and the wastewater sides.
 - b. The CA-NV Section AWWA and the CWEA could collaborate together to facilitate development of this program. It naturally crosses the borders of both wastewater and water treatment knowledge and activities. (However, no formal agreements are currently in development.)

Included Technologies

The exam should be based on the standard elements of an AWT train for potable reuse, including those being considered for DPR and should be practical and responsive to the changing nature of technology.

1. Technologies to be covered in training and certification exams should include at least the following:
 - a. MF/UF
 - b. RO/NF
 - c. Chemical disinfection
 - d. Advanced Oxidation
 - e. Ozone + BAC
2. Other knowledge that could be included in testing for the first level of certification:
 - a. Advanced disinfection, stabilization, advanced separation, brine management
 - b. Critical Control Points
 - c. Basic instrumentation
 - d. Source water
3. The program should evolve in content over time as technology changes.
4. It should effectively address differences between technical knowledge (including continuing education units, or CEUs) and hands-on experience for each existing certification program.



Remaining Challenges to Developing a New AWT/PR Certification Program

The group identified and discussed a number of remaining technical and institutional challenges associated with developing a new program. These centered on implementation, mobility, and career path questions, and program boundaries.

Implementation

1. Sufficient resources will be necessary to run the program. This includes financing the development of training and certification programs *and* financing administration of the certification process within the California State Water Resources Control Board Operator Certification Program.
2. There needs to be sufficient training opportunities for potential candidates to gain the knowledge they need to pass the test.
 - a. Design engineers, vendors, and associations are an important part of the alternative competency demonstration process.

Mobility and Career Path

1. Utilities (i.e., potential employers) will have to establish clear treatment tracks, address pay implications, and determine job requirements for different operator types.
2. The minimum entry point for operators and required level of knowledge and water or wastewater experience must be defined. The requirements for transitions between PR1, PR2, PR3,... need to be established. Each level will require knowledge and experience elements including technologies, regulations, and end use. Increasing levels address increasing knowledge and accountability.
3. Advanced grades (e.g., grades T5 and [wastewater] V) should allow an operator to jump above a PR1. However, they would still have to take the required tests.
4. Advanced treatment experience with reuse systems should count toward experience requirements for water treatment and wastewater operator certification.
5. An “in-training” process like the wastewater Operator-in-Training (OIT) program is not desirable.

Program Boundaries

1. As the program will be open to both water treatment and wastewater operators, there is a need to address gaps in “crossover” knowledge (wastewater operators need to understand water treatment and regulations, and water treatment operators must learn similar things about wastewater). Every gap does not necessarily need to be covered as experience and system-specific training will help address remaining gaps.
2. The test focus should change depending upon the certification level. Lower level AWT/PR certifications could focus on technology basics. Upper level AWT/PR certifications could test more advanced monitoring, emergency response, and regulations concepts.
3. The benefits of broadening from a more narrow PR focus to AWT should be considered. For example, it could provide a more robust economic engine to drive the program, making it



more viable. AWWA Cal-NV members have interests in AWT certification that go beyond PR, although that is still a central need. Thus, it could address other concerning source waters such as stormwater and contaminated groundwater.

4. As a compromise, calling it an advanced water purification (AWP) certification program with a focus on potable reuse would speak to the public's interests and provide confidence. One suggestion was that the program could be phased. For example, it could start with source water as wastewater and evolve to other impaired source waters.

It is anticipated that these issues will be resolved as certification program development work moves forward.

Remaining Unresolved Issues Related to Developing a New AWT/Potable Reuse Certification Program

The group was able to achieve consensus on the critical foundational structure of the future certification program. No consensus was reached on the target audience for the certification program. Consensus is needed to complete the initial "job analysis" step, whereby the content of the certification exam topics is identified. What "job(s)" are to be certified (AWT or PR operations) will, in turn, clarify the scope and content of the program.

The other critical question to be resolved is what organization(s) will create and maintain the program. As mentioned previously, there is an effort underway through the CA-NV Section AWWA's AWT Operator Certification Committee to explore the possibility of developing an AWT or PR-focused certification program. At the CUWA Workshop, representatives from CA-NV Section AWWA and CWEA agreed that it might be beneficial to collaborate. It was also recognized that each organization would need to further explore with their leadership how such a partnership could work. As of publication, conversations between these groups are on-going but no formal agreements have been made.

An entity or entities will need to commit to developing training and certification programs for an AWT or PR supplement. This step will allow the OOC to create a program. The institutional complexities and financial contributions needed for program development will take time to resolve. Continuous coordination with the DDW and OOC is necessary.



Conclusions and Recommendations

Water reuse, including potable reuse (PR), is a critical element of California’s water supply portfolio. Yet current operator certification programs do not adequately test the range of skill and knowledge operators need to successfully run these systems and, as a result, pose a potential obstacle to implementation of PR programs. New training and certification programs are needed to provide advanced water treatment (AWT) and PR skill-specific operator endorsements and reassure the public that PR systems are being operated by highly-trained, qualified individuals. In a CUWA-facilitated workshop, a wide range of utility and State regulatory agency representatives came together and achieved consensus on the basic structure of the future certification program and a strategy to move it forward.

A number of different strategies for potable reuse operator certification programs have been described including: 1) a separate PR operator certification program, 2) an AWT or PR supplement to the current water treatment or wastewater certification program, 3) an AWT or PR rider or supplement that could be added on to either license. CUWA workshop participants and survey respondents both agreed that a special AWT or PR supplement to enhance water or wastewater operator certification is the best option. Workshop participants developed a number of strategic recommendations:

- 1** The certification program should be centered on AWT technologies used in the purification of wastewater effluent for potable reuse and should include risk management concepts.
- 2** It should be a stand-alone certification AWT or PR “add on” available to both wastewater and water treatment operators with an acceptable level of training and experience.¹¹

¹¹ This is Option 4 in Section 8, “DPR or AWT Hybrid that Can Be Added on to Either License.”



3 There should be one test for each level of certification.

4 The program should provide an adequate population of certified operators from which utilities can hire new PR treatment plant operators and be broad enough to draw a large enough testing population to be financially viable.

In the workshop, it was agreed that development of this new program would be done in coordination with the existing water and wastewater training and certification programs. The ultimate target audience for the certification program has yet to be defined by the water/wastewater community—whether it should be centered on potable reuse specifically, or a more general AWT program with water and wastewater elements. Considerable time was spent in the workshop on this topic with no final resolution. The need for certified PR operators is the strongest driver for developing a new certification program, but there are other groups both in municipal water treatment and industrial applications that may want to use an AWT training and certification program.

Funding is an equally important topic intrinsic to the discussion. Training and certification programs are expensive to create, and the expense of creating and maintaining a training program and a certification program using water/wastewater organization member dollars must be justified. The funding decision will turn largely on: 1) comforts and endorsement by State regulators, and 2) the broadness of the program needed and sponsoring agency's/agencies' fiscal ability to support the program.

Agreement on the target audience and scope of certification is needed to perform the initial “job analysis” step. This step identifies the content of the certification exam topics. CA-NV Section AWWA is surveying California and Nevada utilities to determine the potential audience for the exam. This data should clarify the scope and content of the program—whether it should be a PR-specific program or a more general AWT program.

The other critical question to be resolved is what organization or organizations will create and maintain the training certification programs¹². The CA-NV Section AWWA AWT Operator Certification Committee is currently exploring development of an AWT or PR-focused certification program. At the CUWA Workshop, representatives from CA-NV Section AWWA and CWEA agreed that it is beneficial to collaborate. As of publication, however, no formal agreements have been made. Both water and wastewater perspectives are needed to train and certify potable reuse operators.

Many utilities are considering moving forward with PR programs while formal DPR regulatory mechanisms and requirements are in development. Therefore, a program for training and certification needs to be implemented in the near future.

Potable reuse operator certification would establish a minimum standard level of skills and knowledge for operating a PR system and reassure the public that PR is being managed by individuals with the proper background, education, and experience.

¹² It should be noted that training and certification programs are separate efforts and are not necessarily both done by the same organization.



Regardless of the selected strategy, legislation and/or regulations will need to address the proposed new certification requirements. Additional work will also be needed to determine details on the range of knowledge and criteria for qualifications. Any certification program would need to be developed in coordination with the Office of Operator Certification and the DDW. It is anticipated that these issues will be resolved as work moves forward on developing a training and certification program.



References

CCR (California Code of Regulations). 2015a. Title 22. Division 4. Chapter 13. Operator Certification. Retrieved from <http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Lawbook/dwregulations-2013-07-01.pdf>, 2015.

CCR (California Code of Regulations). 2015b. Title 23. Division 3. Chapter 26. *Classification of Wastewater Treatment Plants and Operator Certification*. Retrieved from http://www.waterboards.ca.gov/water_issues/programs/operator_certification/docs/regs.pdf on July 23, 2015.

CDPH (California Department of Public Health, now California Water Resources Control Board Department of Drinking Water). 2014. Title 22, Division 4, Chapter 3 *Groundwater Replenishment Using Recycled Water*.

Tchobanoglous, G., Leverenz, H., Neller, M.H., Crook, J. 2011. *Direct Potable Reuse: A Path Forward*. WaterReuse Research Association: Alexandria.

EPA (Environmental Protection Agency). 1999. Final guidelines for the Certification and Recertification of the Operators of Community and Nontransient Noncommunity Public Water Systems. *Federal Register*, 64(24): 5916-5921, February 5, 1999.



Acronyms

AFY	acre-feet/year
AMTA	American Membrane Technology Association
AOP	advanced oxidation processes
AWPF	advanced water purification facilities
AWT	advanced water treatment
BAC	biologically active carbon
BAT	Best Available Technology
CA-NV Section AWWA	California-Nevada Section of the American Water Works Association
CASA	California Association of Sanitation Agencies
CCR	California Code of Regulations
CDPH	California Department of Public Health
CE	continuing education
CEU	Continuing Education Unit
CUWA	California Urban Water Agencies
CWEA	California Water Environment Association
DDW	State Water Resources Control Board, Division of Drinking Water
DPR	direct potable reuse
DW-OCP	Drinking Water Operator Certification Program
EPA	Environmental Protections Agency
Grade I	Level I Wastewater Operator Certification
Grade II	Level II Wastewater Operator Certification
Grade III	Level III Wastewater Operator Certification
Grade VI	Level VI Wastewater Operator Certification
Grade V	Level V Wastewater Operator Certification
GRRP	Groundwater Replenishment Reuse Program
IPR	indirect potable reuse
LASAN	Los Angeles Sanitation
MF	microfiltration
mJ/cm ²	millijoules per square centimeter
NWRI	National Water Research Institute
OIT	Operator-in-Training



OOC	State Water Resources Control Board Office of Operator Certification
PR	potable reuse
PR1	Level 1 Potable Reuse Operator Certification
PR2	Level 2 Potable Reuse Operator Certification
PR3	Level 3 Potable Reuse Operator Certification
PR4	Level 4 Potable Reuse Operator Certification
PR5	Level 5 Potable Reuse Operator Certification
RO	reverse osmosis
SAT	soil aquifer treatment
SEDA	Southeast Desalting Association
SMOA	Southwest Membrane Operator Association
SVAWPC	Silicon Valley Advanced Water Purification Center
SWRCB	State Water Resources Control Board
T1	Level 1 Water Treatment Operator Certification
T2	Level 2 Water Treatment Operator Certification
T3	Level 3 Water Treatment Operator Certification
T4	Level 4 Water Treatment Operator Certification
T5	Level 5 Water Treatment Operator Certification
TDS	total dissolved solids
UV	ultraviolet light
UV-AOP	ultraviolet light advanced oxidation process
WRCA	WaterReuse California
WTP	water treatment plant
WW-OCF	Wastewater Operator Certification Program
WWTP	Wastewater treatment plant



Attachment 1 - The Certification Process

“Certification” is a formal process to identify and acknowledge individuals who have met an established standard of competency for a defined job. This process typically involves obtaining education and on-the-job experience, and passing an exam that measures job-critical knowledge and skills. When the individual has met these requirements, the administering agency “certifies” that the individual has the required level of skill and ability for the defined job.

Development of a certification program is complex, time-consuming, and labor-intensive. An example of how a DPR certification program might be developed is presented in Figure 1.1. The process is typically done by a committee of stakeholders and technical experts with the help of certification program consultants. It requires consideration of technical issues related to the certification topic, water sector needs and other economic assessments, a job analysis, eligibility requirements, consultation with regulators to ensure the program is acceptable from the DDW’s standpoint, and more. The current certification programs aren’t adequate for robust DPR operator certification. There is great value in coming together as a group to determine the best approach for certifying DPR operators so that we can get the cumbersome process of program development underway and create a program that has widespread support and regulator buy-in.

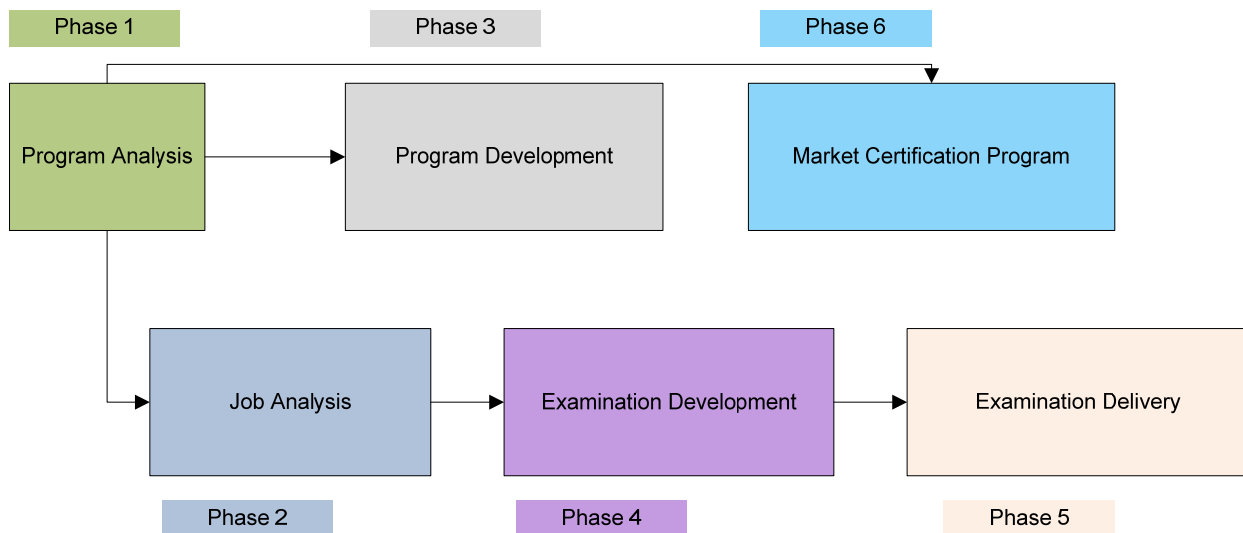


Figure A.1. CA-NV Section AWWA Certification Program Development Process. NOTE: This is representative of the basic process involved in developing a certification program and is not intended to be an exhaustive portrayal.



Attachment 2 - WaterReuse California Survey Instrument

Potable Reuse: Operator Certification

Background:

The Expert Panel providing recommendations to the State Board on the Surface Water Augmentation Regulations and the feasibility of direct potable reuse (DPR), the Advisory Group which advises the Expert Panel in DPR issues and the State Water Resources Control Board-Division of Drinking Water (DDW) have identified operator certification as a major issue for consideration in ensuring that potable reuse projects are reliably operated. At this time DDW does not have adequate staffing with which to begin developing a new operator certification program for advanced treatment systems, and there remain some critical outstanding policy issues about the nature of a new or revised certification for potable reuse since this includes advanced technologies and crosses into treatment for both water supply and wastewater.

WaterReuse California (WRCA) and the California Urban Water Agencies (CUWA) are developing a white paper that will identify key components for consideration for a revised or new operator certification program for advanced purified recycled water for potable reuse. Collaborative partners such as the American Water Works Association (AWWA) and California Water Environment Association (CWEA) will provide input as they will likely be involved in the implementation of a program as it moves forward. As part of this effort, WRCA is interviewing operators at existing potable reuse facilities to better assess what unique operational issues they face and what range of knowledge is needed for operation of indirect potable reuse (IPR) and DPR facilities.

Currently, operators of agencies producing advanced purified recycled water are mostly certified wastewater treatment operators (Grade V). As the state of California seeks to expand potable reuse for IPR for groundwater, surface water augmentation and eventually DPR, additional certification requirements may be needed to help ensure public safety and public confidence in the process.

Potable Reuse Operational Issues

1. What is the name of the agency you work for? (Note: This is for tracking purposes only; your agency name will not be included in any survey results)

2. What is the population served by the agency?

3. Describe your employer:

- Water supplier
- Wastewater agency
- Both, or
- Other (describe)

4. What type of potable reuse does your agency currently employ and/or what type of potable reuse are you planning for?

- IPR – groundwater recharge (surface spreading)
- IPR – groundwater recharge (injection)
- IPR – surface water augmentation



-
- DPR – augmenting source water with advanced purified water prior to the Water Treatment Plant (WTP)
 - DPR – introducing advanced purified water directly into the distribution system (after the WTP)
 - Our agency is not planning for potable reuse projects, but does use advanced treatment process in its operations
 - Our agency is not planning for potable reuse projects, but I am interested in being certified in this area
 - Other (describe)

4a. If your agency does/has done groundwater recharge, what type of reclaimed water is/was used?

- Tertiary filtered and disinfected (i.e., “Title 22 water”)
- Advanced treated (i.e., reverse osmosis with UV advanced oxidation)
- Other (describe)

5. What is your role in the organization?

- Upper Management
- Operations Manager
- Operator
- Other (describe)

6. How many years of experience do you have at the facility?

7. What water or wastewater treatment certificates or other licenses do you hold?

- Water Treatment (Grade: select one 1 2 3 4 5)
 - Grade 1
 - Grade 2
 - Grade 3
 - Grade 4
 - Grade 5
- Wastewater Treatment (Grade: select one 1 2 3 4 5)
 - Grade 1
 - Grade 2
 - Grade 3
 - Grade 4
 - Grade 5
- Registered Civil Engineer
- Registered Chemical Engineer
- Other technical certifications (list)
- None

8. What aspects of your current operator training or certification program(s) do you consider essential for potable reuse operations?



-
- Source Water
 - Water Treatment Processes*
 - Wastewater Treatment Processes*
 - Water Treatment Plant Operation/Maintenance*
 - Wastewater Treatment Plant Operation/Maintenance*
 - Distribution System Operation/Maintenance*
 - Collection System Operation/Maintenance*
 - Laboratory Procedures
 - Drinking water regulatory requirements*
 - Wastewater regulatory requirements*
 - Administrative Duties
 - Other (list)

9. If you are currently operating a potable reuse facility, which of the following unique operational or treatment requirements needed for a potable reuse facility that are not currently addressed by your existing certification program(s)(water or wastewater) Check all that apply:

- Microfiltration
- Reverse Osmosis
- Biologically active filters
- UV Disinfection
- UV-Advanced Oxidation
- Ozone
- Monitoring (e.g., contaminant and TOC detection) protocol
- Unified approach to failure analysis, prediction, and avoidance
- Automation and process control
- Emergency response
- Drinking water regulatory requirements
- Multiple discharge requirements
- Control of discharges to sewer system
- Monitoring of wastewater quality
- Other (list)

10. If you are currently operating a potable reuse facility, is there additional training or information that could help you do your job better? Please describe.

- College degree (describe)
- On-site plant operations training
- Certification courses (describe)
- Non-certification specialized course(s) (describe)



- Industry conferences
- Industry training
- Pilot plant operations
- Other (describe)

Comments:

11. If you are currently operating a potable reuse facility, how much has on-the-job experience contributed to your knowledge of operating a potable reuse facility?

- Substantially
- Moderately
- Minimally

Please describe:

12. How many years of experience do you believe is sufficient to operate a potable reuse facility?

13. How can the water and wastewater certification programs be modified to give you more opportunity or flexibility to advance in the area of potable reuse to supplement drinking water supplies? (Rank approach in order of preference)

- Add content to existing water operator certification exams to address potable reuse
- Add content to existing wastewater operator certification exams to address potable reuse
- Create an “add on” certification module for certified *water* operators that addresses potable reuse
- Create an “add on” certification module for certified *wastewater* operators that addresses potable reuse
- Create an “add on” certification module for certified *water* operators that addresses advanced treatment processes
- Create an “add on” certification for certified *wastewater* operators that addresses advanced treatment processes
- Other proposed approach (describe)

14. What qualifications do you think should be required for an operator of a potable reuse facility (check all that should apply)?

- Current water certification
- Current wastewater certification
- Current water or wastewater certification
- Advanced treatment certification
- Potable reuse certification with advanced treatment content
- Minimum number of years of experience in water or wastewater operations (List minimum number of years)
- 2-year college degree in water/wastewater
- 4-year college degree in science or engineering-related field
- Post-graduate degree in science or engineering-related field



-
- Specialized training or certificate (describe)
 - Other (describe)

15. What qualifications should be required to obtain an advanced treatment certification if one is offered?

a. Operator Certification (pick one)

- Current water certification (recommended minimum grade level)
- Current wastewater certification (recommended minimum grade level)
- Current water or wastewater certification (recommended minimum grade level)

b. Work Experience (in addition to certification)

- Minimum number of years of experience in water or wastewater operations (List minimum)

16. Should education, training or engineering registration be used as an alternative qualification to current operator certification or work experience?

- Yes
- No

17. If so, which of the following should be allowed?

- 2 year college degree in water/wastewater
- 4 year college degree in science or engineering related field
- Registered civil or chemical engineer
- Specialized training (describe)
- Other (describe)

18. Do you think the operator certification requirements should be the same for projects that do groundwater injection, surface spreading, surface water (reservoir) augmentation, raw water augmentation or direct treated water augmentation?

- Yes
- No

Comments:

19. Is there anything we missed that you would like to comment on related to this subject?

Comments:

