Arizona Department of Environmental Quality
Recycled Water Work Groups

Final Report

January 15, 2018

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Foreword

This report was prepared at the request of the Arizona Department of Environmental Quality (ADEQ) to provide information in support of their effort to update the State of Arizona's Recycled Water Rules. Two work groups were charted by ADEQ: Recycled Water Quality Standards and Recycled Water Infrastructure and Technology. The work groups were comprised of volunteers who donated their time to explore a series of questions posed by ADEQ regarding both the current rules in effect in Arizona, as well as the potential for potable recycled water.

This report includes recommendations for consideration by ADEQ, based on the collective experience of the work group members, industry case studies, and similar efforts underway in other states. The complied recommendations do not necessarily reflect the opinions of each individual volunteer (including the editors); nor their employers. It is expected that the findings from this report shall be used by ADEQ as a framework for advancing changes to Arizona's rules relating to recycled water via a public process, with full opportunity for discussion and refinement.

Acknowledgments

The following individuals participated in the recycled water work groups:

Tim Thomure (Chair)	***Director of Tucson Water***
Channah Rock (co-Chair)	***University of Arizona***
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Charles Gerba	University of Arizona
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The following ADEQ staff provided support on working groups and regulatory context:

Travis Taylor	Environmental Hydrogeologist
Holli LaBrie	Compliance Assistance Coordinator
Chuck Graf	Hydrologist
Heidi Haggerty Welborn	Water Quality Division Rules Specialist
David Dunaway	Groundwater Protection and Water Reuse Value Streams Manager

The following individuals provided logistical support throughout the process:

- Jessica Dery, Assistant in Extension – Food Safety, The University of Arizona
- Natalie Brassill, Assistant in Extension – Water Quality, The University of Arizona

The following individuals served as the Independent Expert Advisory Panel for the potable reuse of recycled water section:

- Shane Snyder, University of Arizona
- Jason Dadakis, Orange County Water District
- Chance Lauderdale, HDR
- Daniel Gerrity, University of Nevada Las Vegas
- Gilbert Trejo, El Paso Water Utilities
- Eva Steinle-Darling, Carollo Engineers
- Paul Westerhoff, Arizona State University
- Allegra da Silva, Stantec
- Chris Impellitteri, US EPA

Section 1 – Introduction

In April 2017, the Arizona Department of Environmental Quality (ADEQ) chartered two volunteer work groups to provide recommendations in support of their ongoing effort to update the rules pertaining to water reuse in the State of Arizona. The first work group focused on recycled water quality regulations (Chaired by Dr. Channah Rock) and the second work group reviewed issues related to recycled water infrastructure and technology (Chaired by Timothy Thomure). The charters for these work groups are included as Attachments 1 and 2, respectively.

The first meeting of both groups was held on April 28, 2017 and a total of five meetings were conducted between April and September 2017. Homework was assigned prior to each meeting, including reviews of prior reports and studies, current regulations in Arizona and other locations, and the questions posed by ADEQ. Each work group meeting was recorded by ADEQ (audio only) and working documents were maintained by the co-Chairs and their support team.

The discussion of potable reuse of recycled water was supported by the concurrent development of a document titled: *Guidance Framework Document for Arizona Potable Reuse*, authored by the National Water Research Institute (NWRI, 2018). The NWRI document was the final outcome of the Steering Committee on Arizona Potable Reuse (SCAPR), initiated in 2013. The NWRI report provided significant input to the recommendations provided in this report; however, it is a stand-alone effort. NWRI has neither directly reviewed, nor specifically endorsed, the recommendations provided herein by the ADEQ work groups. The NWRI report is provided as Attachment 3.

This report is organized into three main sections. Section 1 is an introduction, Section 2 presents recommendations for potable reuse of recycled water in Arizona, and Section 3 presents responses and recommendations for all other (i.e. non-potable) questions raised by ADEQ in the work group charters. The Editors look forward to continuing to partner with ADEQ as the revisions to Arizona's recycled water regulatory framework advance through the formal rulemaking process.

Section 2 – Recycled Water for Potable Reuse

The primary source document used by the ADEQ work groups for the potable recycled water section is NWRI's Guidance Framework Document for Arizona Potable Reuse. The listed citation for this document is:

> *Mosher, J.J., and G.M. Vartanian (2018). Guidance Framework Document for Arizona Potable Reuse. Prepared for WateReuse Arizona and AZ Water Association, Prepared by National Water Research Institute, Fountain Valley, CA.*

This Section of the report was prepared in the order of specific topic areas requested by ADEQ in the work group charters. For each topic area, general recommendations from the NWRI (2018) report were placed into this document (where applicable) and edited by the work groups to provide specific input to ADEQ. Following each table of edited recommendations, explanatory narrative sections were developed by the editors of this report (blue text) and reviewed by the full work groups. The Independent Expert Advisory Panel reviewed this Section and provided input to the editors in generating this final report.

2.1 SOURCE WATER PROFILE

Recommendations for Wastewater Treatment (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	For DPR applications, the treated wastewater effluent must meet all existing federal and state regulations under the Clean Water Act.	✓	
2	For DPR applications, control of nitrate should either be accomplished in the WWTP to supply Class A+ or Class B+ for advanced water treatment, or properly engineered multiple barrier AWTP process proposed.	✓	
3	Pathogen log removal credits are needed for the wastewater treatment process if log removal reductions are needed.	✓	
3a	Credits can be established in guidance or utilities can propose credits based on available information or a case specific study.		✓
4	Require continuous on-line monitoring of WWTP effluent for key water quality operational parameters as a part of Critical Control Point strategy and Develop Off-spec water discharge options (i.e., response action plans)		✓

The Arizona framework should allow any starting water quality to ultimately be a source water for DPR. DPR applications in Arizona should include a compliance point in the overall scheme where Class A+ or B+ water quality is demonstrated. Options may include starting from a Class A+ or B+ reclaimed water as the source water to the AWTF, or inclusion of a compliance point (proposed by the applicant) within the AWTF where Class A+ or B+ standards are achieved, monitored, and reported. The latter does not imply that there are end uses of the Class A+ / B+ water in those instances; rather, it is intended to provide assurance that high quality reclaimed water is the "starting point" for DPR in Arizona. By utilizing "+" grade water the need for N treatment is minimized as well as aids in Log Reduction Requirements.

2.2 SOURCE WATER PROTECTION (E.G. PRE-TREATMENT PROGRAMS)

Recommendations for Source Control Programs (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	A pretreatment program, if required by the State of AZ, and source control program should be established as part of a DPR permitting process regardless of wastewater treatment system size.	✓	
1a	The elements of implementing an enhanced education and source control program in conjunction with the pretreatment program can be developed for utilities pursuing a DPR projects, regardless of size.		✓
2	Minimum source control program requirements should be established for all systems, regardless of size, jurisdictional issues, and/or boundaries.		✓
3	A source control program for a DPR project should control chemicals from a drinking water perspective. The source control program should go beyond pretreatment regulations to manage chemicals as well as other human health hazards (e.g. Industrial waste streams, hospital waste streams, etc.).		✓
4	Interagency cooperation and responsiveness between the entities operating the WWTP, AWTF, and DWTF to ensure pretreatment and source control are conducted effectively can be developed.		✓

A Source Control Program should be required for any sewer shed, regardless of utility size, that will serve as a source water for DPR. A Source Study should be required, which will be a supporting document to the Design Report (see following sections). The Source Study should address the following:

1. Investigate discharges into the collection system to determine what residential, commercial, or industrial contaminants already exist;
2. Identify the potential for spills and other sources of stored chemicals or hazardous materials (e.g., dry cleaners) that may enter the wastewater collection system as well as potential for temporal variability of discharge (e.g. Time of day, year, etc.) to ensure that an AWTP has as much information as possible to adjust treatment technologies/ approaches accordingly;
3. Identify education and outreach programs to protect source water quality (e.g. commercial/industrial discharge practices, pharmaceutical takeback programs, stormwater protection programs); Educate commercial/industrial dischargers that water will now be used as drinking water for the community.
4. Compile a list of current commercial and industrial entities that discharge into the wastewater system using the Standard Industrial Code (SIC) approach this should also include historical/anticipated discharge volumes and chemical types;
5. Train wastewater operators and source control managers for the need of increased scrutiny, because this is a potable water supply.
6. Establish source control criteria for existing and new industries or businesses (e.g., medical care facilities, dental clinics, photo processors, and silver jewelry manufacturers); and
7. Sample the Class A+ / B+ source water for primary drinking water MCL's, SMCL, and

monitor for compounds included on CCL and UCMR 1-4 lists (Example tier 2 and 3 are listed below. Tier 1 chemicals are covered under the Safe Drinking Water Act). The information will be used to determine what advanced treatment processes and monitoring are necessary. This survey should be repeated every five years to monitor for new sources of chemicals listed on the Tier 2 and Tier 3 lists.

8. Sampling frequency and duration to be proposed by applicant on a case-by-case basis.

Unregulated Chemicals to be Measured from the Standpoint of Public Health (Tier 2) (NWRI, 2013)

Chemicals	Rationale
N-Nitrosodimethylamine (NDMA)	Byproduct of chloramination
Chlorate	Reflective of hypochlorite use
Perfluorooctanoic acid	Known to occur, frequency unknown
Perfluorooctane sulfonate	Known to occur, frequency unknown
Perchlorate	Of interest, same analysis as chlorate and bromate
1,4-Dioxane	Occurs at a relatively low frequency in wastewater, but likely to penetrate RO membranes
Ethinyl estradiol	Should evaluate its presence in source water
17-β-estradiol	Should evaluate its presence in source water

Unregulated Chemicals to be Measured to Support the Design of Organic Chemical Removal by Waste Water Treatment Plants (Tier 3) (NWRI, 2013)

Pharmaceuticals	**Rationale**
Cotinine, Primidone, Phenytoin	Surrogate for low molecular weight; partially charged cyclics
Meprobamate, Atenolol	Occur frequently at ng level

Pharmaceuticals	Rationale
Carbamazepine	Unique structure
Estrone	Surrogate for steroids
Sucralose	Surrogate for water soluble, uncharged chemicals, moderate molecular weight
Tris-(2-chloroisopropyl)-phosphate (TCPP)	Chemical of interest
Tris-(2-chloroethyl)-phosphate (TCEP)	Chemical of interest
N,N-diethyl-meta-toluamide (DEET)	Common constituent in highly treated wastewaters
Triclosan	Chemical of interest

2.3 DOCUMENTATION OF PILOT ADVANCED WATER TREATMENT STUDIES

DPR projects in Arizona should be required to conduct a site-specific pilot study. Although the unit process treatment technologies for typical DPR treatment trains are generally well understood, each DPR scheme is unique and the consequences of full system failure may be severe. As a best practice, it is also recommended that the required pilot study be made available as a demonstration site to garner public support and acceptance.

A Pilot Study Proposal should be submitted to ADEQ for review, comment, and approval. The Pilot Study Proposal should be based on the Source Study, present the proposed AWTF treatment train, and demonstrate the ability to meet the microbial and chemical control requirements (see following sections). The pilot plant must include sensors and other critical control point (CCP) devices that would be implemented at full scale. The pilot should be operated for a minimum of six months at a flow rate that must be scalable to the full-scale process that is representative of seasonal variation. It is also important to consider a range of blends with other potable waters in order to assess corrosion potential and control. In addition, the formation potential of disinfection byproducts should be assessed. Water produced from the pilot study is not approved for introduction into the drinking water distribution system; however, it may be made available for demonstration purposes (e.g., tasting) if additional conditions are met. These conditions may include, but are not limited to, successful validation of water quality results during initial pilot operation, documented operational monitoring of critical control points (see following section), and appropriate and consistent public notification. Any and all deviations in effluent water quality observed in the pilot testing must be described in detail and provide what responses would have been taken if it had been a full-scale operational AWTP.

Results of the Pilot Study shall be documented in a Pilot Study Report that will be a supporting document to the Design Report.

An "Emergency DPR" provision could be considered to allow a project to advance more quickly than the six-month pilot requirement, at the discretion of the Director of ADEQ.

2.4 TECHNOLOGIES, PROCESSES, AND METHODOLOGIES TO BE EMPLOYED FOR MICROBIAL CONTROL

Recommendations on Advanced Water Treatment Technologies (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	A bypass from the outlet of the AWTF into the sewer system (if available) and/or recycled back (returned) to the start of the treatment process should be included in all potable reuse projects.		✓
2	Pilot testing or demonstration studies are necessary for the design and operation of full scale DPR projects.		✓
3	For DPR, allow for a Best Available Demonstrated Control Technology (BADCT) approach to approving treatment technologies to control for chemicals and pathogens. This approach would employ engineering controls, sensors, processes, and operating methods or other alternatives, including site specific-characteristics (i.e., the local conditions).		✓

Recommendations for Pathogen Control and Log Reduction Requirements (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	The basis of the regulation is a goal of 10^{-4} annual risk of infection from pathogens. This level of risk is consistent with rules promulgated under the SDWA and with other potable reuse efforts (i.e., California and Texas).	✓	
2	A multiple barrier treatment approach from removal of pathogens and chemical constituents should be defined and required (such as adopted by California for IPR).	✓	
2a	Specific requirements can be provided in supporting guidance/permitting.		✓
3	Both the California (12/10/10 log reductions from raw wastewater influent for virus, *Cryptosporidium*, and *Giardia*) and Texas (minimum 8/5.5/6 log reductions for virus, *Cryptosporidium*, and *Giardia* post wastewater treatment) pathogen log reduction criteria approaches should be offered. Allowing both approaches provides maximum flexibility for projects in Arizona.	✓	

4	The implementation of a log credit system will need to be established; however, the system can be addressed through policy or guidance. In addition, the burden can be placed on the utility to propose their approach to achieving the log reduction targets in the form of a project proposal.		✓
4a	A Design Report should be required through regulation.	✓	
4b	The requirements of a project proposal can be addressed in guidance/permitting.		✓
5	Using the Texas approach requires the ADEQ to review the project, characterize the wastewater, and approve the treatment process.		✓

Pathogen removal requirements are currently based on estimates of the maximum pathogen concentrations in raw wastewater and acceptable pathogen concentrations in drinking water. While pathogen levels in drinking water have been well characterized (EPA, 1989; EPA, 1998; EPA, 2006), pathogens in raw wastewater have been much less evaluated. This uncertainty led regulators in CA to apply a high degree of conservatism when crafting the pathogen removal requirements by selecting the maximum concentration for each respective pathogen observed in the literature (10^5 enteric virus and *Giardia* cyst per liter, and 10^4 *Cryptosporidium* oocyst per liter) (Rose et al 2004; Fong and Lipp, 2005). The resulting LRVs for V/G/C, as required by the California regulations, are 12/10/10. For DPR projects in Arizona, the recommended reduction requirements are based on the 10^{-4} (one in 10,000) annual risk of infection.

It is recommended that Arizona adopt a hybrid approach to microbial control (utilities would have the option to select one of two approaches detailed below):

1. A Standard Approach based on 12/10/10 log removal targets from raw wastewater (i.e., California approach) with supporting Source Study, Pilot Study, and Design Report and
2. A Demonstration Approach allowing for lower log reduction values, starting from Class A+ or Class B+ reclaimed water, supported by a more extensive Source Study, Pilot Study, and Design Report (i.e. Texas approach).

The Design Report, required for all DPR projects, should address: source water quality, the proposed treatment train, approach to ensuring a multi-barrier approach (e.g. limiting any one unit process to a six-log removal credit, etc) finished water quality (including blending scenarios, finished water stability if applicable), operations, maintenance, critical control point monitoring, engineered storage, failure response actions, and start-up/commissioning.

2.5 LOGARITHMIC REDUCTION CREDITS FOR MICROBIAL CONTROL

Recommendations for Pathogen Reduction Values for Treatment Processes (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	The State of Arizona can establish or approve log reduction values for a pathogen credit system for DPR treatment technologies based on systems developed in California and Texas and based on available guidance.		✓

It is recommended that facilities may propose to use the Standard Approach, using conservative estimates of pathogen removal based on accepted values within the literature (12/10/10, V/G/C), or may elect to pursue the Demonstration Approach, using pathogen monitoring programs involving measurements of pathogen concentrations (or approved surrogates) through each unit process. In the case of wastewater treatment facilities, the lack of pathogen data in raw wastewater and throughout each treatment process may lead to discrepancies between site-specific treatment performance and literature-based performance.

It is recommended that regulations should require Arizona potable reuse projects to conduct wastewater monitoring efforts during the permitting process (see also Source Study section).

- ADEQ to require source water quality monitoring to include samples to capture diurnal fluctuations and grab sample locations to include raw wastewater, secondary, and tertiary (as appropriate).
- Six months to two years of source water quality characterization to demonstrate LRV though secondary and tertiary waste water treatment.
- Include the following: Total Culturable Viruses, Total coliform/*E.coli* bacteria, Male-specific and Somatic Coliphage, *Salmonella*, *Cryptosporidium*, *Giardia* by cultural/microscopy methods and the Virus Suite (GI(A), GI(B), GII Noroviruses, Adenovirus, and Enteroviruses) by molecular methods.
- In order to align with the Long Term 2 (LT2) Enhanced Surface Water Treatment Rule, a minimum of 20 samples to be collected over the course of at least 6 months, but no longer than two years.

To demonstrate the central tendency of the wastewater/water treatment process and resulting water quality, data for each sampling location (raw wastewater, secondary effluent, tertiary effluent) will be analyzed by calculating the geometric mean. This type of analysis buffers the variability of analytical methods as well as sample collection methods. Selecting the 95th percentile removal values between each unit process represents the expected pathogen removal efficiency of the facility.

After the initial LRVs have been established, a verification survey must be conducted every 2 to 5 years to confirm the appropriate LRVs based on source water quality. In the event that no new industrial discharge permits are issued throughout this period a utility would elect the 5 year cycle or in the event that new industrial discharge permit(s) are issues that introduce new chemicals into the raw wastewater or AWTF source water, a two year cycle would be required. The semi-annual survey updates the LRVs by revising the geometric mean (GM). The GM are revised using a minimum of 5 new water samples combined with the most recently collected 15 samples. This creates a "rolling" data set of samples collected within the

past 4 years. Based on the updated source water quality profile, it is the responsibility of the facility to modify their treatment, as appropriate, to ensure they remain compliant with ADEQ regulations. The applicant must provide a contingency plan for how the AWTF will respond to periods of non-compliance with Class A+ or B+ source water.

2.6 IDENTIFICATION AND DESCRIPTION OF TECHNOLOGIES, PROCESSES, AND METHODOLOGIES FOR CHEMICAL CONTROL

Recommendations for Chemical Control (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	A three-tiered approach can be used to control chemicals for DPR and include: 1. Tier 1 – SDWA and State Requirements (including DBPs and nitrate) 2. Tier 2 – Unregulated Chemicals (including chemicals on CCLs and UCMRs) of Interest from the Standpoint of Public Health 3. Tier 3 – Unregulated Chemicals that Are Useful for Evaluating the Effectiveness of Organic Chemical Removal by Treatment Trains. The three tier monitoring approach can be required in regulations to guide chemical control.	✓	
1a	The details for implementing the requirement can be set in guidance/permitting.		✓
2	Nitrate and Perchlorate are regulated under the SDWA and present a potential acute risk and, as a result, are of particular importance to DPR and should be monitored for in the advanced water treatment system.	✓	
3	Approved analytical methods are needed.		✓
4	Conduct comprehensive analytical studies on the types and quantities of chemicals (including CECs of interest and emerging CECs) that can be present in the treated wastewater from the WWTP. The results would help determine how much removal is needed and what CECs or CEC indicator parameters need to be monitored.		✓

The Regulation should not be prescriptive on treatment technologies or treatment trains. Performance targets and performance consistency are the drivers. The baseline source water quality for chemical constituents will be identified in the Source Study, which will help determine the unit processes required in the AWTF. The Pilot Study and Design Report should consider the Tier 1, Tier 2, and Tier 3 constituents. Tier 1 parameters are the various chemicals that have SDWA MCLs. Tier 2 and Tier 3 parameters are presented in the Source Water Protection section.

2.7 PLAN OF MONITORING FOR PUBLIC HEALTH PROTECTION AND COMMISSIONING AND STARTUP PLAN

Recommendations on Monitoring, Instrumentation, and Process Control Requirements of DPR Systems (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	Startup performance monitoring plan and results should be provided to ADEQ for approval. Water quality monitoring is required for each major treatment process and final product water quality (starting from source water and through the AWTF).	✓	
2	Appropriate process monitoring for DPR systems using rapid surrogate measures is needed to verify treatment performance with respect to pathogen removal targets and to document and review system performance.		✓
3	In the event the DPR system cannot attain target pathogen credits or other chemical water quality excursion, a judgment needs to be made based upon all of the information available as to whether the facility should be shut down or out-of-specification water bypassed or diverted to another system (i.e., the sewer).		✓

Start-up and commissioning shall be addressed in the Pilot Study Proposal and updated in the Design Report.

Process and compliance monitoring for DPR systems involves the following two key components:

1. Documentation and review of system performance in accordance with design intent and manufacturer recommendations to ensure water-quality specifications are met; and
2. The ability of the control system to accurately measure chemical and pathogen reduction performance to meet specified criteria.

The details of system performance monitoring will vary based on the actual treatment train selected. The Regulation should require that a DPR Operations Optimization Plan (OOP) be developed to ensure public health. Source documents that provide information on process and compliance monitoring for DPR technologies are available, including the National Water Research Institute (NWRI) Report titled: *Guidance Framework Document for Direct Potable Reuse in Arizona.*

The recommended approach to monitoring DPR systems is the use of critical control points (CCPs):

- Hazard analysis is used to identify…
- CCPs are unit processes where the reduction of risk can be demonstrated and verified by monitoring.
- CCPs inform operations and are monitored by water treatment operators.

Assessment of treatment performance should involve the use of monitoring for indicators and surrogates.

- Indicator compound: An individual chemical that can be used to measure the effectiveness of a process for a family or group of compounds in the treatment process of interest (e.g., conductivity for RO).
- Surrogate: A quantifiable parameter that can serve as a performance measure of treatment processes that relates to the removal of specific contaminants. Surrogate parameters (e.g., UV absorbance, turbidity, electrical conductivity) provide a means of assessing water quality characteristics without conducting more difficult trace contaminant analyses for specific contaminants and pathogens.

2.8 OPERATION AND MAINTENANCE PLAN INCLUDING CORRECTIVE ACTIONS FOR OUT-OF-RANGE MONITORING RESULTS AND CONTINGENCIES FOR OFF-SPEC WATER

Recommendations on Facility Operations and Maintenance (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	An OOP plan for DPR should be required.	✓	
1a	These plans should include procedures for initial startup, annual startup, shutdown, asset management, and O&M.		✓
1b	The O&M plan must include regulatory compliance sampling and monitoring.		✓
2	For DPR projects, the following should be required: (1) start-up reporting, (2) DPR system reporting added to drinking water reporting, and (3) an annual report.	✓	
2a	The details for start-up reporting, additional reporting, and the annual report can be specified in guidance or permitting.		✓
3	A response plan to control off-specification water should be required.	✓	
3a	The procedures of a response plan to control off-specification water can be incorporated into the O&M plan for DPR.		✓
4	Alternative sources of water should be addressed in ADEQ-required Emergency Operation Plan and the Emergency Response Plan.		✓

As indicated above, the Regulation should require that a DPR Operations, Maintenance, and Monitoring Plan be developed to ensure public health. The table above lists the major elements that should be required in the plan, the details of which should be determined in Guidance or Permitting. Some minimal standards for the following topics should be identified in Regulation.

Engineered storage should be required and should be sized to hold the water for the time period equivalent or greater than the failure response time (FRT), which allows for system monitoring, verification of results, potential resampling, calibration of monitoring devices, determination of failure, and operational response. The engineered storage would be part of an integrated control system that uses online monitoring results and intermittent testing (e.g., pressure decay test for membranes) for all

advanced processes to document that each process is functioning properly and the combined processes are meeting or exceeding the design targets for the removal of chemicals and pathogens.

A response plan should be required in the event of off-spec water at a DPR facility. The plan should include:

1. The process to identify and specific steps to address problems; and
2. The amount of time needed to react and the use of automated systems with triggers and alarms, such as through the use of Supervisory Control and Data Acquisition (SCADA) systems.
3. The amount of time needed to adjust operations to control the release of off-spec water.

A bypass from the outlet of the system into the sewer system (if available) or recycled back to the start of the treatment process should be included in all projects. Discharging to this bypass during startup or during process upsets will allow the operators to verify and document that all systems are operating in accordance with the DPR Operation, Maintenance, and Monitoring Plan. Further, this requires that the WWTP maintain an alternate discharge permit (e.g. AZPDES) for times when the AWTF is offline.

Treatment process predictive analytics (i.e., the SCADA or other system) should be required to continuously record the CCP data. In addition, it would be recommended to calculate the total pathogen log reduction credits in real-time, with automated warning systems and, if needed, system shutdown and diversion.

An annual startup may be needed for systems that are operated intermittently or seasonally. The annual startup plan should include:

- Information identified in the initial startup plan;
- Information on periodic maintenance or cleaning and equipment rehabilitation or replacement;
- A checklist of tasks for each treatment process and the system as a whole, as performed by certified operators who have been trained on the overall operation of the DPR system; and
- A schedule for completing these tasks.

A shutdown plan should provide the same level of detail as the startup plan, including provisions to drain piping and tanks where freezing or stagnant non-compliant water exists. Some systems after shutdown may need to stay “wet”; therefore, handling this stagnant water during the preparation for startup needs to be addressed.

In Arizona, an Emergency Operations Plan is required for drinking water systems. A.A.C. R18-4-204 requires all community water systems, regardless of size, to develop and maintain an Emergency Operations Plan which details physical and technical aspects of water systems operation, such as maintaining proper water pressure, collapse of a major structure or loss of mechanical components like pumps or valves. The emergency operations plan also address public notice and alternate water supplies.

The federal Bioterrorism Preparedness and Response Act requires every community water system that serves a population of greater than 3,300 people to conduct a vulnerability assessment to identify areas and processes within a water system that could be vulnerable to attack, sabotage or disruption. Vulnerability assessments are voluntary for systems serving 3,300 or less people; however, they should be required for all DPR systems in Arizona, regardless of size, and should be used to compile an Emergency Response Plan. This plan should contain all of the information required in an Emergency Operations Plan, but provide greater detail regarding the potential problems the water system may face. The Emergency Response Plan includes information about other agencies that must be notified including, law enforcement, public health officials, and firefighters.

Example components of a DPR O&M plan are provided in the NWRI Report titled: *Guidance Framework Document for Direct Potable Reuse in Arizona.*

2.9 OPERATOR TRAINING PLAN

Recommendations on Operator Training (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	The O&M requirements for a DPR system exceed the demands of a wastewater or drinking water supply, requiring special operator skills and experience. The DPR treatment plant designated Operator of Record should have a Grade 4 level of certification as water treatment plant operators regardless of system size.	✓	
1a	The details of the number of operators required and level/types of certification can be addressed in guidance or permitting.		✓
1b	Lead operators and the Operator of Record must be Grade 4 licensed water treatment operators.		✓
2	Certified water/wastewater operators will be needed to run a DPR system. Staffing for a DPR system should be 24/7 unless an operational electronic remote sensing system is available to provide real-time data, appropriate alarms, and automatic response so that operators and other expert support personnel can be on call at all times.		✓

Arizona does not yet have a Certification Program that covers all aspects of a DPR system. An analysis needs to be performed on the existing certification system, its requirements for each type (Wastewater Collection, Wastewater Treatment, Water Distribution, and Water Treatment) and each level (1 through 4) to determine what aspects of DPR are adequately covered, and what gaps exist. Specifically, the unit treatment processes of the AWTF are likely not directly addressed. The gaps should be addressed through one or more new Endorsements that cover specific DPR requirements and can be added onto the existing major certification categories. Ideally, the operator of record for the DPR process should have also been part of the pilot study.

At a minimum, DPR systems should be required to have a designated Operator of Record that holds a Grade 4 Water Treatment Operator License. Other operators must hold licenses, at a minimum Grade 3 Water Treatment or Wastewater Treatment. Once an Endorsement program is established, those elements would be added as requirements for DPR operators.

2.10 DOCUMENTATION OF TECHNICAL, FINANCIAL, AND MANAGEMENT CAPABILITY

Recommendations on Technical, Managerial, and Financial (TMF) Capacity (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	An assessment could be required for DPR projects involving a TMF capacity assessment or a similar assessment that does not involve the State TMF program.	✓	
2	The capacity assessment process for evaluating the ability of a utility to implement DPR can be detailed in guidance and could be part of the utility project proposal.		✓

A TMF capacity assessment should be required to help utility administrators, employees, and operators identify potential or existing weaknesses and improve the utility's ability to safely operate a DPR system on a long-term basis. It would also serve as a minimum requirement for ADEQ approval of a DPR system. The detailed requirements for the TMF capacity assessment should be provided in guidance.

Potential Areas to Assess for the Technical, Managerial, and Financial Capacity of a Direct Potable Reuse Project

Capacity	Description	Potential Areas to Assess
Technical	Deals with the performance and operation of the AWTF.	• Feasibility of consolidation • Existing water sources (sufficient sources, source control, etc.) • Water system treatment capacity • Monitoring • Number of trained certified operators • O&M plan • Treatment, storage, and distribution facilities • Compliance records, violations of federal and state compliance standards, and plans to correct these violations
Managerial	Deals with governance (e.g., administrators must understand the responsibilities of overseeing the AWTF; employees and contractors must understand their roles; adequate time is needed to conduct all required tasks).	• Ownership • Management • Water rights • Operations (including training and technical competency, and the O&M plan) • Organization • Master planning (including an inventory of equipment and infrastructure) • Emergency response planning • System policies • Customer service • Security

Capacity	Description	Potential Areas to Assess
Financial	Deals with financial ability to operate and maintain existing infrastructure and financial planning for future needs. Assessed through budget statements, asset management, and financial audits.	• Capital costs • Lifecycle costs • Budgeting (and budget control) • User fees • Financial audits/bond rating • Rate studies • Financial planning and management • Capital improvement plan (CIP)

2.11 ADDITIONAL RECOMMENDATIONS

Recommendations on Utility Collaboration (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	MOUs or inter-governmental agreements are needed to define the roles and responsibilities of multiple utilities and/or jurisdictions. These agreements can describe the methods that the utilities and/or agencies would use to work together and implement the DPR project.	✓	

Recommendations on Alternatives to the Criteria for Direct Potable Reuse (Edited from NWRI, 2018)

No.	Recommendation	Regulation	Guidance or Permitting
1	The State of Arizona should include an alternative provision as part of DPR regulations. The purpose of the alternative provision would be to allow for a utility to propose an alternative approach to any of the DPR criteria or requirements. The utility would need to demonstrate that the alternative provides at least the same level of public health protection.	✓	
2	Specific requirements for implementing the alternatives provision could be addressed in guidance/permitting.		✓

Recommendations on Public Acceptance and Outreach (Edited from NWRI, 2018) Not recommended for Regulation

No.	Recommendation	Regulation	Guidance or Permitting
1	The development of specific guidance for agencies interested in implementing DPR projects can help assure the public that potable water produced from wastewater through DPR is adequately protective of public health.		✓
2	Utilities considering DPR should be encouraged to develop a robust public and permitted industry outreach program to build awareness, trust, confidence, support, and acceptance of the DPR project.		✓

The following comments/questions are for additional ADEQ consideration with respect to the guidance framework presented above.

- The discharge of radionuclides and/or radiologic compounds to sewers may be regulated under federal regulations and enforced by entities other than the WTTP agency. Should this be assessed during the Source Study and included in the guidance/permitting process?

- The State of California expert panel should be releasing an updated list of recommended CECs for recycled water & potable reuse project monitoring in Dec/Jan. It is recommended that ADEQ obtain the updated list for review at that time.

- It is recommended that some clarity be prvided on implementation of the multiple barrier treatment process. In what circumstances does it make sense to limit any process to 6-log inactivation, or requiring LRVs for any given pathogen to be split amongst at least two barriers as a good practice.

- It is recommended that ADEQ clarify how the State of Texas defines “secondary treatment”. The panel feels that the “gate” that we are placing on verifying A+ and/or B+ is suffienct, but should be cross referenced.

- With respect to the 95th percentile of pathogen concentrations, it is advised that ADEQ run thorugh mock scenarios using anticipated values coupled with a QMRA to clarify the dafety factors build in to this recommendation and public health protection.

- The panel recommends aht ADEQ may need to resolve when the up-stream wastewater (inside or outside the AWP) A+/B+ is in a period of non-compliance, and what a contingency plan should look like (monitoring, alternative water source, treatment, etc.)

- ADEQ should consider within their rules revision what reports will be required (i.e. just the annual report or some other reporting structure more like wastewater, e.g. Daily Monitoring Reports or like drinking water) to ensure proper complince by utilities.

REFERENCES

Cunliffe, D. (2017). WHO Potable Reuse: Guidance for Producing Safe Drinking Water. Presented at the 11th IWA International Conference on Water Reclamation and Reuse, Long Beach, CA.

EPA (1989a) Drinking Water; National Primary Drinking Water Regulations; Filtration; Disinfection; Turbidity, Giardia lamblia, Viruses, Legionella, and Heterotrophic Plate Count; Final Rule, 40 CFR Parts 141 & 142, Federal Register, 54(124) p27486-27541.

EPA (1998) Interim Enhanced Surface Water Treatment Rule. 40 CFR Part 9, 141, and 142.

EPA (2006) National Primary Drinking Water Regulations; Long Term 2 Enhanced Surface Water Treatment Rule; Final Rule, 40 CFR Parts 9, 141 & 142, Federal Register, V71(3) p654-786.

Fong, T-T. and Erin, L.K. (2005) Enteric Viruses of Humans and Animals in Aquatic Environments: Health Risks, Detection, and Potential Water Quality Assessment Tools. Microbiology and Molecular Biology Reviews, 69 (2), 357-371

Rose, J.B., Farrah, S.R., Harwood, V.J., Levine, A.D., Lukasik, Jerzy, Menendez, P., and Scott, Troy M. (2004) Reduction of Pathogens, Indicator Bacteria, and Alternative Indicators by Wastewater Treatment and Reclamation Processes. WERF 00-PUM-2T. Water Environment Research Foundation, Alexandria, VA.

Section 3 – General Reuse

This section provides the input of the work groups on the various questions posed by ADEQ on the two charter documents, excluding the potable framework presented in Section 1.

3.1 RECYCLED WATER QUALITY STANDARDS QUESTION 1

Reclaimed Water Classes:
Review the existing five reclaimed water classes (A+, A, B+, B, and C) in A.A.C. Title 18, Chapter 11, Article 3:

a. Are these classes satisfactory to ensure the safe use of reclaimed water for the existing uses?
b. Are these classes satisfactory to ensure the safe use of reclaimed water for any likely future uses, including potable reuse?
c. Do we need more or fewer classes, and if so, why and what should be the requirements for any additional classes?

It is the work group's recommendation that the five reclaimed water classes are satisfactory to ensure the safe use of reclaimed water for the existing uses. The Notice of Proposed Rulemaking (NPRM) dated April 21, 2017 for the Interim Rule includes a new Part E for Purified Water for Potable Reuse. As long as Part E covers criteria for all source water classes from Part B, we do not see a need for adding a new reclaimed water class specific for potable reuse. Further rationale is ADEQ's determination in the interim rulemaking that purified water is no longer considered reclaimed water.

3.2 RECYCLED WATER QUALITY STANDARDS QUESTION 2

Reclaimed Water Quality Standards:
For the constituents serving as standards in each reclaimed water class, and for any newly proposed classes:

a. Are the constituents:
    i. Appropriate to protect public health?
    ii. Should alternate or additional constituents serve as standards?
    iii. How will alternate or additional constituents better address the problems?
    iv. Fecal coliform testing is currently required. Is E. coli testing more appropriate, or should something different be required? Should a coliphage standard be required?
b. Are the numerical limits for the constituents serving as standards:
    v. Appropriate to protect public health?
    vi. Are the units of measurement correct or appropriate?
    vii. How will changes in numerical limits for constituents resolve issues or problems?
c. Are the frequencies of testing for the constituents serving as standards appropriate?
d. Should testing methods be specified in rule for the constituents serving as standards. If so, why?

For questions 2a-c, the work group believes that feedback from reclaimed water utility owners and operators should be considered the most important for potential changes to reclaimed water quality

standards. Specific criteria and conditions for advanced treatment for potable reuse should be considered under Part E.

Fecal coliform captures a broader net of possible pathogens than E. coli alone. Coliphage could be a better indicator of possible viral pathogens, but some of the test methods for Coliphage are only qualitative, others can be cumbersome and have lengthy result times, and very few laboratories within the State of Arizona have capacity to implement such methods. As such, the work group recommends maintaining fecal coliform testing while also allowing E.coli or other equivalent test methods as demonstrated by the utility requesting the alternate method. This includes the use of MPN or Most Probable Number based methodologies as well as direct count culture based methods as approved by the US EPA for analysis of water and wastewater.

The work group recommends that turbidity and nitrogen requirements and sampling locations for Class A+ and Class A water need to be re-evaluated. Questions arose related to if turbidity requirements were to be met prior to disinfection, after disinfection, or at the discharge point prior to the distribution system. Clarification is needed on which constituents (including nitrogen) require composite vs. grab sampling procedures and if the rule implies that if turbidity is monitoring continuously that the daily average is then calculated and reported? This portion of the rule may also need clarification on the frequency of measurements as well as time of day measurements are required to be collected. With respect to frequency, the work group requests that ADEQ better define the terms “daily” and “weekly” and that additional guidance be provided relative to the recommended 4 out of 7 test results to prevent multiple days consecutively without sampling requirements.

It is suggested that ADEQ rely on references to acceptable testing methods for drinking water and/or wastewater in those current respective ADEQ regulations. The only stipulation should be that the testing method(s) is approved by the Arizona Department of Health Services. While ADHS has the Arizona-certified labs identified on their web site, details related to methods and analysis are still not easy to locate. In addition, many Arizona-state licensed labs ship their samples to other states to complete analysis. Because of this, questions related to regulation of remote facilities may also need clarity.

3.3 RECYCLED WATER QUALITY STANDARDS QUESTION 3

Filtration and Disinfection Requirements for Class A/A+ Water:

a. Are the filtration and disinfection requirements for Class A/A+ water sufficient to safeguard against viral and cystic pathogen risk when monitored with required or recommended coliform/pathogen testing (fecal coliform, *E. coli*, etc.)? If changes are recommended, how do they resolve the problem?

Current rules require either fecal coliform or *E. coli* monitoring daily. Both of these tests provide relatively quick results without much expense. Other tests may be better for determining viral and cystic pathogen risk, but these methods could take longer to get results and the analytical costs are greater. Identifying ADHS approved laboratories to run these tests could also be challenging. Any recommended changes should ensure better public health protection, but would also need to be cost effective and provide timely information.

3.4 RECYCLED WATER QUALITY STANDARDS QUESTION 4

Unregulated Constituents:
Should testing of additional constituents be required for informational purposes only, that is, testing for constituents for which no standards or limits are set? If so, describe what the benefits the test results would provide.

It is the work group's recommendation that testing for unregulated constituents in non-potable reuse systems and end uses should not be required in rule. Voluntary monitoring and sharing of data should be encouraged by ADEQ.

3.5 RECYCLED WATER INFRASTRUCTURE AND TECHNOLOGY QUESTION 1

Pipeline Conveyances:
Review current technical standards for pipeline conveyances found in AAC R18-9-602(D) through (G) and recommend any needed changes:

a. Do additional technical requirements or criteria need to be added and, if so, what should they encompass?
b. How will the recommendations resolve issues?

Please find the following work group's recommended changes to R18-9-602. The workgroup recommends the inclusion of the following text within section B.

"1. For pipeline conveyance systems constructed within public rights of way or easements, applicable design and construction standards of practice shall include pressurized pipeline material, design, and installation standards from ADEQ Bulletin 10, Maricopa Association of Goverments (MAG) Standards, Pima Association of Government (PAG) Standards, American Water Works Association (AWWA) Standards, or public water utility standards for the location of the pipeline, as applicable.

2. Design of a pipeline conveyance system constructed within public rights of way or easements shall be completed under responsible charge of a professional engineer registered in the State of Arizona in accordance with Arizona Board of Technical Registration requirements.

3. Gravity pipeline conveyances shall be tested against and meet applicable ~~**A static pressure of at least 50 pounds per square inch greater than the design working pressure without**~~ leakage requirements as ~~**determined**~~ outlined in A.A.C. R18-9-E301(D)(2)(j)* ~~**is achieved**~~ prior to being placed into service; and

4. Pressurized pipeline conveyances shall be tested against and meet applicable MAG Section 611, and incorporated by reference AWWA C-600, standards prior to being placed into service."

Additionally, the workgroup suggests the deletion of sections D and E, as they would now be covered under section B.

Under current section F, subsection 4, the following text in bold should be included; … "an air gap **of no less than two times the diameter of the potable water supply line**."

Under section G, subsection 1 the following text should be deleted; …~~**For a pipeline conveyance, eight inches in diameter or less.**~~ The corrected text should read as follows:

> "G. A person shall:
>
> 1. For a pipeline conveyance, use pipe colored purple, encased in purple polyethylene tube, or wrapped with durable purple tape. Provide underground identification tape 1-ft above the pipeline conveyance marked in English: "CAUTION: RECLAIMED WATER, DO NOT DRINK"."

REFERENCES

RE: A.A.C. R18-9-E301(D)(2)(j)*

j. Test each segment of the sewer line for leakage using the applicable method below and record the results:

i. "Standard Test Method for Installation of Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air, F1417-92(1998)," published by the American Society for Testing and Materials;
ii. "Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method, C924-02 (2002)," published by the American Society for Testing and Materials;
iii. "Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines, C828-03 (2003)," published by the American Society for Testing and Materials;
iv. "Standard Test Method for Hydrostatic Infiltration Testing of Vitrified Clay Pipe Lines, C1091-03a (2003)," published by the American Society for Testing Materials;
v. "Standard Practice for Infiltration ion and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines, C969-02 (2002)," published by the American Society for Testing Material; or
vi. "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications, D2321-00 (2000)," published by the American Society for Testing Materials; or
vii. The material listed in subsections (D)(2)(j)(I) through (vi) is incorporated by reference and does not include any later amendments or editions of the incorporated material. Copies of the incorporated material are available for inspection at the Arizona Department of Environmental Quality, 1110 W. Washington, Phoenix, AZ 85007 or may be obtained from the American Society for Testing and Materials International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

3.6 RECYCLED WATER INFRASTRUCTURE AND TECHNOLOGY QUESTION 2

Maintaining Water Quality throughout Distribution System:

During the stakeholder listening sessions, ADEQ received comments regarding maintenance of water quality throughout the distribution system. Comments fell on both sides of the issue. Some commenters suggested that ADEQ keep the rule as is, which does not explicitly specify maintenance of a disinfection residual in the distribution system. Other commenters recommended that ADEQ add a disinfection requirement to the rule (AAC, Title 18, Chapter 9, Article 6).

a. Should the rule address or not address disinfection criteria for the distribution system?
b. If yes, what criteria are recommended and why?
c. In either case, explain the rationale of the working group for their determination.

1. Because of greater levels of nutrients present in recycled water, which in turn promote the growth of microorganisms, recycled water poses a greater risk for the growth of legionella bacteria during its distribution and storage than does drinking water. This is also true for the growth of organisms that serve as hosts for legionella, including amoebas. The potential for microorganism growth is further enhanced where a disinfectant residual is not maintained in the recycled water during distribution.

2. Because of the potential for legionella to occur in recycled water, which has been documented in at least one study (LeChevallier, 2016), there is a recognized risk of human infection by legionella through inhalation where recycled water is used in a manner in which the water is aerosolized. Potential applications of recycled water where aerosolization (misting, spraying) could take place include: 1) cooling towers, 2) sprinkler irrigation in golf courses etc., and 3) decorative fountains.

3. For cooling towers and other closed loop industrial applications that use recycled water and create mist or drift, one method for legionella control is to require the end user to utilize appropriate mitigation measures, including mist or drift eliminators and/or apply a biocide to the recirculating water to prevent or minimize the presence of legionella (and amoeba). Such control methods are required for recycled water use in California (CDPH, 2014).

4. For applications where control methods listed in (3) cannot be implemented, including the application by spraying of recycled water on golf courses and green spaces or use in decorative fountains, the most effective means of minimizing the presence of legionella in the recycled water, and thus the risk of infection, is to maintain a residual chlorine concentration in the recycled water at the point of use. Based on limited research (LeChevallier, 2016) a free chlorine residual of 0.5 mg/L or chloramine residual of 1.0 to 1.5 mg/L should provide adequate protection. Depending on the duration of recycled water aging during distribution (and storage if applicable), maintaining a disinfection residual may require supplemental chlorine addition (followed by an appropriate amount of contact time) prior to recycled water use should legionella growth have occurred in the distribution of the recycled water.

5. If residual cannot be maintained at the point of use of recycled water, ADEQ may require sampling to establish the levels of legionella present in the recycled water at the point of use. Such a monitoring approach could be similar to the cryptosporidium monitoring requirements under the USEPA Long Term 2 Enhanced Surface Water Treatment Rule. Based on the monitoring results (levels of legionella observed), some graduated treatment technique may be required by ADEQ.

REFERENCES

California Department of Public Health. *Regulations Related to Recycled Water. Title 17 Code of Regulations*. Revised June 18, 2014.

LeChevallier, M. W. Development of a Risk Management Strategy for Legionella. Southern Regional Technology Transfer Conference. Greenville, South Carolina. 2016.

3.7 RECYCLED WATER INFRASTRUCTURE AND TECHNOLOGY QUESTION 3

Class A+ and A Treatment Technology Requirements:
Review the technology requirements for treatment of Class A+ and A reclaimed water in AAC R18-11-303(A) and 304(A) and recommend any needed changes:

a. Are the requirements for filtration sufficient?

The work group believes that, generally speaking, the filtration and disinfection requirements are sufficient, however, there are a few areas that can be better defined. The primary water quality criteria identified as determining adequate filtration is turbidity. The means in which turbidity is measured and reported, could be improved upon. The 24 hour requirement of less than 2.0 NTU is sufficient. However, the daily maximum of 5 NTU poses a challenge. A clear time frame for the 5.0 NTU level is not currently identified. The rule states "The turbidity of filtered effluent does not exceed five NTU's at any time." There are obvious times when this can occur and have no reflection of the actual filtration process, such as maintenance on the turbidity analyzer, a quick flushing of a sample line leading to the analyzer, SCADA communication issue, data base collection and storage issue, or a filtration backwash. In the latter example backwashes can and often due create a small spike in turbidity. This could be argued that an increase in solids is being seen in the effluent and the turbidity is reflective of the process or the spike could be related to air in the sample stream dependent on the type of filtration backwash system. It is recommended that a specific time should be identified related to the maximum turbidity level of 5 NTU. Such as "The turbidity of filtered effluent does not exceed five NTU's for a total of 15 minutes in a 24 hour period." An option should also be provided for measurement of turbidity in situations when an inline analyzer fails. Such as "Grab samples of turbidity every 4 hours can be recorded in place of continuous monitoring in cases of instrumentation failure. The inline analyzer must be repaired and placed back in service within 48 hours or a replacement plan and timeline must be submitted to the Department within 7 days." Section "C" states alternative turbidity criteria can be used however it is vague and suggest it is a permanent implementation of different criteria opposed to a temporary condition such as instrumentation failure.

Additionally, it is suggested that the language requiring chemical feed facilities to add coagulants or polymers are required to ensure filtered effluent meets turbidity requirements should be removed. These filter aid processes are seldom used. At most language that states an area should be identified to implement a filter aid process in cases where turbidity criterion is consistently exceeded.

b. Should alternatives for filtration be allowed?

Yes. The work group believes the language in section “C” adequately covers this option.

c. Should alternatives for filtration be explicitly specified in rule?

The work group suggestes that examples of alternatives could be noted in rule, but does not recommend stipulating a precise list of alternatives that could only be used as an alternative to filtration.

Attachment 1

Workgroup Charter: Recycled Water Quality Standards

Arizona Department of Environmental Quality

Workgroup Charter: Recycled Water Quality Standards

Value Proposition:

ADEQ is undergoing a multiphase restructure and revision of its recycled water use rules primarily because augmenting sustainable water supplies is becoming increasingly important in Arizona's arid environment. ADEQ sees these rule revisions as a positive means to further enhance Arizona's unique environment, maintain its national leadership in the water reuse field, and support environmentally responsible economic growth.

Specifically under this Charter, ADEQ requests this workgroup to provide technical recommendations that ensure that ADEQ's reclaimed water quality standards and testing are adequate for their designated uses.

In implementing its mission to protect and enhance public health and the environment, ADEQ strives for radical simplicity, nationally recognized technical and operational excellence, and balanced, leading-edge environmental protection. Please allow this vision to guide the workgroup's recommendations developed under this Charter.

Charter Member Structure and Operation:

Member Structure. The workgroup should have between 6 and 12 members, including the chair. The chair, with input from workgroup members, should name a co-chair. The chair and the ADEQ Water Quality Division Director shall mutually agree on the number, designation, mission, scope, and membership of this workgroup and any changes. Table 1 below shows the initial member list.

Table 1Workgroup Member List (invited)

Name	Affiliation	Role
Marlene Gaither	Coconino County Public Health Services District	Microbiology
Shane Snyder	University of Arizona	Contaminants of Emerging Concern (CECs)
Leif Abrell	University of Arizona	Contaminants of Emerging Concern (CECs)
Paul Westerhoff*	Arizona State University	Contaminants of Emerging Concern (CECs)
Carie Wilson	City of Scottsdale	Water Quality Regulatory Manager
Troy Walker	Hazen and Sawyer	Process Engineering
Corin Marron	Carollo Engineers	Process Engineering

Name	Affiliation	Role
Charles Gerba	University of Arizona	Risk Assessment
Eric Thomas	Arizona Department of Health Services	Public Health
John Kmiec	Town of Marana	Water Supplier/Purveyor
Marcy Mullins*	Global Water Utilities	Regulatory Support
Holli LaBrie	ADEQ	Regulatory Support

*members to be part of the external review committee.

External Review or Consultation. ADEQ anticipates that an external review group will be assembled at the choice of the chair, and that the chair shall ensure that any review is conducted so that workgroup deadlines will be met.

Changes to Workgroup Membership. If either the ADEQ Water Quality Director or the chair are concerned about the commitment, behavior, or performance of a workgroup member, the two should consult to determine appropriate action, which may include replacement of the member.

Withdrawal from Workgroup. A member may withdraw from the workgroup at any time.

Good Faith Commitment. ADEQ recognizes and appreciates that workgroup members are experts in their field and are volunteering their valuable time. It is expected that workgroup members will participate in good faith throughout the process.

Decisions/Consensus. Ideally, the workgroup will be able to operate on a consensus basis. If a consensus cannot be reached, in order to move forward, decision will be by a quorum of 50% + 1 of the members (which may include telephonic attendance).

For the sake of the record and to make certain that ADEQ fully understands all sides of the issue, the chair will ensure that the dissenting voters provide a written explanation of the reasons for disagreement. These explanations will be included in the final deliverable of the workgroup.

Internal Review. A draft of the deliverable will be provided to all workgroup members for review and comment before the deliverable becomes final.

Records. Members shall keep record of sources referenced in discussions. This is to ensure that ADEQ can confidently draft the preamble to the rule and defend it should the need arise. Minutes for all meetings shall be kept. The chair will consult with ADEQ, on a meeting by meeting basis if needed, to determine whether this responsibility will be performed by an ADEQ staff person or a member of the workgroup or other person assigned by the chair. ADEQ will make minutes and agendas publicly available on its website.

Meeting Number and Frequency. The chair and workgroup members will decide the meeting number and frequency required to complete the deliverable within the assigned timeframe.

Meeting Locations. ADEQ can provide space in its own facilities for meetings in Phoenix or Tucson, as needed. If the workgroup meets at another location, meeting arrangements and teleconference tools are their responsibility.

Funding. ADEQ is grateful for the financial support that WateReuse Arizona has dedicated for this purpose.

Member Responsibilities:

Workgroup Member Responsibilities. Members should make every effort to attend all meetings in person or electronically. Members represent their affiliations and bring their special expertise to the table. Full participation is needed to ensure all affiliations and expertise are represented, all viewpoints are voiced, and decisions are reached by consensus to the maximum extent possible. This will allow ADEQ to confidently proceed in developing a science-based rule revision that is fair, effective, defensible, and beneficial to the citizens of Arizona.

Workgroup Chair Member - Responsibilities. The chair should schedule meetings to ensure that he or she can attend and conduct the meetings. Housekeeping best meeting practices to keep in mind include:

- Establishing a workgroup timeline;
- Take roll for each meeting;
- Prepare and distribute meeting agendas (please consult with ADEQ as it may be able to provide support for these responsibilities);
- Moving the discussion forward to keep the agenda on time;
- Ensuring that the workgroup remains productive;
- Ensuring that all sides of an issue are explored, including hidden or unpopular aspects;
- Encourage participation;
- Assist the workgroup in reaching consensus and articulating issues where consensus is not possible;
- Assist workgroup members in preparing the deliverable; and
- Ensure that workgroup deadlines are met and the final report is delivered to ADEQ on schedule.

Deliverable:

ADEQ anticipates a sectioned report that answers the Detailed Project Scope questions below, including a list of all documents or other information reviewed to create the final report. A prior similar report will be provided to the chair as a guideline for preparing the deliverable.

Timeframe:

ADEQ expects the workgroup to have its first meeting by May 1st, 2017, at the latest, and to deliver a reviewed and finalized report to ADEQ no later than October 31, 2017.

Project Scope:

1. **Reclaimed Water Classes:**
   Review the existing five reclaimed water classes (A+, A, B+, B, and C) in A.A.C. Title 18, Chapter 11, Article 3:
   a. Are these classes satisfactory to ensure the safe use of reclaimed water for the existing uses?
   b. Are these classes satisfactory to ensure the safe use of reclaimed water for any likely future uses, including potable reuse?
   c. Do we need more or fewer classes, and if so, why and what should be the requirements for any additional classes?

2. **Reclaimed Water Quality Standards:**
   For the constituents serving as standards in each reclaimed water class, and for any newly proposed classes:
   a. Are the constituents:
      i. Appropriate to protect public health?
      ii. Should alternate or additional constituents serve as standards?
      iii. How will alternate or additional constituents better address the problems?
      iv. Fecal coliform testing is currently required. Is *E. coli* testing more appropriate, or should something different be required? Should a coliphage standard be required?
   b. Are the numerical limits for the constituents serving as standards:
      i. Appropriate to protect public health?
      ii. Are the units of measurement correct or appropriate?
      iii. How will changes in numerical limits for constituents resolve issues or problems?
   c. Are the frequencies of testing for the constituents serving as standards appropriate?
   d. Should testing methods be specified in rule for the constituents serving as standards. If so, why?

3. **Filtration and Disinfection Requirements for Class A/A+ Water**
   Are the filtration and disinfection requirements for Class A/A+ water sufficient to safeguard against viral and cystic pathogen risk when monitored with required or recommended coliform/pathogen testing (fecal coliform, *E. coli*, etc.)? If changes are recommended, how do they resolve the problem?

4. **Unregulated Constituents**
   Should testing of additional constituents be required for informational purposes only, that is, testing for constituents for which no standards or limits are set? If so, describe what the benefits the test results would provide.

Attachment 2

Workgroup Charter: Recycled Water Infrastructure and Technology

Arizona Department of Environmental Quality

Workgroup Charter: Recycled Water Infrastructure and Technology

Value Proposition:

ADEQ is undergoing a multiphase restructure and revision of its recycled water use rules primarily because augmenting sustainable water supplies is becoming increasingly important in Arizona's arid environment. ADEQ sees these rule revisions as a positive means to further enhance Arizona's unique environment, maintain its national leadership in the water reuse field, and support environmentally responsible economic growth.

Specifically under this Charter, ADEQ requests this workgroup to provide technical recommendations that ensure that recycled water infrastructure and water treatment are appropriately regulated to protect human health and the environment given current technology. ADEQ also seeks policy and rule recommendations to ensure safe direct potable reuse.

In implementing its mission to protect and enhance public health and the environment, ADEQ strives for radical simplicity, nationally recognized technical and operational excellence, and balanced, leading-edge environmental protection. Please allow this vision to guide the workgroup's recommendations developed under this Charter.

Charter Member Structure and Operation:

Member Structure. The workgroup should have between 6 and 12 members, including the chair. The chair, with input from workgroup members, should name a co-chair. The chair and the ADEQ Water Quality Division Director shall mutually agree on the number, designation, mission, scope, and membership of this workgroup and any changes. Table 1 below shows the initial member list.

Table 1Workgroup Member List (invited)

Name	Affiliation	Role(s)
Tim Thomure (Chair)	Director of Tucson Water	Public Utility Practitioner
Jim Lozier	CH2M	Reverse Osmosis and Residuals
Rob McCandless	Brown and Caldwell	Membranes and Residuals
Keel Robinson	Xylem, Inc	Advanced Oxidation
Andrew Gilmore	Carollo Engineers	Secondary Wastewater Treatment
Ben Lee	Water Works Engineers	Disinfection
Zaid Chowdhury	Garver	Stabilization and Corrosion Control
George Maseeh	Carollo Engineers	Storage and Process Monitoring
Art Nunez	City of Scottsdale	Operations
John Calkins	EPCOR	Private Utility Practitioner
Lisa Snyders	The Coombs-Hopkins Co.	Equipment Vendor
Travis Taylor	ADEQ	Regulatory Support

External Review or Consultation. ADEQ anticipates that an external review group will be assembled at the choice of the chair, and that the chair shall ensure that any review is conducted so that workgroup deadlines will be met.

Changes to Workgroup Membership. If either the ADEQ Water Quality Director or the chair are concerned about the commitment, behavior, or performance of a workgroup member, the two should consult to determine appropriate action, which may include replacement of the member.

Withdrawal from Workgroup. A member may withdraw from the workgroup at any time.

Good Faith Commitment. ADEQ recognizes and appreciates that workgroup members are experts in their field and are volunteering their valuable time. It is expected that workgroup members will participate in good faith throughout the process.

Decisions/Consensus. Ideally, the workgroup will be able to operate on a consensus basis. If a consensus cannot be reached, in order to move forward, decision will be by a quorum of 50% + 1 of the members (which may include telephonic attendance).

For the sake of the record and to make certain that ADEQ fully understands all sides of the issue, the chair will ensure that the dissenting voters provide a written explanation of the reasons for disagreement. These explanations will be included in the final deliverable of the workgroup.

Internal Review. A draft of the deliverable will be provided to all workgroup members for review and comment before the deliverable becomes final.

Records. Members shall keep record of sources referenced in discussions. This is to ensure that ADEQ can confidently draft the preamble to the rule and defend it should the need arise. Minutes for all meetings shall be kept. The chair will consult with ADEQ, on a meeting by meeting basis if needed, to determine whether this responsibility will be performed by an ADEQ staff person or a member of the workgroup or other person assigned by the chair. ADEQ will make minutes and agendas publicly available on its website.

Meeting Number and Frequency. The chair and workgroup members will decide the meeting number and frequency required to complete the deliverable within the assigned timeframe.

Meeting Locations. ADEQ can provide space in its own facilities for meetings in Phoenix or Tucson, as needed. If the workgroup meets at another location, meeting arrangements and teleconference tools are their responsibility.

Funding. ADEQ is grateful for the financial support that WateReuse Arizona has dedicated for this purpose.

Member Responsibilities:

Workgroup Member Responsibilities. Members should make every effort to attend all meetings in person or electronically. Members represent their affiliations and bring their special expertise to the table. Full participation is needed to ensure all affiliations and expertise are represented, all viewpoints are voiced, and decisions are reached by consensus to the maximum extent possible. This will allow ADEQ to confidently proceed in developing a science-based rule revision that is fair, effective, defensible, and beneficial to the citizens of Arizona.

Workgroup Chair Member - Responsibilities. The chair should schedule meetings to ensure that he or she can attend and conduct the meetings. Housekeeping best meeting practices to keep in mind include:

- Establishing a workgroup timeline;
- Take roll for each meeting;
- Prepare and distribute meeting agendas (please consult with ADEQ as it may be able to provide support for these responsibilities);
- Moving the discussion forward to keep the agenda on time;
- Ensuring that the workgroup remains productive;
- Ensuring that all sides of an issue are explored, including hidden or unpopular aspects;
- Encourage participation;
- Assist the workgroup in reaching consensus and articulating issues where consensus is not possible;
- Assist workgroup members in preparing the deliverable; and
- Ensure that workgroup deadlines are met and the final report is delivered to ADEQ on schedule.

Deliverable:

ADEQ anticipates a sectioned report that answers the Project Scope questions below and provides recommendations as appropriate, including a list of documents and references upon which the answers and recommendations are based. A prior similar report will be provided to the chair as a guideline for preparing the deliverable.

Timeframe:

ADEQ expects the workgroup to have its first meeting by May 1, 2017, and to deliver a finalized report to ADEQ by October 31, 2017.

Project Scope:

1. **Pipeline Conveyances:**
   Review current technical standards for pipeline conveyances found in AAC R18-9-602(D) through (G) and recommend any needed changes:
   a. Do additional technical requirements or criteria need to be added and, if so, what should they encompass?
   b. How will the recommendations resolve issues?

2. **Maintaining Water Quality throughout Distribution System:**
   During the stakeholder listening sessions, ADEQ received comments regarding maintenance of water quality throughout the distribution system. Comments fell on both sides of the issue. Some commenters suggested that ADEQ keep the rule as is, which does not explicitly specify maintenance of a disinfection residual in the distribution system. Other commenters recommended that ADEQ add a disinfection requirement to the rule (AAC, Title 18, Chapter 9, Article 6).
   a. Should the rule address or not address disinfection criteria for the distribution system?
   b. If yes, what criteria are recommended and why?
   c. In either case, explain the rationale of the working group for their determination.

3. **Class A+ and A Treatment Technology Requirements:**

Review the technology requirements for treatment of Class A+ and A reclaimed water in AAC R18-11-303(A) and 304(A) and recommend any needed changes:

a. Are the requirements for filtration sufficient?
b. Should alternatives for filtration be allowed?
c. Should alternatives for filtration be explicitly specified in rule?

4. Potable Reuse Recommendations:

ADEQ intends to modify the prohibition against potable reuse for human consumption in AAC R18-9-704(G)(2)(a) so that reclaimed water may not be distributed for human consumption except as otherwise allowed by ADEQ's recycled water rules. For example, a permitted advanced water treatment facility, which treats and purifies reclaimed water, produces potable water that may be distributed for human consumption and is no longer considered reclaimed water or subject to further reclaimed water regulation.

What are the committee's recommendations on developing rules and guidance to ensure safe potable reuse?

As a starting point in these discussions, please provide implementation recommendations for ADEQ's intended proposed interim permitting criteria. For example, what are the workgroup's recommended components and expectations for each? The interim criteria include the following:

a. Source water characterization, including quantity, quality, and variability of source flows;
b. Source water protection (e.g. pre-treatment programs)
c. Description of and results from a pilot water treatment system for the facility;
d. Implementation of a pilot water treatment train at an appropriate scale of operation;
e. Technologies, processes, and methodologies to be employed for microbial control;
f. Logarithmic reduction targets for microbial control;
g. Identification and description of technologies, processes, and methodologies for chemical control;
h. Plan of monitoring for public health protection;
i. Commissioning and startup plan, including preoperational and startup testing and monitoring, expected time-frame for meeting full operational performance, and any other special startup condition that may merit consideration in the individual permit;
j. Operation and maintenance plan including corrective actions for out-of-range monitoring results and contingencies for non-compliant water;
k. Operator training plan; and
l. Documentation of technical, financial, and management capability.

As indicated above, in order to assist ADEQ in preparing the preamble to the eventual rule specifying DPR criteria, the workgroup will maintain a list of references tied to the recommended criteria (the SCAPR final report, etc.).

(The workgroup should also be aware of additional existing reuse permitting factors in rule at A.A.C. R18-11-309(C) that may be relevant).

Attachment 3

Guidance Framework Document for Direct Potable Reuse in Arizona (NWRI, 2018)

[Submitted under separate cover]