

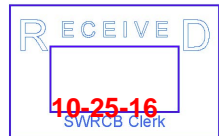


Public Comments  
Report to the Legislature on DPR  
Deadline: 10/25/16 12:00 noon

October 25, 2016

Felicia Marcus, Chair  
and Members  
State Water Resources Control Board  
P.O. Box 100  
Sacramento, CA 95812-1011

**Subject: Comment Letter – Report to the Legislature on DPR**



Dear Chair Marcus and Members of the Board:

On behalf of WateReuse California (WRCA) we thank you for the opportunity to comment on the State Water Resources Control Board (Board) draft report to the California Legislature, "Investigation on the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse" (report). In general we are very pleased with the contents of the report.

As discussed in the coalition letter that WRCA also submitted to the Board, the Expert Panel found that there is no need for additional research to be conducted to establish uniform criteria for direct potable reuse (DPR), yet consistent with its charge, the Expert Panel suggested additional research to further ensure the protectiveness of DPR. These six research recommendations are included in the report's Implementation Plan and the Board finds a significant benefit in conducting the research concurrently with criteria development. However, some of the research items are fairly broad or open-ended, and we are concerned about any potential unintended delays while this research proceeds.

WRCA has asked Trussell Technologies Inc., an environmental engineering firm with expertise in potable reuse, to evaluate and elaborate on the six Expert Panel research recommendations. We believe the attached report from Trussell Technologies lays out relevant and achievable near-term research projects that can be completed to provide the Board with the information needed to develop criteria that are protective of public health.

WRCA looks forward to meeting with Board staff to discuss the recommendations in the Trussell report and those included in the coalition letter. Please do not hesitate to contact me if you have questions or concerns regarding the attached report.

Sincerely,

A handwritten signature in black ink that reads "Jennifer West".

Jennifer West  
Managing Director  
WateReuse California

Attachment: Trussell Technologies Report



**Evaluation of the State Water Resources Control Board's report  
*Investigation on the Feasibility of Developing Uniform Water Recycling Criteria for  
Direct Potable Reuse***

**Date:** October 25, 2016

**Recipient:** WateReuse California

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**Subject:** Comments on the Research Recommendations in the State Water Resources Control Board's Implementation Plan

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**Introduction**

In its draft report, *Investigation on the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse*, the State Water Resources Control Board (State Board) offered an implementation plan based on the Expert Panel's six research recommendations. All six recommendations address important research topics that should be pursued; however, additional clarity on the near- and long-term goals of these pursuits should be specified to create a clear and transparent path to direct potable reuse (DPR) regulations.

The growth of science and technology allows us to continuously improve our understanding of public health protection. All regulations are, by necessity, created in the absence of a "final" answer, but at a period when sufficient understanding allows for progress to be made safely. The Expert Panel confirmed that the knowledge threshold has been crossed: we currently understand the issues well enough to move forward with DPR regulations that are protective of public health. The State Board has requested that additional progress be made to ensure the protectiveness of their future regulation.

This document provides specific recommendations for each of the six research areas proposed by the Expert Panel and the State Board<sup>1</sup>. The focus of these recommendations is on (1) important 'milestones' that can be accomplished in the near-term, and (2) 'metrics for success' describing how the information generated can be used to provide the State Board with greater confidence as it develops DPR regulations.

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<sup>1</sup> The Expert Panel's six research recommendations are present in the State Board's Implementation Plan as Items #2 through 7. These six recommendations are the focus of the current discussion.

**Targeted monitoring for source control and final water quality (DDW Plan #2)**

The Expert Panel recommended that the State Board engage in proactive monitoring of the scientific literature to identify potential new risks that could present serious harm to health over short durations of exposure. To aid in this effort, the Expert Panel recommended that the literature review created by the State Board's own *internal* group be complemented by a peer review process from a group of *external* experts. It is important that the State Board further develop its competence in this area so it can participate effectively in the dialogue. The information gained from such reviews would be used to inform targeted monitoring for both source control and final effluent water quality.

In the State Board's implementation plan, there is no mention of how source control programs, specifically, will be impacted by the Board's review of emerging contaminants; this is an important omission. In addition, the State Board recommends that the research be accomplished by a 'blue ribbon' panel with no mention of the State Board's internal expert group in the process. Both (1) the involvement of State Board staff in this research and (2) its implications for source control should be included in the Board's final report to provide greater clarity on the scope of this research theme.

*Suggested Research Approach*

To provide proactive monitoring of potential health risks, three entities should be involved:

1. State Board's Internal Experts
2. University or other research entity
3. External Peer Review group

The State's Internal Experts should provide on-going monitoring of the scientific literature; this information should be used to ensure DPR source control programs reflect the latest scientific findings. This on-going effort should be complemented at five-year intervals by a university or other research entity contracted to develop a state of the science review on emerging health risks. At the same five-year interval, the External Peer Review group should review the findings from both groups' efforts and provide input to the State Board on source control and monitoring requirements for DPR.

The purpose of this review is to better inform targeted monitoring for source control and final effluent quality. The source control effort will require close coordination between Divisions of the State Board responsible for enforcement of the Clean Water and Porter Cologne Acts, as well as those enforcing the Safe Drinking Water Act. The External Peer Review group should evaluate the conclusions of the scientific review, but also gather input from water and wastewater industry representatives on the state of source control programs in communities undertaking or developing potable reuse projects. With this perspective, the Expert Panel can provide the State Board with recommendations on how a statewide source control policy for DPR projects can be implemented by the Regional Boards with review by the State Board's Division of Drinking Water (DDW). These outcomes should lead to a well-defined and implementable source control program for DPR



projects, while providing further definition of the regulatory authority at the State Board (i.e., DDW working closely with regional boards to specify requirements).

#### *Milestones*

- 1) Create a framework for information gathering, and identify relevant individuals for the three expert groups
- 2) Conduct one complete round of review and present recommendations for targeted monitoring to State Board
- 3) Ensure funding is allocated for the on-going efforts of these groups

#### *Metric for Success*

The State Board oversees a process to identify emerging health risks for DPR, with these efforts used to inform source control and monitoring policies for DPR.

#### **Use of QMRA for DPR (DDW Plan #3)**

Quantitative microbial risk assessment (QMRA) offers unique opportunities to understand the reliability of DPR systems. It provides a tool to assess minimum treatment requirements and to compare the protection provided by different potential DPR treatment trains. Importantly, its insights can address many of the knowledge gaps raised by the State Board outside of the six specific research recommendations. In particular, QMRA provides a metric for the concept of reliability and offers insight into the benefits of additional LRV<sup>2</sup> capacity (i.e., treatment redundancy) and the benefits of multiple barriers (i.e., robustness).

#### *Suggested Research Approach*

The State Board should convene a workgroup of QMRA experts to develop a uniform risk assessment framework for DPR, using available performance data to assess the safety provided by potential DPR systems. As a starting point, the workgroup can examine the extensive data set from the DPR Demonstration Facility tested in WRRF 14-12. The Expert Panel used data from this project to determine that DPR could in fact be protective of public health, a finding that was critical in their assessment of DPR feasibility. The workgroup can use the data to provide additional insight into questions of redundancy, multiple barriers, and related concepts, while reviewing the QMRA currently being undertaken in WRRF 14-12. In line with the Expert Panel's conclusions, there are enough data currently available to answer these questions and develop objective, enforceable criteria for DPR. The workgroup should seek to develop recommendations for treatment and design of DPR systems.

In the long-term, the QMRA can be updated using new information from pathogen monitoring (see DDW Plan #4), as well as full-scale treatment performance data from future potable reuse projects.

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<sup>2</sup> LRV: "log removal value" is a measure used by both EPA and DDW to describe the efficiency of a treatment process or train of treatment processes in removing pathogens. For example, LRV values of 1, 2, and 3 are equivalent to removals of 90%, 99%, and 99.9%.

### *Milestones*

- 1) Create a QMRA workgroup to develop a uniform framework for DPR
- 2) Obtain workgroup consensus on the safety of the DPR system evaluated by the Expert Panel
- 3) Develop recommendations for DPR treatment and design

### *Metric for Success*

The QMRA workgroup provides input to State Board verifying that DPR can be done reliably, and offers recommendations for DPR treatment and design criteria.

### **Pathogen Monitoring in Raw Wastewater (DDW Plan #4)**

DPR treatment requirements can be better targeted—and less conservative—with improved understanding of the pathogen concentrations in raw wastewater. The existing data on pathogens in wastewater in the U.S. include only one systematic survey with uniform methods. That survey was done on six treatment plants in Florida that were each sampled four times. As laid out by the Expert Panel, a pathogen monitoring campaign should collect sufficient data to characterize pathogen loading, including seasonal and geographic variability. The State Board should consider requiring new potable reuse projects to conduct pathogen monitoring campaigns similar to what is required for new drinking water sources in EPA's Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The campaign should include monitoring of both raw wastewater and secondary effluent to (1) characterize raw wastewater pathogen loading and (2) quantify pathogen removal performance of the primary and secondary processes in the water recycling facility (WRF). The State Board should utilize data from the monitoring campaign to assign pathogen LRV credits for the WRF. This effort may also require close coordination between Divisions of the State Board responsible for the enforcement of the Clean Water and Porter Cologne Acts, and those enforcing the Safe Drinking Water Act.

### *Suggested Research Approach*

Because accurate measurement of pathogens in wastewater remains a challenge, a workgroup of subject matter experts should convene to establish and verify appropriate measurement methods. This is important to ensure that the measurements at different locations are comparable. Once methods have been vetted and approved by the subject matter experts, the State Board should provide funding for a monitoring campaign involving multiple utilities. In line with the spirit and intent of (1) the watershed sanitary surveys used to characterize drinking water sources and (2) the requirements of the LT2ESWTR for monitoring of *Cryptosporidium* in drinking water sources, the monitoring campaign should be conducted monthly for a period of two years. The participation of six agencies in this campaign would provide measurements of pathogen concentrations in over 100 raw and treated wastewater samples, and significantly augment the data set currently used by DDW. This campaign would provide a sufficient data set to allow DDW to confirm that their LRV requirements are sufficiently protective of public health.



*Milestones*

- 1) Establish a workgroup to develop and verify appropriate methods for the measurement of pathogens in wastewater
- 2) Collect measurements of pathogen concentrations in raw and treated wastewater at 6 or more utilities over a two-year period, covering different locations and seasons

*Metric for Success*

The State Board receives an expanded dataset of pathogen concentrations to provide additional confidence in the safety provided by DPR pathogen removal requirements.

**Outbreak Monitoring (DDW Plan #5)**

The impact of outbreaks on raw pathogen concentrations remains inconclusive, due in part to the fact that most data were not collected in tandem with information on community health. Thus, existing data sets may represent endemic levels of disease alone, or they may already include the impacts of outbreaks. The Expert Panel concluded that outbreaks may only have a moderate impact on the variability in raw pathogen numbers after reviewing recent research reports. Based on these findings, the Expert Panel concluded that their assumptions about maximum raw water pathogen concentrations were not violated during outbreak conditions. While research to further confirm these findings is needed, the development of DPR regulations should not be contingent on outbreak monitoring.

*Suggested Research Approach*

This effort is new in that it will require the integration of pathogen monitoring campaigns with community health surveillance. The State Board should convene a panel of experts to develop an approach for tracking outbreaks, communicating the information between partners, and ensuring that pathogen monitoring occurs during peak outbreak conditions. Coordination of potable reuse sponsors with health agencies, including the California Department of Public Health (CDPH) and local health departments, will be critical to integrate public health surveillance data into the monitoring. If possible, the outbreak tracking project should coordinate with the pathogen monitoring effort (#4) to test the effectiveness of the outbreak monitoring method. One location in the sampling campaign could implement the outbreak surveillance method while simultaneously engaging in high-frequency sampling of the raw wastewater, e.g., weekly over a yearlong period. This approach would improve the probability of detecting an outbreak and would validate the effectiveness of the tracking method.

Another topic of potential future interest is to assess how the size of the population within the sewershed impacts raw pathogen variability. Smaller communities may have less ability to buffer out the pathogen peaks associated with outbreaks; understanding this relationship may lead to better guidance for DPR in small communities.

*Milestones*

- 1) Create a workgroup to develop an approach for integrating pathogen monitoring campaigns with community health surveillance





- 2) Implement the surveillance approach during a high-frequency sampling campaign in conjunction with DDW Plan #4.

#### *Metric for Success*

The State Board receives a method for integrating outbreak surveillance into pathogen monitoring, and receives the findings of an intensive, yearlong outbreak monitoring campaign.

#### **Control of Chemical Peaks (DDW Plan #6)**

The Expert Panel recommended that short-term research be conducted to identify treatment processes that can provide ‘averaging’ of chemical peaks that might pass through the advanced water treatment facility. These peaks could represent compounds that persist through advanced treatment processes, or spills of chemicals (e.g., from industrial sources) into the wastewater collection system. The presence of both types of peaks is of concern for DPR; however, multiple system barriers can provide protection against the discharge of off-spec water, with treatment processes being only one of these strategies. Complementary efforts can be used to *prevent* these inputs (e.g., through source control) and to *detect and respond* to the passage of any chemical peaks (e.g., through high-frequency monitoring).

This is not to say that additional treatment-based strategies are not needed; more research into this topic is warranted and should be pursued. However, DPR regulations should not hinge on the completion of such research, given that existing strategies can be utilized to safely implement DPR. The Expert Panel itself opined that “a short-duration pulse is best managed through a targeted industrial source control program and more frequent sampling” of the compounds that are likely to pass through into finished effluents (pg. 80). The use of high frequency TOC monitoring can be used to detect chemical peaks and rapidly divert the water to prevent the chemicals from reaching consumers.

#### *Suggested Research Approach*

Multiple recent and on-going projects can offer insights into the effectiveness of different treatment processes to provide averaging or attenuation of chemical peaks. The DPR demonstration facility at San Diego utilizes two additional chemical barriers in the form of ozone and BAC that provide an additional treatment barrier to chemical peaks. Multiple challenge studies have been undertaken to assess the effectiveness of these barriers in preventing the passage of the low molecular weight organics known to pass through RO membranes. Other WateReuse studies provide information on alternative strategies, such as the buffering provided by engineered storage basins (WRRF 12-06). The benefit of degassing could also be assessed at the existing potable reuse facilities that utilize this process after RO treatment. A near-term approach should include the evaluation of the effectiveness of these various treatment options by a group of subject matter experts. This group should produce a white paper summarizing the relevant findings, and laying out longer-term research goals to assess additional strategies.



### *Milestones*

- 1) Convene a workgroup to assess chemical control strategies from existing potable reuse facilities and research projects, and to develop a white paper to assess research findings, recommend strategies, and identify future research.

### *Metric for Success*

The State Board receives information on the effectiveness of attenuation strategies for chemical peaks, and on future research that could support longer term DPR efforts.

### **Targeted monitoring for source control and final water quality (DDW Plan #7)**

The Expert Panel recommended research in two areas: (1) research to improve the identification of the low levels of organic compounds in advanced treated effluents, and (2) research to develop non-targeted analysis to improve our ability to identify unknown contaminants. Firstly, the Expert Panel recommended that the industry pursue chemical detection methods that provide better insight into the make-up of the low levels of organic compounds present in advanced treated effluents. Given the effectiveness of RO as a chemical barrier, the remaining organics typically constitute a small fraction of the total organics in the feedwater. In general, this subset is comprised of small, uncharged molecules with low molecular weights, characteristics that make these constituents challenging to detect through commonly used spectroscopic methods. The Expert Panel recommends that new methods continue to be developed to identify the low molecular weight compounds that remain in finished effluents.

Secondly, the Panel recommends that the identification of known compounds—through targeted analysis—be complemented by methods that can identify a wider spectrum of compounds. One strategy to accomplish this is non-targeted analysis, which takes the question, “*Is Compound X present?*” and reframes it as, “*Which compounds are present?*” These emerging methods provide new information through their ability to detect both known compounds (i.e., those characterized in chemical databases) as well as unknown compounds. While the methods alone may not identify the unknown compounds, they provide evidence of constituents that could be tagged for further characterization. The major difficulty with these methods is that they are relatively new techniques, with little application in recycled water matrices. The Expert Panel emphasized the nascent stage of development of many of these technologies, and, therefore, the uncertainty surrounding their ability to answer the Expert Panel’s questions.

It is important to note that the Expert Panel also stated that the low levels of these compounds in RO permeate and “subsequent removal in later treatment processes (e.g., during advanced oxidation) would result in concentrations of contaminants that may not pose unacceptable risks to public health.” In other words, the presence of low levels of organics in such treated effluents is not of immediate concern for the protection of public health. Given both the technological limitations associated with existing methods, and the lack of relevant health concern for these compounds of interest, less stringent short-term milestones are required for this topic. The research approach should reflect the fact that this theme is a lower public health priority, and therefore can benefit from a longer period





to develop the necessary methods and assess the future results. It should also be emphasized that low molecular weight organic compounds are not exclusive to DPR, but may be of relevance for other potable systems that utilize similar technologies in their treatment trains, including conventional drinking water systems using ozone.

#### *Suggested Research Approach*

Characterizing the constituents that remain in finished effluents is an important research theme that the industry should continue to pursue. Important progress can continue to be made on the control of toxics through the pursuit of other, parallel research themes, particularly the ones related to the continued vigilance for new contaminants of concern and their inclusion in source control programs. In the near-term, a workgroup of experts should be convened to develop a white paper that (1) summarizes the state of the science in these advanced techniques, and (2) provides a phased plan for future research.

The phased plan for future research should include a path for the testing and development of targeted analysis methods for low molecular weight compounds. Research in this area should be supported and undertaken by laboratories in the academic, commercial, and industrial spheres. Non-targeted analysis is less well-developed, but should also be pursued as a longer-range goal for its potential in identifying both known and unknown contaminants. Non-targeted analysis will be more important in support of future DPR treatment trains that attempt to produce drinking water without reverse osmosis.

#### *Milestones*

- 1) Convene a workgroup of experts to summarize the state of the science in advanced chemical detection techniques, and create a roadmap for future research

#### *Metric for Success*

The State Board receives a white paper describing the challenges and potential of advanced chemical detection techniques, and a roadmap outlining a long-term research plan.

#### **Conclusions**

DDW has stated that the development of DPR regulations in the absence of new research findings may lead to more conservative requirements. The recommendations provided in this document lay out relevant and achievable near-term research projects that can be completed to provide the State Board with the information needed to develop criteria that are protective of public health.



<b>Research Recommendation</b>	<b>Metric for Success</b>	<b>Milestones</b>
<p><b>Targeted Monitoring for Source Control and Final Water Quality (DDW Plan #2)</b>  On-going research to identify emerging chemical health risks should be conducted to inform monitoring requirements for source control and final effluent quality. The three entities needed to complete this research are: (1) an internal group of experts within the State Board, (2) a university or research entity, (3) and an external expert peer review group (i.e., blue-ribbon panel). The State’s internal experts should provide on-going monitoring of the scientific literature; this information should be used to ensure DPR source control programs reflect the latest scientific findings. This on-going effort should be complemented at five-year intervals by a research entity contracted to develop a state of the science review on emerging risks. At the same interval, the external peer review group should review the findings from both groups’ efforts and provide input to the State Board on source control and monitoring requirements for DPR. The implementation of source control programs should involve collaboration between the State Board staff responsible for both the Clean Water Act and Safe Drinking Water Act, with input from water and wastewater industry representatives.</p>	<p>State Board oversees a process to identify emerging health risks for DPR, with efforts used to inform source control and monitoring policies for DPR</p>	<ol style="list-style-type: none"> <li>1) Create a framework for information gathering, and identify relevant individuals for the three expert groups</li> <li>2) Conduct one complete round of review and present recommendations for targeted monitoring to State Board</li> <li>3) Ensure funding is allocated for the on-going efforts of these groups</li> </ol>
<p><b>QMRA Workgroup (DDW Plan #3)</b>  QMRA provides an opportunity to translate concepts such as reliability, redundancy, and multi-barrier treatment into specific treatment and design criteria for DPR. The State Board should convene a workgroup of QMRA experts to develop a uniform risk assessment framework for DPR, using available performance data to assess the safety provided by potential DPR systems. This analysis should seek to quantify the benefits of treatment redundancy and the use of multiple and diverse treatment barriers. The risk-based findings should be used to develop recommendations, including minimum LRV treatment requirements. In the long term, the QMRA can be updated with data from the pathogen monitoring effort (see #4) and future potable reuse projects.</p>	<p>QMRA workgroup provides input to State Board verifying that DPR can be done reliably, and offers recommendations for DPR treatment and design</p>	<ol style="list-style-type: none"> <li>1) Develop uniform framework for DPR QMRA</li> <li>2) Obtain workgroup consensus on the safety of the DPR system evaluated by the Expert Panel</li> <li>3) Develop recommendations for DPR treatment and design</li> </ol>
<p><b>Pathogen Monitoring (DDW Plan #4)</b>  DPR treatment requirements can be better targeted—and less conservative—with improved understanding of the pathogen concentrations in raw wastewater. A pathogen monitoring campaign should be undertaken to characterize pathogen loading, including seasonal and geographic variability. The campaign should also monitor concentrations in the secondary effluent to quantify removal performance through primary and secondary processes. Because accurate measurement of pathogens in wastewater remains a challenge, a workgroup of subject matter experts should convene to establish and verify appropriate measurement methods. Once methods are established, the State Board should provide funding for a monitoring campaign involving multiple utilities collecting samples monthly for a period of two years.</p>	<p>State Board receives an expanded dataset of pathogen concentrations to provide additional confidence in the safety provided by the pathogen removal requirements</p>	<ol style="list-style-type: none"> <li>1) Establish a workgroup to develop and verify appropriate methods for measurement of pathogens in wastewater</li> <li>2) Collect measurements of pathogen concentrations in raw and treated wastewater at 6 or more utilities over a two-year period, covering different locations and seasons</li> </ol>

<b>Research Recommendation</b>	<b>Metric for Success</b>	<b>Milestones</b>
<p><b>Outbreak Monitoring (DDW Plan #5)</b>  Outbreaks of gastrointestinal illness may raise the concentration of pathogens in raw sewage and threaten the reliability of DPR systems. The impact of outbreaks on raw pathogen concentrations remains inconclusive, and should be studied further. The Expert Panel reviewed existing literature and concluded that their assumptions about maximum raw water pathogen concentrations were not violated during outbreak conditions. A workgroup should develop a standard method for tracking outbreaks, communicating information between partners, and monitoring pathogens during outbreak conditions. If possible, the outbreak tracking project should coordinate with the pathogen monitoring effort (#4) to test the effectiveness of the outbreak monitoring method. One location in the sampling campaign could implement the outbreak surveillance method while simultaneously engaging in high-frequency sampling of the raw wastewater, e.g., weekly over a yearlong period. This approach would improve the probability of detecting an outbreak and would validate the effectiveness of the tracking method.</p>	<p>State Board receives method for integrating outbreak surveillance into pathogen monitoring, and receives the findings of an intensive, yearlong outbreak monitoring campaign</p>	<p>1) Create a workgroup to develop a standard approach for integrating pathogen monitoring campaigns with community health surveillance   2) Implement the surveillance approach during a high-frequency sampling campaign in conjunction with Research Recommendation #4</p>
<p><b>Control of Chemical Spikes (DDW Plan #6)</b>  The presence of chemical spikes that pass through advanced treatment facilities is a potential concern for DPR; several strategies could be used to prevent these spikes from reaching consumers. While additional treatment barriers could be used, other effective strategies include source control, diversion, and other failure response measures. Multiple recent and on-going research projects can offer insights into the effectiveness of different strategies for attenuating chemical peaks, including the use of enhanced treatment, enhanced source control, and engineered storage. Subject matter experts should convene to develop a white paper that reviews the research findings, evaluates the effectiveness of these control strategies, and offers longer-term research goals for the assessment of additional strategies.</p>	<p>State Board receives information on the effectiveness of attenuation strategies for chemical peaks, and on future research that could support longer term DPR efforts.</p>	<p>1) Convene a workgroup to assess chemical control strategies from existing potable reuse facilities and research projects, and to develop a white paper to assess research findings, recommend strategies, and identify future research</p>
<p><b>Non-Targeted Analysis and Low-Molecular Weight Compounds (DDW Plan #7)</b>  Despite the efficacy of advanced treatment, a small concentration of organic compounds remains in RO-treated effluents. While the Expert Panel concluded that these low levels should not pose a threat to public health, additional research in two areas would provide useful information: (1) improving methods to identify the low levels of organic compounds in advanced treated effluents, and (2) developing non-targeted analysis to improve our ability to identify unknown compounds. Given the technological limitations with existing methods, and the lack of relevant health concern for these compounds of interest, short-term research goals should include convening a workgroup of experts to develop a white paper that (1) summarizes the state of the science in these advanced techniques, and (2) provides a phased plan for future research.</p>	<p>State Board receives a white paper describing the challenges and potential of advanced chemical detection techniques, and a roadmap outlining a long-term research plan.</p>	<p>1) Convene a workgroup of experts to summarize the state of the science in advanced chemical detection techniques, and create a roadmap for future research</p>

## Proposed Timeline for Implementation of Research Plan

Research Milestone	2017	2018	2019	2020
<b>Targeted Monitoring for Source Control and Final Water Quality</b> 1. Select contractor for state of science report, appoint External Peer Review group 2. Development of state of the science report 2. External Peer Review group reviews research findings and creates report 3. Ensure funding allocated for future efforts				
<b>QMRA Workgroup</b> 1. Convene workgroup and develop framework for DPR QMRA 2. Workgroup consensus on safety of the DPR system evaluated by Expert Panel 3. Develop recommendations for DPR treatment				
<b>Pathogen Monitoring</b> 1. Establish workgroup to develop and verify methods 2. Collect pathogen measurements at 6 facilities over 2-year period 3. Develop report with monitoring results and recommendations				
<b>Outbreak Monitoring</b> 1. Create workgroup to develop outbreak monitoring approach 2. Implement surveillance approach during high-frequency sampling 3. Develop report with monitoring results and recommendations				
<b>Control of Chemical Spikes</b> 1. Convene workgroup to assess chemical control strategies 2. Develop white paper to assess research findings and recommend strategies				
<b>Non-Targeted Analysis and Low-Molecular Weight Compounds</b> 1. Convene workgroup to summarize state of science on detection technologies 2. Create a roadmap for future research and interim recommendations				