Mountains to Metro

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Proactively managing the risk contaminants of emerging concern pose to drinking water utilities

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Background & Significance

Contaminants of Emerging Concern

Contaminants of Emerging Concern (CECs) are any contaminants that are currently unregulated, not commonly monitored in the environment, and known or suspected to affect ecological and/or human health. CECs enter the environment primarily through human activity.

Environmental Challenge

Thanks to technological advances, CECs are detectable almost everywhere in trace amounts. However, uncertainty surrounding their effects on people and the environment makes it difficult for drinking water utilities to incorporate them into water quality protection planning.

Our Client

Denver Water is a drinking water utility that serves ~ 1.4 million people in the Denver Metro area. They want to understand the threat CECs may pose to water quality.

Study Area

- Upper South Platte Basin, Colorado
- Denver Water's primary water supply
- ~ 4000 square miles
- Mostly undeveloped
- Popular outdoor recreation destination

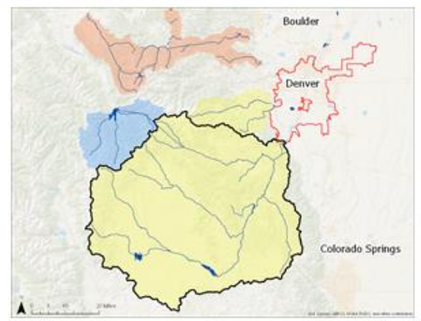

Figure 1. Denver Water Collection System. The Upper South Platte Basin is shown in yellow. The study area is outlined in black. Denver Water's service area is outlined in red.

Objectives

1) Develop methods to help drinking water utilities incorporate unregulated contaminants into water quality protection plans.

2) Apply this approach to Denver Water as a case study.

Conclusion

What our work means to drinking water utilities

We have developed a method for water utilities to incorporate CECs into water quality protection plans.

This method can be used, adapted, and shared by Denver Water, and ensures they are prepared to respond to the potential risk posed by CECs.

SharedSource Team

The SharedSource team recommended that Denver Water continue monitoring Contaminants of Emerging Concern in the rural South Platte Collection System. The team developed a CEC monitoring framework for use by Denver Water and other drinking water utilities to ensure effective monitoring of CECs in the future.

Acknowledgements

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References
Denver Water (2018) . Water quality monitoring results, South Platte Collection System. [Unpublished data].

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Approach

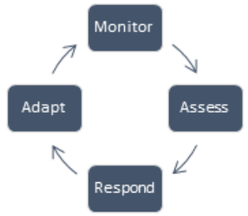
To achieve our objective, we developed a four step approach and applied it to Denver Water:

1) Monitor to determine CEC presence

2) Assess risk posed by CECs

3) Respond by selecting management intervention.

4) Adapt CEC monitoring plan to capture events and changes what will affect water quality.



1) Monitor to determine CEC presence

Indicators of Recreation | Pharmaceuticals | Pesticides

Land use change affects the sources present, and should be tracked over time to ensure that monitoring efforts are checking for CECs in appropriate places.

2) Assess risks posed by CECs

Drinking water utilities should compare observed CEC concentrations to the most stringent health guidelines available

Risk was defined as the potential for the concentration of CECs to exceed future regulatory standards. A risk ratio is the maximum detected value of a CEC reaching drinking water treatment plants divided by the most stringent public health guideline available (Table 1).

$$\text{Risk Ratio} = \frac{\text{CEC Concentration}}{\text{Most Stringent Health Guideline}}$$

Table 1. Risk Ratio and Risk Level

Risk Level	Risk Ratio
Very Low	<0.001
Low	0.002 - 0.01
Medium	0.02 - 0.49
High	>0.5

Note: The risk ratios presented in this table are based on the experience of the team working in a specific location. Each organization should have an internal discussion about risk preferences.

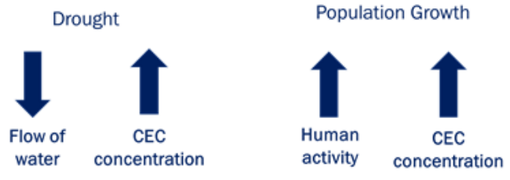
3) Respond by selecting a management action

Adjust or continue monitoring | Wastewater treatment plant technology upgrade | Stream or wetland restoration | Drinking water treatment plant technology upgrade

4) Adapt to changing conditions

Drought and population growth will impact trends in CEC presence and detection.

Both are expected to increase in the American West. These factors are also influenced by seasonal rainfall and how water managers choose to store and release water at given times based on demand.



Denver Water Case Study

Next, we applied our four-step approach to Denver Water:

1) Monitor: Our team led CEC monitoring during Summer 2018 at 12 sites. The results were used to inform subsequent steps.

Wastewater treatment plants are the main sources of CECs in the study area, which are associated with pharmaceuticals and chemicals in personal care products.

Other CECs in the study area could be explained by leaking septic systems, outdoor recreation, and atmospheric deposition.

Figure 2. Alma, Colorado is located in the study area, and is expected to experience population growth.

2) Assess: Pharmaceuticals and chemicals in personal care products pose a very low risk to Denver Water at this time. One CEC poses an unclear risk due to a lack of health guidelines.

Current risk posed by CECs was determined using monitoring results from step one to determine the risk ratio and risk level for each CEC. The risk posed by perfluorinated compounds is unclear because there are no health guidelines available.

To assess future risk, a model was used to simulate how CECs move through water bodies in the study area. The model simulated how increased development and droughts would change CEC concentrations. Results showed that **risk posed by CECs remains low**, even during drought and increased development simulations.

3) Respond: Continued monitoring was determined to be the best way for Denver Water to gather a baseline of information and manage the risk of CECs.

Denver Water should continue to monitor for CECs at four sites, each of which represents the water coming from a distinct region of the study area.

4) Adapt: The CEC monitoring plan should be reevaluated every 5 years.

Reevaluation serves as an internal check to ensure that the monitoring plan is still effectively capturing important sources and factors that affect water quality.

Our team included several other sampling sites at strategic locations to provide Denver Water with flexible options for distinguishing between sources in the study area if necessary. Basic cost breakdowns were also provided.