November 5, 2021

Kevin Reidy, Water Conservation Technical Specialist
Colorado Water Conservation Board
1313 Sherman Street, Suite 718
Denver, CO 80203

Project #: CMS 148932 CTGG1 2020-2655
Project Name: Direct Potable Reuse (DPR) Demonstration

Re: DPR Demonstration Final Progress Report and Invoice 4

Dear Kevin,

Colorado Springs Utilities is pleased to submit the Final Progress Report for the Direct Potable Reuse (DPR) Demonstration project. The "Purewater Colorado" trailer was installed at our J.D. Phillips Water Resource Recovery Facility and has been successfully purifying recycled water. Operational and water quality data is being continuously collected throughout the various treatment processes inside the trailer. More importantly, numerous outreach activities have been conducted throughout the summer and fall of 2021. **At this time, we are pleased to report that the outreach goals listed in the grant application have been completed.**

The following is a brief description of tasks completed for each phase of the project through the third quarter of 2021. Overall project completion at the end of September is 100%.

Task 1 – General Project Management – 100% Complete

Colorado Springs Utilities and Colorado School of Mines have been coordinating on this project since Spring of 2019. We have tracked hours worked for project management and coordination throughout the various project stages to demonstrate hours worked as in-kind services to match requirements of the grant. No grant money was used to pay for project management activities.

Task 2 – Design – 100% Complete

Colorado Springs Utilities hired Carollo Engineers, Inc. to design the mobile demonstration unit and to assist with other project phases as needed. Carollo completed the design for the mobile unit in June of 2020.

Task 3 – Construction – 100% Complete

Colorado School of Mines completed the construction of the mobile DPR unit, named the "Purewater Colorado" Trailer, in the Spring of 2021. It was transported to the J.D. Phillips Water Resource Recovery Facility by June 2021 and startup activities were performed. Colorado School of Mines hired a graduate student to work full-time on the construction of the mobile unit and he continued to support the project during startup and operations.

Task 4 – Operation – 100% Complete as of 9/30/21 (Grant portion complete)

Startup and "shake-down" activities began in June of 2021 after the trailer was transported and connected to non-potable source water (treated wastewater) at Colorado Springs Utilities J.D. Phillips Water Resource Recovery Facility. Colorado School of Mines and Carollo Engineers provided assistance to Colorado Springs Utilities operators during startup of the mobile unit. After initial startup, operational responsibilities have been shared by Colorado Springs Utilities and Colorado School of Mines. Remote sensors at strategically placed locations in the trailer have been continuously recording operational data as water moves through the numerous treatment processes. The data is transmitted via cellular communication data connection to Colorado School of Mines and operational changes can be made remotely through a custom developed SCADA system by Colorado Springs Utilities operations staff. Colorado School of Mines plans to gather and analyze operational data throughout the duration of operations.

Water quality testing has been significant throughout trailer operations. Utilities has been collecting grab samples between unit processes and testing for numerous constituents to ensure that the trailer is purifying water as intended. Any water served to the public or donated to partner beverage producers as part of outreach actives was collected and tested to ensure the water quality meets or exceeds drinking water standards, and then served during tours or donated to beverage partners. Additionally, periodic sampling for contaminants of emerging concern (CECs), such as pharmaceuticals and PFAS, have been conducted to determine if the trailer removes currently unregulated contaminants. Initial sampling results show that the trailer has an excellent removal rates. By the end of Q3 2021, over $87,500 has been spent on water quality tests with almost $51,000 going to external laboratories. A summary of the water quality data for water served in tour tastings and water provided to beverage producer partners is being prepared and submitted to the Colorado Department of Public Health and Environment for their information and records.

Operational lessons learned are also being documented as we continue to operate the trailer. This will greatly benefit future users of the trailer as it travels to other communities. For example, we used media from our Bailey Water Treatment Facility in the Biologically Active Filtration (BAF) columns. Carollo Engineers and Colorado Springs Utilities believed that utilizing media from an existing treatment plant for the BAF columns would reduce time during operational startup because it can take several months to develop the beneficial microorganisms in the media; utilizing recycled media would speed the process up. However, we did not backwash the media prior to collecting it from the Bailey Water Treatment Facility. The media itself had retained contaminants extracted from raw water, most notably Manganese. Once the trailer was turned on, Manganese concentrations increased as the water flowed through the BAF and essentially contaminated the Granular Activated Carbon (GAC) unit process. Deionized water had to be used to backwash the system. The lesson learned is that the trailer is much more sensitive to contaminants than a full-scale treatment facility and care should be taken if recycled BAF media is going to be used. Similarly, it may be worthwhile to plan for a longer startup time in-leu of utilizing recycled media at the next installation location.

As noted in previous reports, the COVID-19 pandemic greatly extended the project timeline. An unanticipated benefit to the project resulted from the delays because the operational capabilities of the trailer were greatly enhanced. The additional time afforded by the

pandemic was used to plan enhancements to the SCADA monitoring system. In fact, the trailer can be controlled remotely via cellular communications which greatly reduces the operational burden since an operator is not required to be physically located at the trailer location at all times.

Figure 1. Examples of the monitoring system and SCADA controls within the Purewater Colorado Trailer

Task 5 – Outreach – 100% Complete as of 9/30/2021 (Grant portion complete)

*Note – The attached spreadsheet shows money and time spent through Quarter 3 of 2021. Donated hours and expenses accrued for outreach events and tours in October and November 2021 are not reflected in the spreadsheet.

Over the past several months, the project team has really focused on outreach activities. Tours were arranged at the Purewater Colorado Trailer to showcase the technology ("How?") and explain the need ("Why?") for direct potable reuse. Tours were arranged by groups that can be broadly categorized as focused stakeholder tours, internal training/showcasing tours, and general public tours. Purified water from the trailer was available and served during most tours. Storybook Brewery created a flavored soda using water purified from the trailer and we were able to offer tastings during community events. Outreach materials including informational fliers and "swag" were handed out during tours and events. Several breweries are brewing/have brewed beer using water purified from the trailer and we will be able to keep the conversation going over the next several months as the beer is distributed. Additional outreach has been performed during special media events, through the creation of content hosted on websites and social media platforms, and through the creation of two professional videos. Below is a summary of the outreach activities:

DPR Outreach Summary	
49	Tours conducted
945	Tour attendees
85.4	% tasted the purified water
3	Community Event booths
760	Soda tastings at Community events
4	Public presentations
101	Presentation attendees
11	School and college tours
2	Media Events
10+	Media stories
2	Videos created

Overall, we are very proud to say that we have connected individually with approximately 1,800 people in such a short timeframe! At this time, we believe we have successfully completed our outreach objectives as specified in the grant application. Attached is a presentation showcasing some of the outreach tours and events that took place over the last several months.

Project Budget and Grant Invoice

The DPR Grant Invoice 4_Q3 2021 spreadsheet accompanies this update report. The "Overview" tab shows the current invoice of **$131,612.42** (remaining grant balance) and the percent completion of grant-funded portions of the project. The "Accrued Expenses" tab shows a ledger of project expenses accrued up to and including September 30, 2021. The bottom of the ledger shows expenses by task, overall project expenses, and additional expenses above grant requirements.

The "Project Cost Estimate" tab shows the original cost estimate submitted in the grant application and a revised project cost estimate from April 30, 2020. Additional revisions to the tasks were not necessary as we have utilized all of the grant funding according to the revised allocations.

Overall, the project has accrued slightly more expenses than anticipated. Most of the overage is in labor hours from Colorado Springs Utilities personnel. Additional overages can mostly be attributed to water quality testing and the cost of equipment. As anticipated, project management hours were tracked and used for in-kind labor donations. Overall, there was an abundance of additional in-kind services and in-kind cash donations so there were no issues documenting the justification for receiving grant money. Grant money was used to pay for the design and construction of the mobile demonstration trailer, for some of the water quality testing, and for outreach activities like handouts and logistical items for the tours.

Thank you for supporting this collaborative project! Do not hesitate to reach out for additional information, discussion, or clarification.

Sincerely,

Jason Messamer
Project Engineer
jmessamer@csu.org
719-668-4170

Kirk Olds
Manager
kolds@csu.org
719-668-3739

Attachments

- Final Invoice
- Final DPR Grant Invoice Spreadsheet (electronic)
- Outreach Activities Pictures

Invoice to: Colorado Water Conservation Board
1313 Sherman St. Rm. 718
Denver, Co 80203

Attn: Kevin Reidy, Water Conservation Technical Specialist
Department of Natural Resources
kevin.reidy@state.co.us
303-866-3441 x3252

Project Name: Direct Potable Reuse (DPR) Demonstration

Grantee: Colorado Springs Utilitities (CSU)
Address: 1521 S. Hancock Expressway MC 1821
Colorado Springs, CO 80947-1821

Contact: Jason Messamer, Project Engineer
jmessamer@csu.org
719-668-4170

Kirk Olds, Manager
kolds@csu.org
719-668-3739

CWCB Contract or Purchase Order No.: CMS 148932
CTGG1 2020-2655
Full Grant Amount: $350,000
Date of Invoice: 11/5/2021
Invoice #: 4 (Final)

Task	Description	Total Budget Grant Funds	Previously Invoiced	Current Application	Remaining Grant Funds	Grant Funds Percent Complete
1	General Project Management	$0	$0	$0	$0.00	100.0%
2	Design	$133,800	$133,800.00	$0	$0.00	100.0%
3	Construction	$186,200	$84,587.58	$101,612.42	$0.00	100.0%
4	Operation	$20,000	$0	$20,000	$0.00	100.0%
5	Outreach	$10,000	$0	$10,000	$0.00	100.0%
	TOTALS	**$350,000.00**	$218,387.58	**$131,612.42**	**$0.00**	**100%**

Project Update: Completion percentages refer to expected grant-eligible reimbursements for each task. Overall project completion on a dollar basis is approximately 119%. See Progress Report 4 for additional details.

Submitted by: Jason Messamer
Title: Project Engineer
Signature: 

Kirk Olds
Manager
Signature: 

Welcome

PureWater Demonstration Celebration


DIRECT
POTABLE
REUSE
MOBILE
DEMONSTRATION
PUREWATER
COLORADO
NIKES

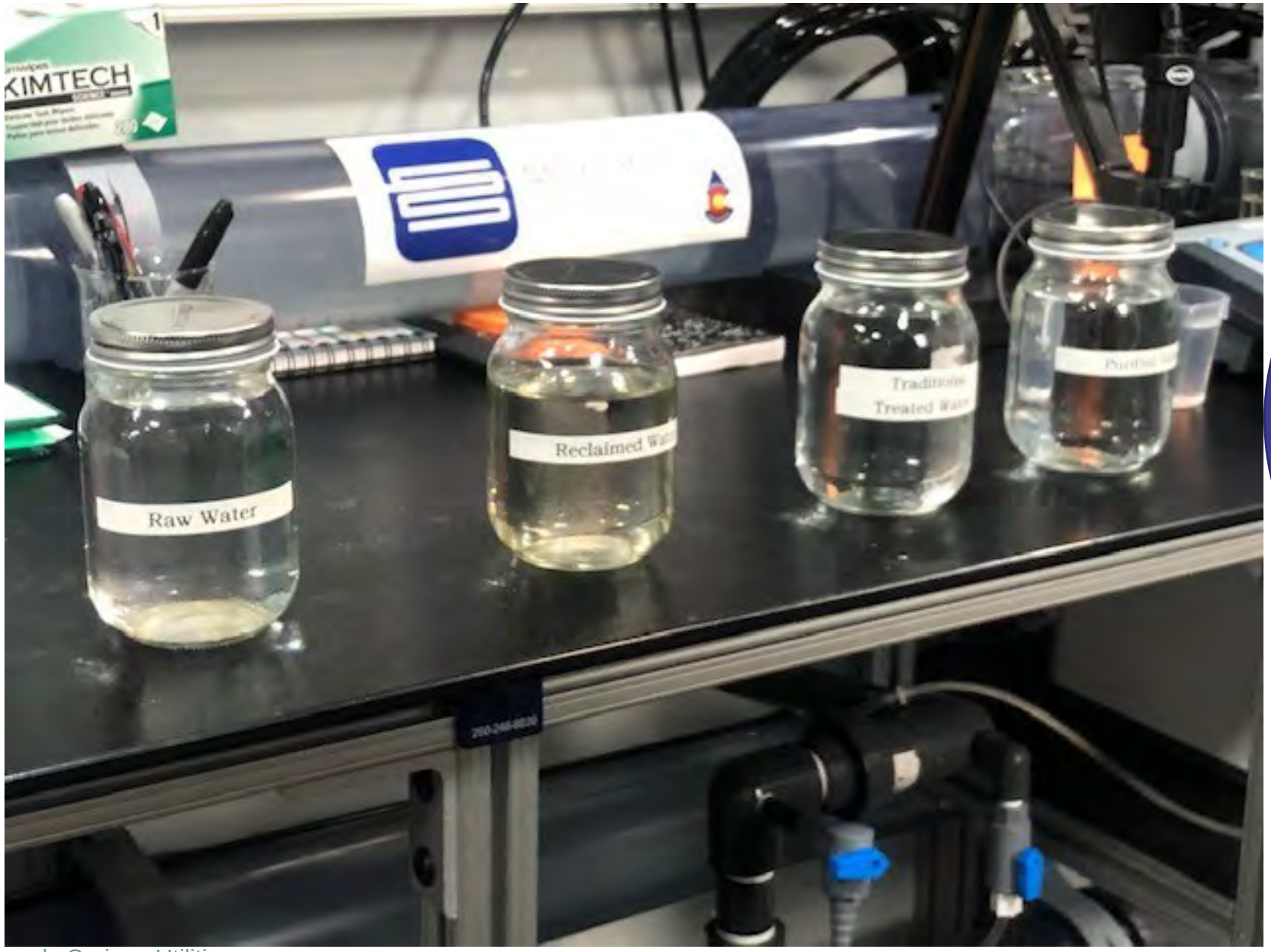

DIRECT
POTABLE
REUSE
MOBILE
DEMONSTRATION
MINES
WEST
carollo
COLORADO
WaterReuse
AQUA-AEROBIC
SYSTEMS, INC.
DENVER
WATER
SUEZ
NGL
REALTECH
NSF

Outreach Materials


DIRECT POTABLE REUSE
MOBILE DEMONSTRATION
TODAY WE WORK
TOMORROW
Water Reuse
PROJECT WET
RECYCLING WATER FOR A SUSTAINABLE FUTURE
PUREWATER COLORADO
WITH COLORADO SPRINGS UTILITIES


Current
Drinking Water
Purified
Drinking Water
Purell
DIRECT

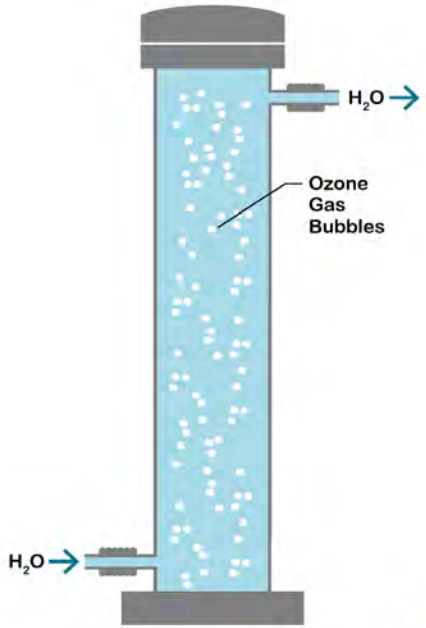

Colorado Springs Utilities
It's how we're all connected
COLORADO SPRINGS UTILITIES WATER SUPPLY
South Platte River Basin 5%
Colorado River Basin 65%
Arkansas River Basin & Local Sources 30%
WATER SYSTEM MAP
COLORADO SPRINGS WATER SUPPLY SYSTEM
INTEGRATED WATER RESOURCE PLAN (IWRP)
Colorado River Projects
Agricultural Transfers
Demand Management
Storage
Reuse
All components are necessary to assure sufficient, reliable water supply for Colorado Springs
Reuse is Part of Water Supply
REUSE
Non-potable Reuse (currently using)
Exchanges (currently using)
Indirect Potable Reuse (future possibility)
Direct Potable Reuse (future possibility)
AVAILABLE REUSE MECHANISMS
Non-potable reuse
Exchange
Indirect potable reuse (IPR)
Direct potable reuse (DPR)
WHAT IS DIRECT POTA
REUSE?
Direct Potable Reuse (DPR): cleaning
water to a level that meets or exceeds all
water standards.
HOW DIRECT POTABLE REUSE COUL
OUR CUSTOMERS:
Clean, safe future water source
Reliable, locally controlled
Sustainable
Environmentally friendly
Cost effective
Resistant to climate effects



"I'm impressed with the forward-thinking staff at Utilities."
-Tour Attendee

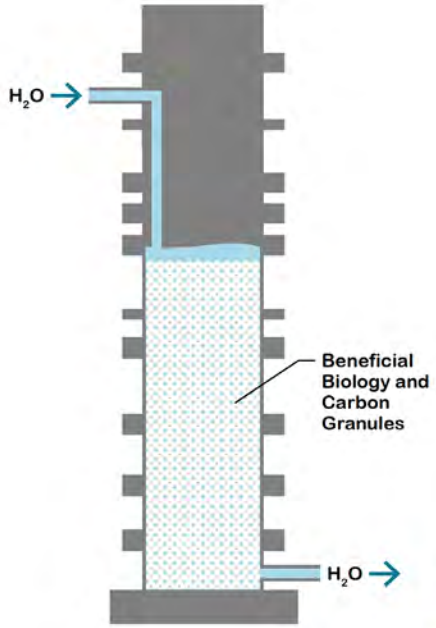
#1. Ozonation

- Ozone is a gas produced by subjecting oxygen molecules to high electrical voltage.
- Prior to the next steps, the ozone degrades organic matter and breaks down into dissolved oxygen.
- This process:
  - Destroys microorganisms.
  - Breaks down trace chemicals.



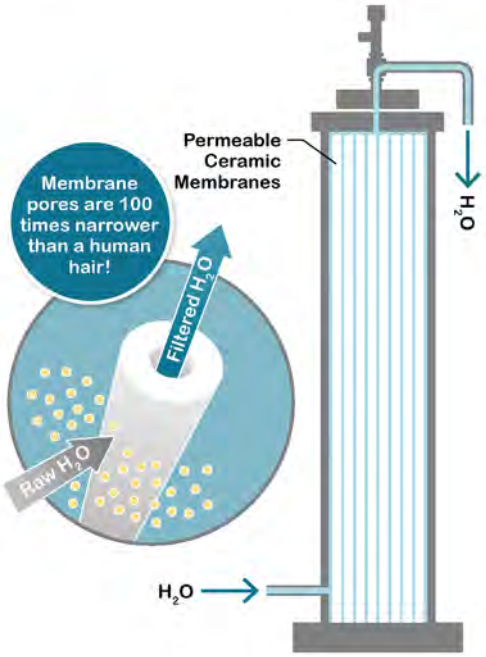
#2. Biofiltration

- Water is sent through biologically activated carbon filters that are covered with "aerobic" bacteria, which thrive in the presence of oxygen.
- This process:
  - Consumes organic matter.
  - Removes trace chemicals.



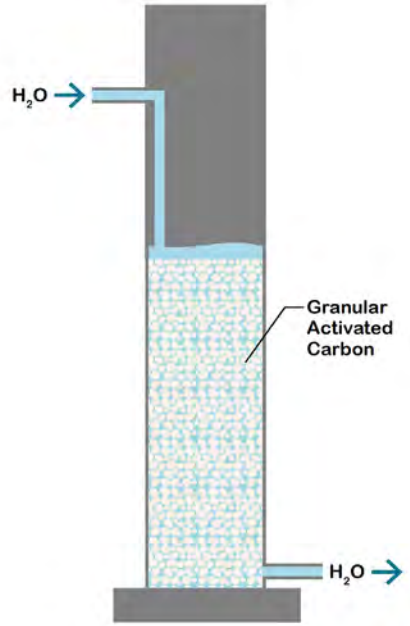
#3. Microfiltration

- Water is pushed through tiny pores in a ceramic membrane.
- This process:
  - Removes microscopic particles including suspended solids, bacteria, and protozoa.



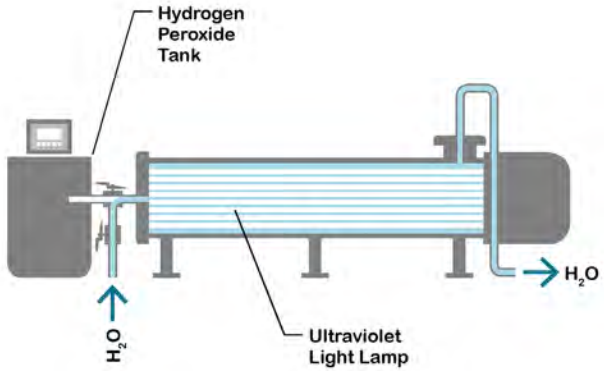
#4. Granular Activated Carbon

- Water flows through carbon granules.
- This process:
  - Removes trace chemicals.
  - Removes organic matter.



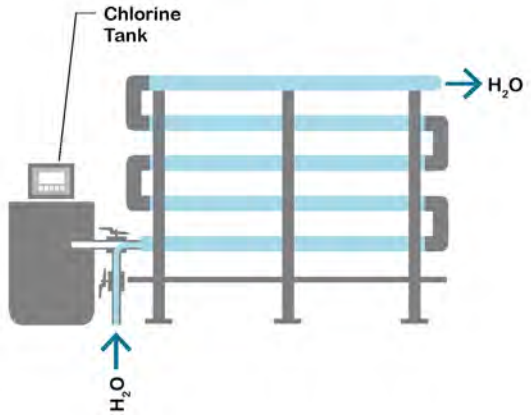
#5. UV/ Advanced Oxidation

- Generates high energy UVC light.
- Creates a chemical reaction that produces high energy radicals.
- This process:
  - Damages the DNA of any microbes or viruses, leaving them unable to replicate.
  - Destroys remaining trace chemicals.



#6. Chlorination

- Adding chlorine at the end of the treatment process further inactivates pathogens.
- A residual disinfectant ensures water remains safe to drink all the way to homes and businesses.



Purified Water

- The water is tested and monitored and must meet or exceed all drinking water standards.
- At the end of all the treatment processes, we are left with safe, clean drinking water – from a locally available source!

Outreach tours

Due to regulations, we are only allowed to serve 24 people per day!

Denver Water tour – 7/20/21

Colorado Springs Utilities Board 7/21/21


Recycling water for a
sustainable Colorado futu
PUREWATER

150th Year Celebration
7/31/21


Colorado Springs Utilities
Colorado
t's how
Utilities
ected
Spr gs Utili
onnected
WATER TODAY
A GREENER TOMORROW
Check for leaks in your toilet
FREE

"A very informative, professional and fun(!) presentation addressing a serious issue facing the community and region at large. Thank you. "
-Tour attendee

Started out beautiful then it poured!!!

Bunch of drowned rats!


Cascade

Media Tour
8/4/21


INTEGRATED WATER
RESOURCE PLAN (IWRP)
Reuse is Part of Water Supply


DIRECT
POTABLE

8/5/21 1st Public Tour

"Glad to know that Colorado Springs Utilities is looking to the future. Potable water is a major concern in our drought prone state."
-Tour Attendee

8/5/21 RDM All-Hands Tour

"It's good to know that there are lots of people making sure that our water is safe for us and our children to drink."
-Tour Attendee

8/10/21 Public Tour

8/13/21 Industry Professionals

8/20/21 Jacobs Engineering

Colorado College
9/16/21


Recycling water for a
sustainable Colorado future
MINES
COLORADO
COLLEGE

9/25/21 Girl Scout Troop Tour

9/28/21 Rogers Elementary

9/29/21 Friends of Mesa Road Gardens

"The presentation was excellent, and the concept is one that is past due. Thanks for your efforts to educate the public!"
-Tour Attendee

Employee Tour
10/06/21

Metro Water Recovery 10/08/21


DIRECT
POTABLE
REUSE
MOBILE
PUREWATER

Cool Science Festival at UCCS 10/9/21

Stats

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Thank you to all our project contributors!