

Tucson Water Tackles 1,4-dioxane & PFAS Challenges within TCE CERCLA Program

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Presentation Outline

- TCE remedy & 1,4-dioxane discovery
- Contingency planning and decisions
- Planning, design, and construction
- O&M experience and improvements
- PFAS discovery
- Major results and recognition







TCE Remedy & 1,4-Dioxane Discovery

TCE Discovery and Investigation



TUCSON



TCE Remedy Implemented



1,4-Dioxane Discovery & Early Efforts







Contingency Planning and Decisions

Contingency Preparations





4. J - J-Ragged results are estimated concentrations below the Method Reporting Limit (1.0 up/L) and above the Method Detection Limit



Regulatory Developments & Treatment Implementation





2011 Edition of the Drinking Water Standards and Health **Advisories**





Planning, Design, and Construction

LPHO UV-Peroxide Technology Selected for TARP





Peroxide Quenching Using GAC Selected for TARP

Complete quenching at low contact times and high surface loading rates Potential to decrease byproducts

- Assimilable Organic Carbon (AOC)
- TTHM precursors
- Other unregulated contaminants

Operational and water quality stability advantages over chemical quenching



Schematic

UCSON

ADVANCED OXIDATION PROCESS (AOP) A proven technology that combines ultraviolet (UV) light with hydrogen peroxide to create a strong oxidant that removes 1,4-dioxane from water





The UV reactors remove 1,4-dioxane by oxidation



Granular activated carbon (GAC) removes any hydrogen peroxide left in treated water

Technical Implementation

- •Design/CM Services: \$3.3M
- Contracting approach
 - ✓ Construction manager at risk
 - Separate GMPs for long-lead equipment purchase and general construction

Schedule

- ✓ Major equipment:
 - GMP-1, \$4.3M awarded July 2012
- ✓ Construction:
 - GMP-2, \$11.0M awarded Sept. 2012
- ✓ Completion: January 2014



\$18.6M





Construction Site Overview







UV Building/ Equipment Construction







Completed Facility









Completed Facility





AOP Follow-up to Complete TARP WTP Transformation

EPA coordination with CERCLA process affects timing

Vapor-phase GAC removed from service August 2017

- Eliminated natural gas usage for duct heaters
- Eliminated GAC media replacement
- Eliminated exhaust air VOC monitoring

Packed columns to be retired

- Eliminate power used for blowers
- Eliminate cost and hazard of sulfuric acid
- Avoid additional scaling and future rehabilitation
- Reduce water quality monitoring requirements



O&M Experience and Improvements

Full-scale Performance: 1,4-dioxane

Average 1,4-Dioxane Concentration (Dec. 2014-Apr. 2021)



Full-scale Performance: TCE





UV Reactors O&M Experience

•UV Part Replacement

- ✓ Lamps under warranty 12,000 hours
- ✓ Ballasts under warranty 5 years
- ✓ Staggered lamp replacement spreads cost over several years

UV Reactor O&M Costs

- ✓~\$15,000/month electric power
- ✓~\$10,000/month hydrogen peroxide
- ✓\$315/replacement lamp
- ✓ \$724/replacement ballast
- ✓~\$164,000 for single-train lamp changeout







GAC Peroxide Quenching Experience

- Robust performance with minimal maintenance by 8 pressure contactors
- Short (2-min) "fluffing" backwash every two weeks
- Periodic peroxide detections in top two of three bed profile sample ports
- Detections not present after backwashing
- No media replacement after 4.5 years of service





Enhanced Recovery

1987-TCE Plume



2021 - TCE Plume





TARP Treatment Upgrades for Enhanced Recovery

• TARP treatment upgrade design currently in progress:

- New well has been constructed for enhanced remediation
- Treatment upgrades for additional well capacity
- 4 GAC contactors have been installed for peroxide quenching
- Communications upgrades
- Packed column aeration retirement









Technical Implementation

- •Design/CM Services
- Contracting approach
 - ✓ Construction manager at risk
 - Separate GMPs for long-lead equipment purchase and general construction

Schedule

- ✓ Major equipment: GMP-1
- ✓ Construction: GMP-2-6
- ✓ Packed column aeration retirement: GMP-X



2021 Completion



PFAS Discovery



GAC Changeout

- Carbon used for hydrogen peroxide quenching replaced
- Additional 4,000 lbs of media (to 18,000 lbs) installed in each vessel to increase EBCT
- Weekly sampling of GAC side sample ports for 14 PFAS
- Shorter chain species are being used as indicators for PFAS migration through carbon bed
- Currently using bituminous coal-based GAC in all vessels
- GAC changeouts conducted:
 - Dec 2018-Feb 2019
 - Sept 2019-Jan 2020
 - Aug 2020
 - February 2021





Full-scale Performance: PFAS



TARP Facility Shutdown – June 21, 2021

TARP Recycled System Source Water Infrastructure

Flexibility in Response to Water Quality Issues

Challenges

- PFAS impacts to TARP are increasing
- Tucson Water committed to treated water quality
- Potable demands can be met without TARP water
- Flexibility needed for Tucson Water to effectively manage all City water supplies

Response

- New infrastructure to direct TARP treated water to the recycled system
- Design and construct:
 - Recycled water storage tank and pump station at the TARP WTP
 - Pipelines to the recycled water system and to the Santa Cruz River
- Ongoing close regulatory coordination with EPA & ADEQ
- Project completion early 2022





TARP Recycled Water System Infrastructure Project



Major Results and Recognition

Continuous Public Engagement

- Unified Community Advisory Board (UCAB)
- Neighborhood association meetings
- Customer communications
 - ✓ Brochures
 - ✓Newsletters
- Groundbreaking event
- Traditional news media
- Electronic media





Aquifer Remediation Statistics (through April 2021)

- Remediation of 55.7 billion gallons of groundwater since 1994
- Removal of 6,072 pounds of TCE since 1994
- Removal of 147.7 pounds of 1,4-dioxane since 2014
- Significant decrease of TCE & 1,4-dioxane contamination









•2016 Crescordia Award – Technology Innovation

•Arizona Forward/SRP

•2015 National Grand Prize - Design

•American Academy of Environmental Engineers & Scientists (AAEES)

•2015 National Recognition Award

•American Council of Engineering Companies (ACEC)

•2014 Judge's Choice Award

•American Council of Engineering Companies of Arizona (ACEC-AZ)

•2014 Water Treatment Project of the Year

•AZ Water Association







Questions?

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