

PFAS Treatment: Permitting Considerations and Engineering Support

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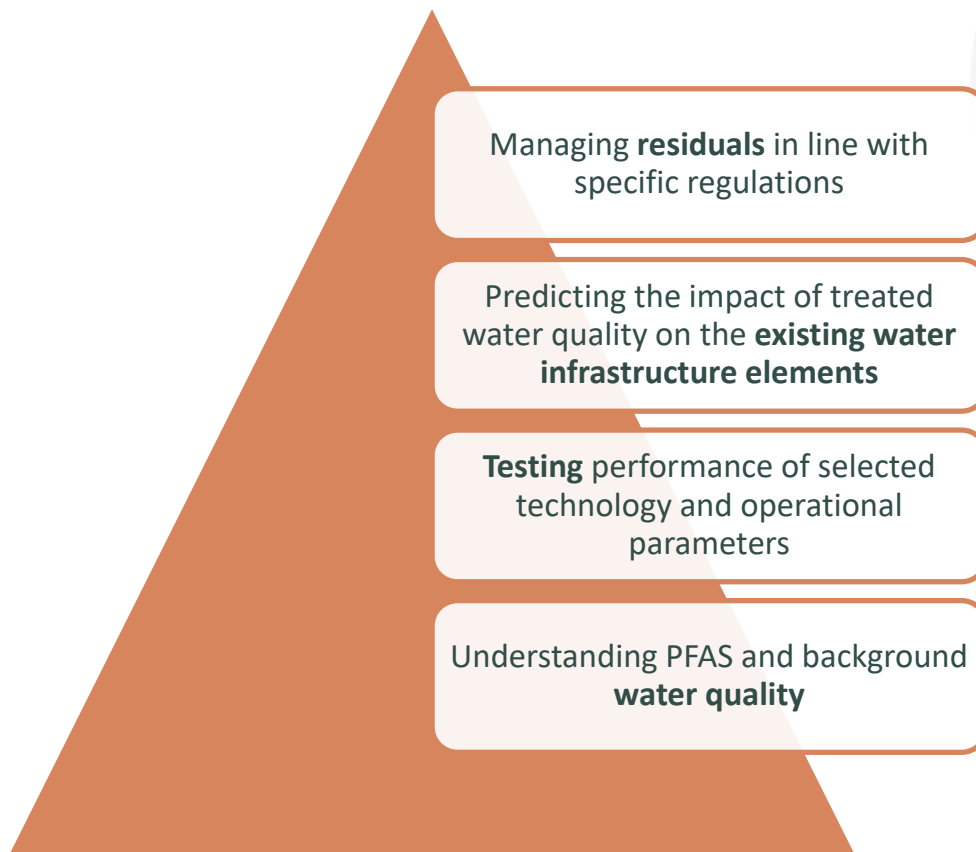
Clean Air, Safe Water,
Healthy Land for Everyone



- Permitting Goals and Objectives
- Treatment Approach
- Six Steps in the Permitting Process
- Lessons Learned
 - Pretreatment
 - Preparation Upfront Testing
 - Modeling
- ADEQ Engineering Support



Long Term and Simultaneous Compliance



Complexity of PFAS contamination
Challenging treatment goals
Existing knowledge gaps

Treatment Approach

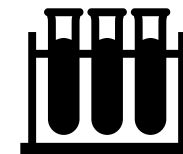
ADEQ **recommends but does not limit** the installation of best available technologies (BAT) as the most reliable options that already have demonstrated effectiveness at full scale in the field.

BAT

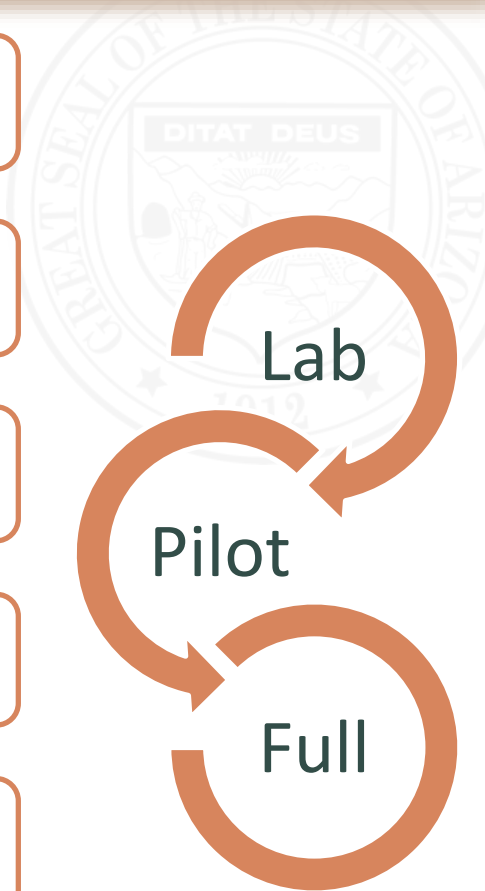


VS

Innovations



Six Steps in the Permitting Process



ADEQ permitting starts with ATC but requires results from the previous three steps. Pre-application meeting is highly-recommended.

Picture Rocks

Marana
5,318 people
Groundwater
PFOA + PFOS ~ 80 ppt
1,4 D
Treatment: UV/AOP > **GAC**
2 x lead/lag vessels
2 MGD
Since 2021

Valley Utilities

Glendale
5,263 people
Groundwater
PFOA + PFOS ~ 200 ppt
As
Treatment: **IX** > E33
3 x lead/lag vessels
1.2 MGD
Since 2021

Central Tucson

Tucson
Remediation project
Groundwater
PFOA + PFOS ~ 2,500 ppt
NA
Treatment: **IX**
1 x lead/lag vessels
0.3 MGD
Since 2021 (December)



Desanders:

| Percent solids removal (by weight) | | |
|------------------------------------|---|------|
| Greater than 50 mesh | % | 100 |
| Between 50 and 100 mesh | % | 99.9 |
| Between 100 and 200 mesh | % | 84 |
| Less than 200 mesh | % | 10 |



Bag filter:
Pore size adjusted
during operation
(25 > 35 > 50 um)



GAC:
Backwashed 1 time
(after 2 years of operation)



Desanders



Bag filters:
Pore size 10 um



IX:
Purolite PFA694EBF (gel resin)
Never backwashed

What is missing?



Piloting checklist:

- **Analyze background WQPs**
 - Identify and quantify competing and fouling analytes, catch variations
- **Do media selection**
 - Narrow testing media based on WQPs, previous testing, supply availability, modeling
- **Add pretreatment to avoid backwashing**
 - Typical is green sand and 10 um bag filters
- **Keep hydraulics similar to full-scale**
 - EBCT and HLR
- **Calculate pilot duration**
 - Based on WQPs, vendors' model estimates
- **Install sampling ports**
 - 25% increments to allow extrapolation
 - Add perforated plates to preserve media separation
- **Prepare monitoring plan (PFAS & background WQPs)**
 - Usually biweekly at 25% EBCT (based on model)
 - Align with budget

Lessons Learned - PFAS Modeling

Are PFAS models available?

- Free of charge models are available

EPA or manufacturers

What is purpose?

- Optimize & predict

Operational param., media selection, media replacement intervals, cost

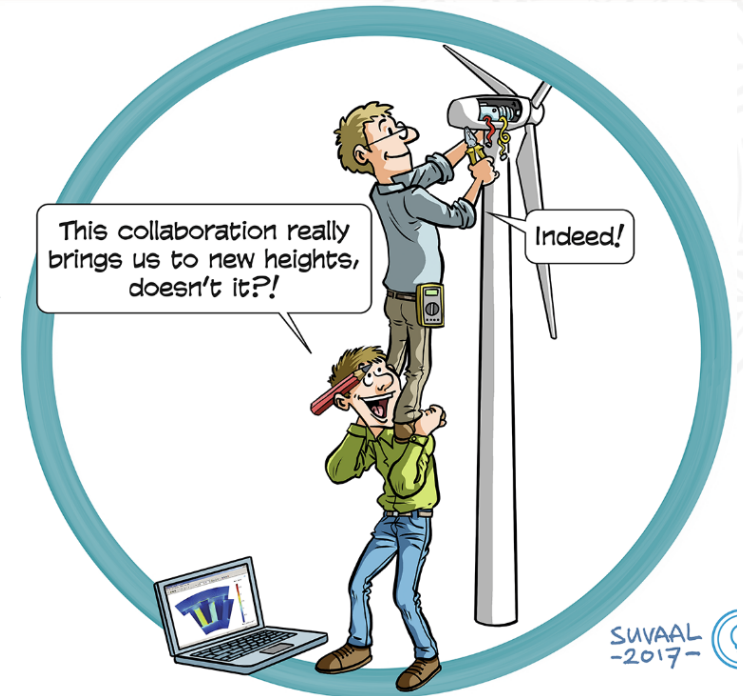
When to use?

- Preliminary design stage
- Testing protocols
- Scale up (*pilot to full*)
- Optimization at full scale (*operation, media*)

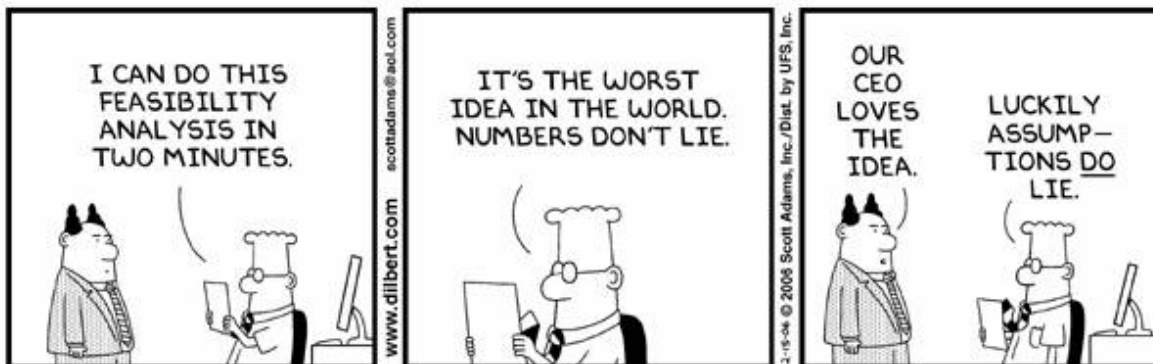
Can modeling replace testing?

- Modeling does not replace testing

Rather, it supplements testing



COLLABORATION



INTERPRETATION

What is accuracy of model estimates?

- Depends on model input parameters/calibration

Literature parameters > Isotherms > RSSCTs > Pilot > Full

Trainings

November 2023

- PFAS Treatment: Permitting Considerations

<https://www.youtube.com/watch?v=mulSbm1voCQ>

- PFAS Treatment: Operation Considerations


<https://www.youtube.com/watch?v=O-whbXveCiA>

Guidance Documents

- Technology decision trees (non-/treatment selection)
- Testing protocols (isotherms, RSSCTs, pilot, modeling)
- Cost models
- Residual management options

Review

- Testing plan
- Connection with EPA and participation in testing project
- Pre-application documents

- 
1. PFAS treatment is **complex** (this is not a traditional contaminant)
 2. **Plug and play** solutions are not available
 3. Understanding your **WQPs** is a must but data may be perishable (time sensitive)
 4. Media **backwashing** must be avoided
 5. Protect media by adding **pretreatment**
 6. Do pilot **testing** even if you do not have time for full breakthrough
 7. Do **modeling** instead of guessing and waiting to see what will happen
 8. Work with **ADEQ** from the very beginning (do not wait for the ATC stage)

Questions?

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Supporting Information

1. Sampling and Analysis of WQPs

Define:

- What to test?
- Where to test?
- How many tests?

Determine:

- a) PFAS
- b) Competing and fouling background water quality parameters
- c) Other potential water quality-related interferences
- d) Variability

ADEQ Recommended Screening List

- ✓ **PFAS speciation:** 29 compounds from the UCMR5 list
- ✓ **Cations:** Calcium, Magnesium, Sodium, Potassium, Iron, Manganese, Total Hardness
- ✓ **Anions:** Sulfate, Nitrate, Arsenic, Fluoride, Perchlorate, Bicarbonate, Uranium, Chloride
- ✓ **Other:** TOC, DOC, Silica, TDS, pH, Temperature, Alkalinity, Suspended Solids, Oil and Grease, Chlorine Residual, Bacteriological Quality (Total Coliform)

2. Preliminary Design

Define:

- Treatment goals
- Existing conditions
- Methodology for cost analysis

Determine:

Cost – benefits based on:

- a) Retrofitting need/potential
- b) TMF capacity
- c) Technology capital cost
- d) O&M requirements
- e) Residual management
- f) Implications

Define:

- Testing goals
- Budget available
- Time available
- Type of test(s)
 - Piloting
 - Rapid small-scale column tests (RSSCTs)
 - Isotherms
 - Modeling

Determine:

- Media lifetime
- Optimal operation
- Scale-up
- Cost



Submit:

- Application
- Design Report
 - Media lifetime as a result of testing is required
 - Waste management solution may require obtaining permits from other ADEQ departments
 - Cost estimates (capital and O&M)
- Construction Plans
- Start-up Plan
- Process Monitoring Plan
- *O&M Manual

Give Information about:

- Final (100%) design. All information provided so that:
 - Construction can start
 - Testing results after construction can be collected in line with approved start-up and process monitoring plans
 - *O&M is approved and in place from start-up

Start-up plan must be approved with the ATC

Checklist #5

The start-up plan shall provide answers on how/who to:

- ✓ Keep **equipment clean** and taped up
- ✓ Keep **media containers sealed** and in a cool dry place
- ✓ Do equipment and piping **disinfection** per AWWA C653-20 standard
- ✓ Rinse and **remove all chlorine** residual from equipment and piping
- ✓ Confirm **total coliform** negative samples
- ✓ Fill GAC/IX beds by a qualified professional to **minimize air bubbles** and trapped air
- ✓ Address **pre-rinsing requirements**; GAC/IX may be pre-rinsed off-site or rinsed on-site with non-chlorinated water
- ✓ Collect initial **bacteriological and water quality samples** to confirm that treatment objectives are met



Submit:

- Application
- As-builts
- Tests

Provide Information about:

- Design after construction (justified changes)
- Chlorination, bacti, pressure results
- PFAS in treated water
- Other results (As if GAC, VOC if IX)