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RECLAMATION

# WQIC: Arizona's One-Stop-Shop for Desal Research

Presented by: Luis Cruzado, Chemical Engineer



# Introduction

- Luis Cruzado – Chemical Engineer at the Bureau of Reclamation's Yuma Desalting Plant

# Geographic Overview



# Yuma Desalting Plant







# Yuma Desalting Plant - Process

**MODE Intake**

Chlorination

Grit Removal

Solids Contact Reactor

Media Filtration

Chloramination

Reverse Osmosis

Colorado River





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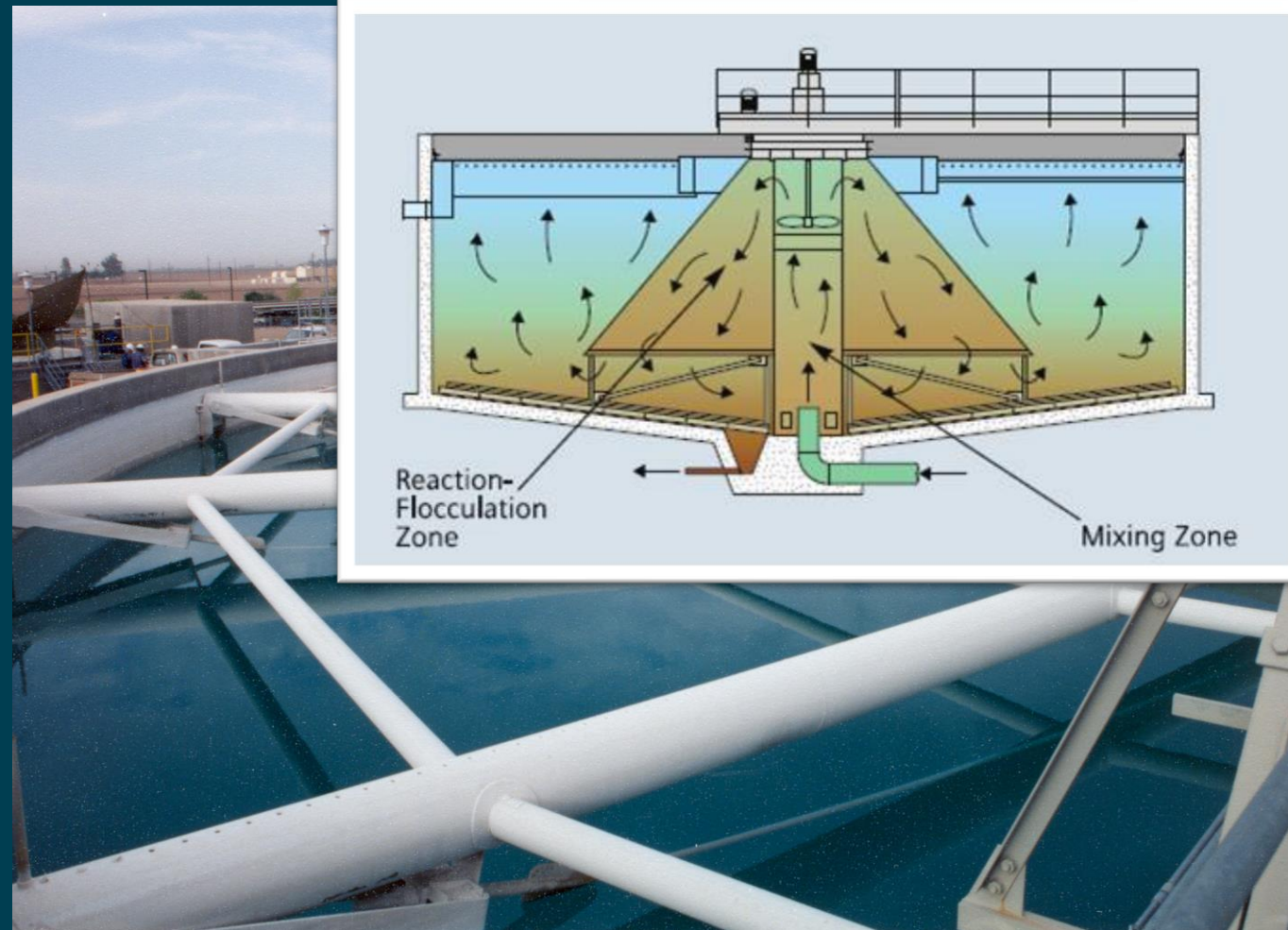
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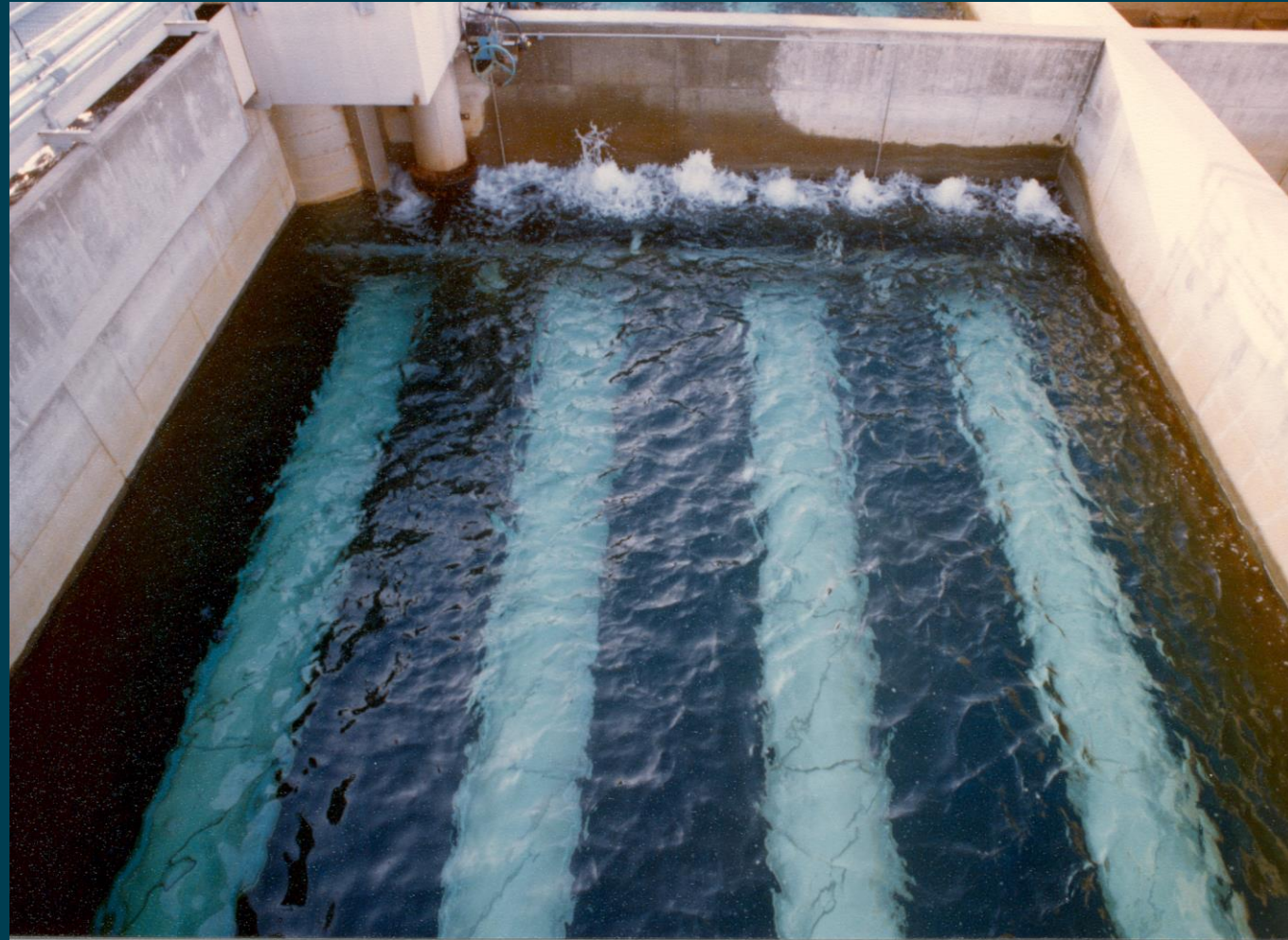
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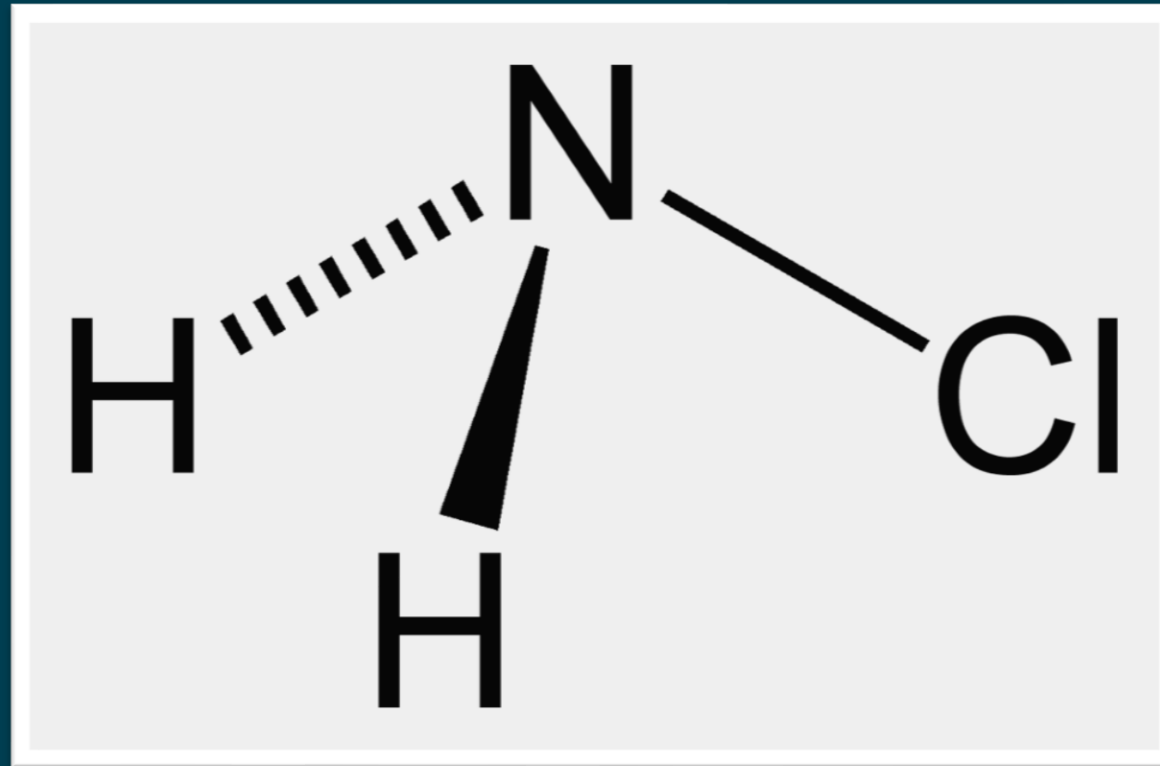
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# Water Quality Improvement Center



- Staffed 24/7/365 for monitoring, data and sampling collection
- Electricians, mechanics, and instrumentation technicians on-site
- On-site environmental lab licensed by AZ
- Office facilities for researchers
- Discharge and waste permits





# WQIC Feedwaters



## MODE

TDS	2,300 ppm
pH	5.7
Ca	80 ppm
Mg	53 ppm
SO <sub>4</sub>	800 ppm
SiO <sub>2</sub>	11 ppm
Fe	0.03 ppm
NO <sub>3</sub>	4.2 ppm

## Brackish Well

TDS	1,000 ppm
pH	7.8
Ca	134 ppm
Mg	36 ppm
SO <sub>4</sub>	290 ppm
SiO <sub>2</sub>	21 ppm
Fe	0.05 ppm
NO <sub>3</sub>	0.6 ppm

## Colorado River

TDS	780 ppm
pH	8.3
Ca	82 ppm
Mg	27 ppm
SO <sub>4</sub>	312 ppm
SiO <sub>2</sub>	12 ppm
Fe	0.01 ppm
NO <sub>3</sub>	0.4 ppm

## RO Permeate

TDS	50 ppm
pH	6.0
Ca	0.2 ppm
Mg	0.1 ppm
SO <sub>4</sub>	<0.1 ppm
SiO <sub>2</sub>	0.6 ppm
Fe	<0.01 ppm
NO <sub>3</sub>	<0.1 ppm

- Plus custom feedwater formulations



# WQIC Pilot Systems

- PS1 – 1 MGD
  - Solids Contact Reactor
    - Coagulation, flocculation, sedimentation and lime softening in one unit
  - Gravity Dual Media Filter
    - Anthracite coal and sand
  - RO
    - Two independent RO skids
    - Up to 400 psi feed pressure







# WQIC Pilot Systems

- PS2 & PS3 – 100,000 gal/day
  - 1/10<sup>th</sup> the scale of PS1
  - Can be operated independently or to feed MU's 1 through 4



# Research Equipment



- Membrane Research Units (MU) 1-4
  - 2-1 array
  - 2.5-in PVs
  - 12 gpm
  - 500 psi max feed pressure





# Research Equipment



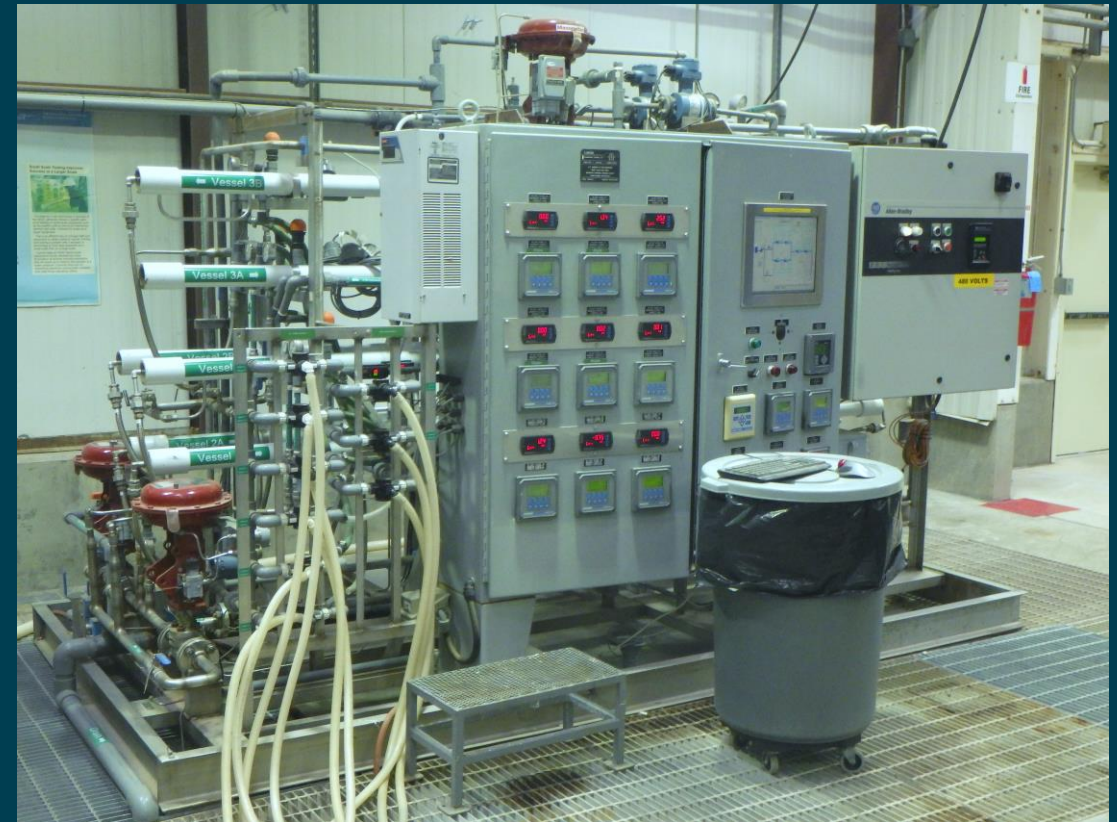
- MU5
  - 4-2-1 array
  - 4-in and 2.5-in PVs
  - 20 gpm max permeate flow
  - Up to 450 psi feed press.
  - Skid mounted



# Research Equipment



- MU6
  - 2-1 array
  - 2.5-in PVs
  - 12 gpm max permeate flow
  - Up to 500 psi feed pressure
  - Skid mounted





# Research Equipment



- Swatch Testing Unit
  - 9 cross-flow or dead-end test cells
  - 3.5-in by 1.5-in swatches
  - Recirculate or once through operation
  - Up to 600 psi feed pressure
  - Wheeled skid
  - Up to 3 chemical injection pumps







# Research Equipment

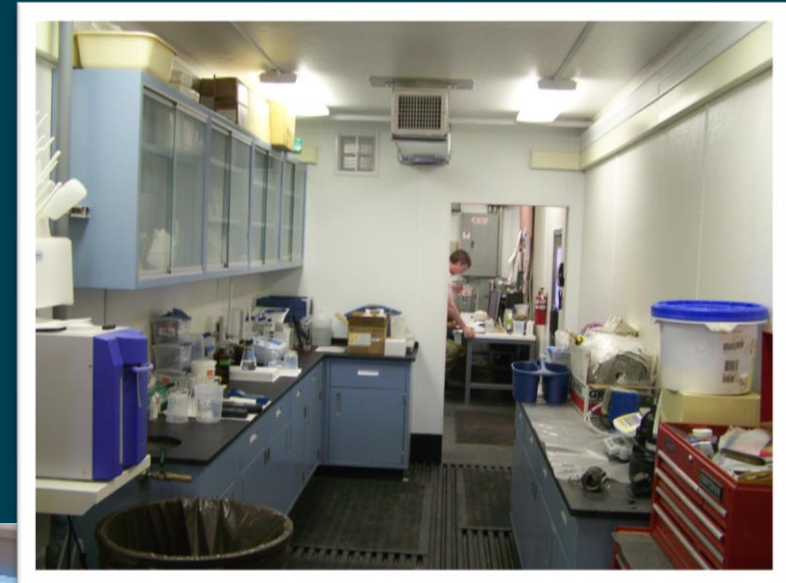
- Element Testing Apparatus (ETA)
  - Two 2.5"x40" 2-element PVs
  - For testing spiral wound elements
  - Up to 400 psi feed pressure
  - Skid mounted



# Research Equipment



- Mobile Research Facility (MRF)
  - 40-ft trailer
  - Connections and transformers for 480V, 240V, and 120V power
  - Lab and office space
  - Air conditioned





# Research Equipment

- Clean-in-place skid
- Tanks from 3,000 gal to 5 gal
- Chemical dosing skids
- Cartridge and media filters
- Pumps
- Skid mounted clarifiers
- And more





# Research Agreements

- **Facilities Use Agreement**
  - Use Reclamation equipment and facilities within the WQIC/YDP
  - Use partner equipment at the WQIC
- **Material Transfer Agreement**
  - Lend equipment for off-site use
  - Reclamation test or validates
- **Cooperative Research and Development Agreement (CRADA)**
  - Extremely flexible agreement
  - Must be used when new IP is expected to be generated



# Examples

- CalPoly – Pomona: CEC in Potable Reuse Concentrate
  - Materials Transfer Agreement (in-kind services)
    - MU5, MRF, and RO cleaning skid
  - Technical support
    - Provided on-site training and assistance setting up
    - Ongoing technical and troubleshooting support



# Examples

- Harvard U: GO membranes on a hierarchical elemental carbon-based support
  - Materials Transfer Agreement (in-kind services)
    - Swatch Testing Unit
  - Technical support
    - Provided on-site training and assistance setting up
    - Ongoing technical and troubleshooting support





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**Contact:**

**Luis Cruzado**

**LCruzado@USBR.gov**

**928-343-8224**