



Produced Water Fit-for Purpose Reuse Research Risk and Toxicology Research Efforts

San Juan Community College

College of Energy

November 3, 2021;

NMSU

Carlsbad Campus

November 9, 2021



**NM Produced Water
Research Consortium**



BE BOLD. Shape the Future.

Risk and Toxicology Workshop Session Presenters

- **Rose Galbraith, MPH**
Environmental Health
Epidemiologist, NM Department
of Health
- **Stephen Hightower, MD FACP**
(Int Med/Ger) former teaching
faculty at UNMH and TAMUH



Overview of Risk and Toxicology Research Session

- 1. Purpose**
- 2. Goals**
- 3. Collaborations and Directions**
- 4. Current and Emerging Research Efforts**
- 5. Questions and Discussions**

Background: NM 2019 Produced Water Act

- The Act encourages the fit-for-purpose treatment and reuse of produced water outside the oil and gas sector to:
 - Enhance fresh-water sustainability;
 - reduce or eliminate fresh water use in the oil and gas sector; and
 - support new economic development opportunities.
- **At the same time maintain public and environmental health and safety**



Purpose: potential uses of treated produced water

Water may be treated to fit-for-purpose specifications for possible uses including:

- Road construction;
- Rangeland rehabilitation;
- Agriculture;
- Industrial applications;
- Municipal landscaping (parks, golf courses);
- Mining;
- Surface water augmentation



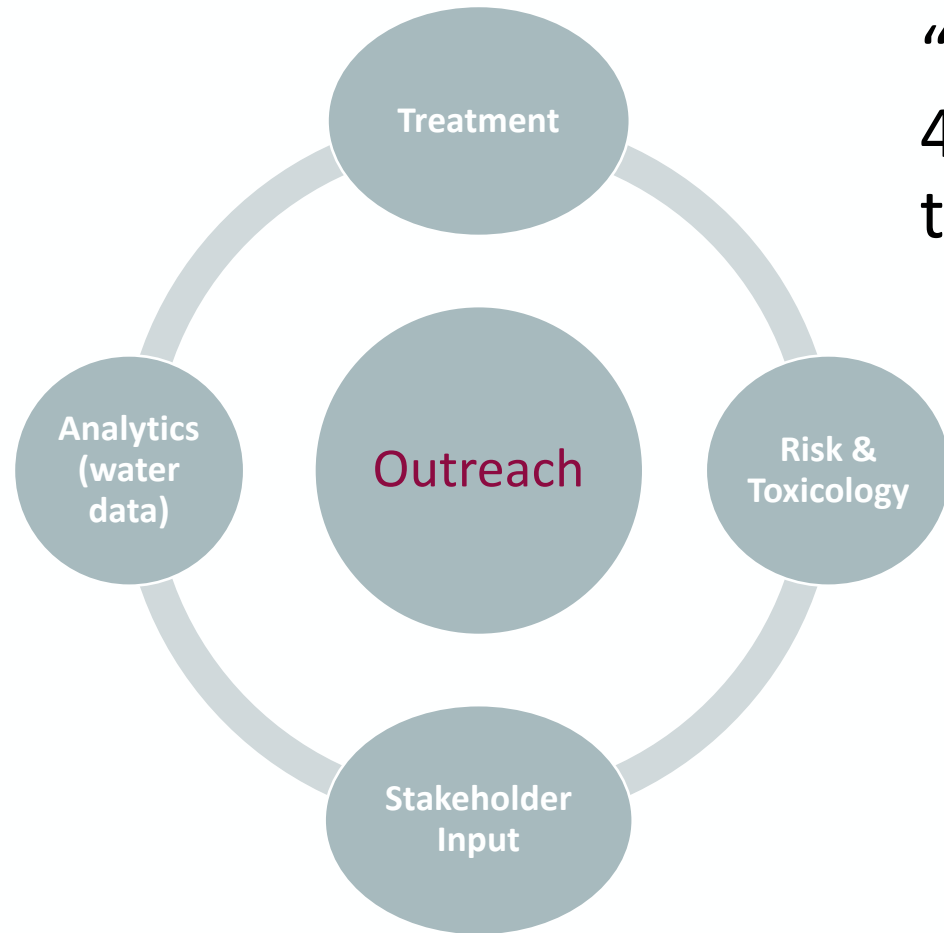
Risk and Toxicology Committee Goals

Work with the Consortium to:

- Determine what's in the raw and treated water
- Assess treatment options
- Use best available toxicological methods to assess human and environmental health risks
- Share information
- Engage stakeholders (you!) throughout the process.



Public Education and Outreach is Important for the Success of Produced Water Reuse

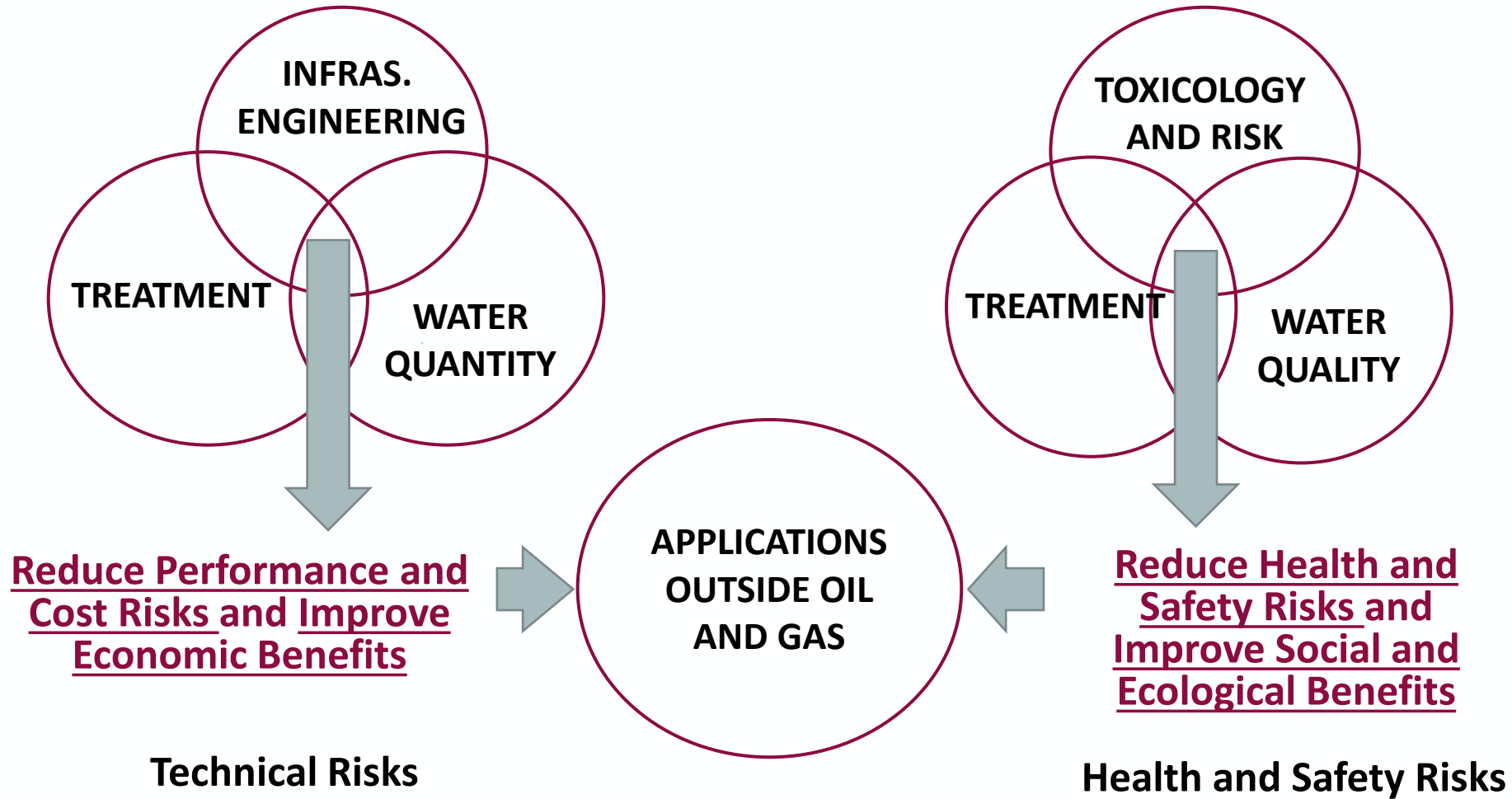


“... we have been using treated waste-water for 40 years, we are not afraid of it, what we want to do is protect our fresh-water resources...”

**NMPWRC, NM Elected Officials Forums,
July-August, 2021**

NM produced water treatment and reuse could approach \$1 Billion per year in economic development in oil and gas producing counties

Consortium Operation - Working Groups and Task Committees



Risk & Toxicology Committee Approach

Risk and Toxicology Analysis of Treated Produced Water

Following four specific methods:

1. Complete Chemical analysis of Produced and Treated Produced Water on a recurrent basis
2. Whole Effluent Toxicity Testing
3. Human Cell Line Testing
4. Greenhouse Evaluation for Soil and Plant Toxicity with Treated Produced Water

1. Spectroscopy for Chemical Identification:



- Chemicals are identified by their specific chemical composition and structure.
- Different technologies may be used to identify different types of chemicals in produced water.
 - ICP-OES: Inductively Coupled Plasma-optical emission Spectrometry
 - ICP-MS: Inductively Coupled plasma-mass Spectrometry
 - GC-MS: Gas Chromatography-Mass Spectrometry
 - LC-MS: Liquid Chromatography-Mass Spectrometry
 - SSEM/EDX: Scanning Electron Microscopy/Energy Dispersive X-ray

Citation: Journal: WATER, 2021,13,183: A Critical Review of Analytical Methods for the Comprehensive Characterization of Produced Water.

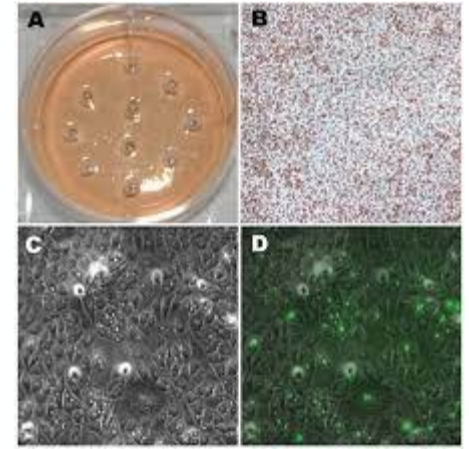
2. Whole Effluent Toxicity Testing

- WET tests measure effluent effects on specific test organisms' ability to survive, grow and reproduce
- Zebra Fish
 - Strong human genetic similarities
 - Highly sensitive to toxins occurring in their environmental waters.
 - Excellent for rapid drug/chemical toxicity testing
 - Allow for analysis of toxins typically more significant to aquaculture plants and animals



3. Human Cell Line Testing

- EPA will assess the toxicity of Produced and Treated Produced Water on Human Cells.
 - female breast cancer cells due to their high endocrine sensitivity.
 - human liver cells due to their function of toxin removal.
 - In both cell lines all genes will be evaluated for any alterations or disturbances.



4. Greenhouse Evaluation for Soil and Plant Toxicity with Treated Produced Water

- Greenhouses at NMSU, Texas Tech, and Texas A&M, agricultural extension services locations will be used.
- Alfalfa, Chile, Cotton or other crops will be studied.
- Analysis for any toxins in roots, stems, leaves, fruit, or soils will be obtained over multiple years to assess for acute toxicity or bioaccumulation over time.
- Evaluation for emerging contaminants.



Review: Consortium Risk and Toxicology Analysis Approach

- Complete chemical analysis of produced water and treated produced water on a recurring basis. (NMSU/EPA)
- Evaluation of Treated Produced Water by:
 - Recurring Whole Effluent Toxicity Testing: (NMSU/EPA)
 - Human Cell Line Testing: (EPA)
 - Soil and Plant toxicology testing on Greenhouse plants from NMSU and Texas A&M using treated produced water (NMSU/EPA)
- Identify an appropriate fit-for-purpose use of the treated produced water based on the chemical composition of the water.
- Continuous monitoring for evidence of soil, plant, or aquatic toxicities over time.

Questions? Where to get more info

Access our resources and learn more at:

<https://nmpwrc.nmsu.edu/> (or search NMPWRC)

Email: NMPWRC@nmsu.edu

Want more info about produced water topics? Search – EPA WRAP, or GWPC

We want your feedback!

Please compete and return the session questionnaire