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Produced Water in New Mexico: A Critical Review of Recent Toxicity and Risk Assessment Literature

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Introduction

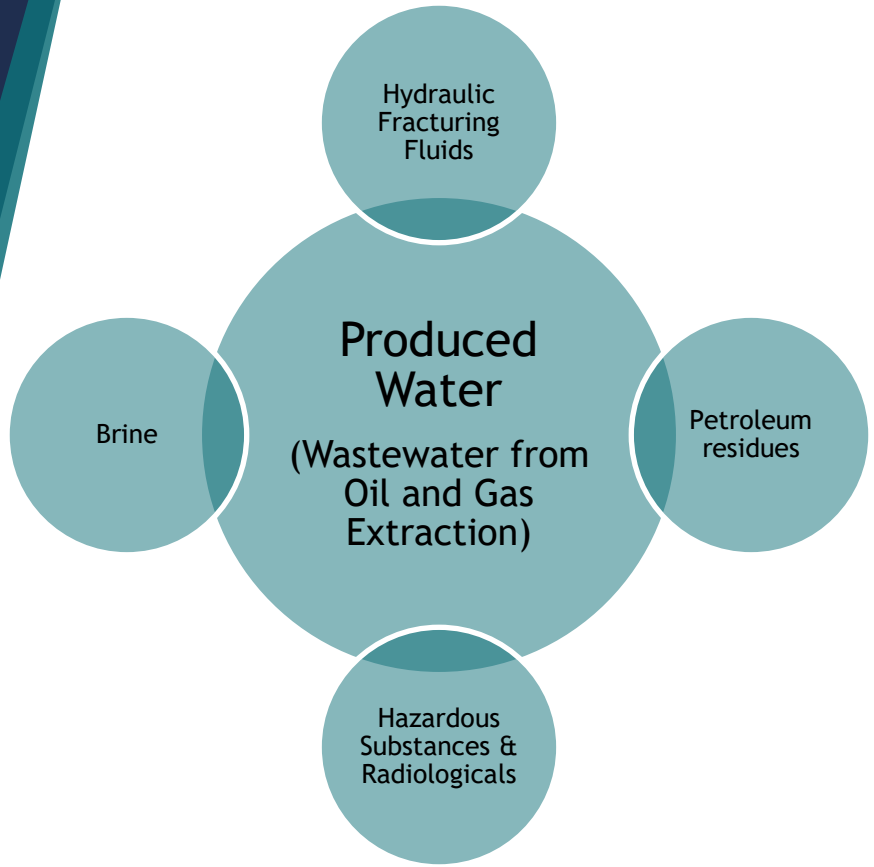
- Dr. Christopher “Topher” Lewis
- BA, Biology, Middlebury College; ScD, Environmental Health, Harvard University
- 20 years experience in human health and ecological risk assessment and environmental damages at IEc
- Previous work in NM:
  - Lead Environmental Scientist on Los Alamos National Laboratory Natural Resource Damage Assessment since 2015
  - Assisted ONRT in assessing impacts from the Gold King Mine Spill
  - Testified before the NM WQCC on the human health and ecological risks associated with discharge of produced water to surface and groundwater

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- Authors: Dr Christopher Lewis and Dr. Ann Jones
- Commissioned by Amigos Bravos
- Link: https://bit.ly/4Aa3qor

What is Produced Water?



Reuse within the oil and gas field

Disposal in State
- Deep underground injection

Export for disposal
- Deep underground injection

- Contains **known** (identified) and **unknown** constituents, including proprietary chemical formulations
- Constituent concentrations are **highly variable**, though are typically concentrated through reuse within the oil and gas field

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The White Paper, in Brief:

Request	Review recent toxicological and risk research WATR cites to demonstrate potential for safe environmental discharge of treated produced water
Key Finding	While recent papers advance our understanding of treatment train efficacy and residual constituents and their toxicity, significant information gaps remain, which would need to be filled to ensure safe discharge
Conclusion	Maintaining the current regulatory *status quo* will allow for continued produced water research and pilot projects while protecting public and environmental health through discharge prohibition

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Key Recent Papers

Tarazona et al. 2024

- Benchmarking produced water treatment strategies for non-toxic effluents: Integrating thermal distillation with granular activated carbon and zeolite post-treatment

Wijekoon et al. 2025

- Comprehensive cytotoxicity assessment of treated produced water from thermal distillation using human cell lines

Senanayake et al. 2025

- Plant growth, ion dynamics, and microbial communities in soils irrigated with treated produced water for sustainable agriculture

Tarazona et al. 2026

- Advancing produced water quality via integrated mechanical vapor recompression: Chemical and toxicological characterization, hazard identification and mitigation

Edirisooriya et al. 2026

- Pilot-scale evaluation of hypersaline produced water treatment and reuse via freeze desalination and seawater reverse osmosis: Organic removal, aquatic and human cell line toxicity studies

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Review Process

Knowledge Gap			Gap Addressed?				
			Tarazona et al. 2024	Wijekoon et al. 2025	Senanayake et al. 2025	Tarazona et al. 2026	Edirisooriya et al. 2026
Toxicity to:	Known contaminants		Partially	Partially	Partially	Partially	Partially
	Unknown contaminants		Partially	Partially	Partially	Partially	Partially
	Aquatic environments/ species		Partially	No	No	Partially	Partially
	Terrestrial environments/ species		No	No	Partially	No	No
	Mammals		No	Partially	No	No	Partially
	Humans		No	Partially	No	No	Partially
Additional Relevant Topics:	Bioaccumulation / long-term effects		No	No	No	Partially	Partially
	Spatial/temporal variability of constituents		No	No	No	No	Partially
	Environmental fate and transport		No	No	No	No	No

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Key Contributions to State of Science

- ✓ Bench/pilot scale treatment train efficacy, need for “post-treatment”
- ✓ Use of whole effluent toxicity (WET) tests
- ✓ Acute and chronic toxicity using standard aquatic test organisms
- ✓ Testing on human cell lines
- ✓ Plant and soil health

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Key Shortcomings

- ☒ Authors acknowledge significant information gaps persist: residuals, additional test species, duration, etc.
- ☒ Key overarching topics mostly unaddressed: bioaccumulation, accumulation in the environment, variability of constituents, fate and transport
- ☒ All testing done at bench/pilot scale
- ☒ One paper on each topic does not constitute a sufficient body of scientific information to ensure treated produced water can be safety discharged to the environment

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Conclusions

- Recent NMPWRC literature has incrementally advanced our understanding of treatment technologies, residuals, and toxicity
- Significant information gaps remain
- Maintaining the *status quo* allows for remaining gaps to be addressed prior to environmental releases

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