

I would like to thank members of the House Environmental Resources and Energy Committee for the invitation to present at the June 10, 2024, hearing on oil and gas well brine spreading on gravel roads in Pennsylvania. I am an Assistant Teaching Professor and the Assistant Director of the Center for Dirt and Gravel Road Studies (Center) at The Penn State University, where I have worked since 2014. I earned my BS in Geology from Guilford College and a MS in Watershed Hydrology from Colorado State University. I have held a Professional Geologist license in the Commonwealth since 2013. Prior to joining the Center I worked for a decade in the public and private sectors as a Geologist and Hydrologist. In my current position I coordinate Center research and provide education, outreach and technical assistance to conservation districts. In addition, I teach a 3-credit 400-level class at Penn State entitled Rural Road Ecology and Maintenance. I am a member of the Transportation Research Board standing committee on Low-Volume Roads and a member of the National Association of County Engineers subcommittee on unpaved roads. I have also served on the Chesapeake Bay Roadside Ditch Management Team as a technical advisor.

In my position at the Center, I coordinate all aspects of research to support Pennsylvania's \$35-million Dirt, Gravel and Low-Volume Road Maintenance Program (Program). The Program's goal is to implement Environmentally Sensitive Maintenance Practices aimed at reducing the environmental impacts of public roads while reducing long-term maintenance costs. The Program allocates funding to conservation districts and then municipalities apply to their local conservation district for road maintenance grants. To date over 1,000 municipalities across the Commonwealth have completed a project through the Program. My research in support of the Program focuses on road surface aggregate selection, road maintenance and dust/sediment production from unpaved roads in collaboration with agencies such as the US Forest Service, US Fish and Wildlife Service, Susquehanna River Basin Commission and Trout Unlimited.

In recent years I have collaborated with the Department of Civil and Environmental Engineering at Penn State on research evaluating the environmental impacts of oil & gas produced water disposal practices, including brine spreading in Pennsylvania. I have been a co-author and advisor on several papers that have been published in well regarded peer-reviewed scientific journals. This research has been in collaboration with Dr. Burgos who you will hear from today.

As assistant director of the Center, I coordinate the product approval process for the Program, which is responsible for reviewing and approving products such as soil stabilizers and dust suppressants for Program funding eligibility. The Program's product approval

process started more than 20 years ago with the goal of testing products used on roads in a rigorous manner which can support a conclusion that use of the product is reasonably certain to cause no harm to the environment. This goal aligns with Section 9106 of the motor vehicle code that established the Dirt, Gravel and Low-Volume Road Maintenance Program which states that counties must adopt “standards that prohibit use of materials or practices which are environmentally harmful”

At this point I will discuss in more detail two items at the foundation of the Program with respect to the use of Oil and Gas Produced Water (O&G PW) as a dust suppressant, effectiveness and environmental impact. As a Program funded by taxpayer dollars and centered on environmental benefits, it is imperative to make sure that O&G PWs work for their intended purpose and do not cause environmental harm.

One goal of the research that I have been involved with is to evaluate effectiveness of O&G PWs as a dust suppressant for rural communities. On the topic of effectiveness, our research has shown through bench scale testing that O&G PWs do not perform as well as commercially available dust suppressants due to the high sodium content. The high sodium content decreases the dust suppression effectiveness compared to commercial calcium based brines and can also destabilize the road. (Stallworth et al., 2020, Laboratory Method to Assess Efficacy of Dust Suppressants for Dirt and Gravel Roads, *Transportation Research Record*. 2020, 267, 188-199; included as Appendix 1). Our research also studied whether O&G PWs meet the United States Environmental Protection Agency (USEPA) criteria for beneficial reuse of industrial waste. The most recent study using bench testing and a model roadbed (Farnan et al., 2024, Oil and gas produced waters fail to meet beneficial reuse recommendations for use as dust suppressants, *Science of the Total Environment*. 2024, 919, 170807; included as Appendix 2) showed that the O&G PWs did not perform significantly better than rainwater in suppressing dust and did not significantly reduce sediment runoff compared to rainwater. In contrast, commercial calcium based brines and other commercially available dust suppressants did reduce dust generation and sediment runoff.

O&G PWs raise potential environmental concerns due to the chemicals found in the waters. One study on the chemical composition of conventional O&G PWs spread on roads in Pennsylvania published in 2018 found elevated concentrations of total dissolved solids (TDS), chloride, bromide, radium, barium, and in some cases, petroleum hydrocarbons, (Tasker et al., 2018, Environmental and Human Health Impacts of Spreading Oil and Gas Wastewater on Roads, *Environmental Science & Technology*. 2018, 52, 7081–7091; included as Appendix 3).

This study showed that the median chloride concentration was 183,000 mg/L, as compared to the drinking water standard for chloride of 250 mg/L, which is used in the Program's Product approval process testing requirements as a maximum concentration limit (for reference chloride in seawater is around 20,000 mg/L). This Program's product approval limit of 250 mg/L chloride has been in place for over 20 years and no chloride-based dust suppressants have ever been used within the Program because of the difficulty meeting this criteria. Additionally, the Program's Product approval process includes aquatic toxicity testing for rainbow trout and chloride concentrations have been shown by the USEPA to be toxic to trout species at levels 20 times lower than found in O&G PW (USEPA, Ambient Water Quality Criteria for Chloride, EPA 440/5-88-001, February 1988; included as Appendix 4). Finally, five O&G PWs from Pennsylvania contained radium levels from 84 to 2,500 pCi/L, which fall above the Program's product approval process limit of 15 pCi/L. (Farnan et al., 2023, Toxicity and chemical composition of commercial road palliatives versus oil and gas produced waters, *Environmental Pollution*. 2023, 334, 122184) Therefore, O&G PWs would not qualify for use or funding within the program due to failing multiple environmental testing protocols and posing a potential environmental harm which are counter to the Program's goals.

In summary, O&G PWs are not effective at suppressing dust and pose potential environmental harm and due to high levels of chloride and radium would not pass the testing requirements to be eligible for Program funds. Ultimately, the use of O&G PWs on Program funded projects is in opposition with not only the fundamental goals of the Program, but the law that created the Program.