

Evaluating Gas Emissions from Plugged and Abandoned Oil Wells in the San Joaquin Basin



Civil/Environmental Engineering Thesis Defense – Open To All!

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This thesis presents measurements of gas emissions from sixty wells in the San Joaquin Basin, evaluating how emissions are influenced by well integrity, subsurface reservoir characteristics, topsoil properties, chemical properties, and atmospheric soil-gas exchange. Results indicate a highly skewed emission distribution, with two wells contributing fluxes over 400 times greater than the next closest well, highlighting the importance of identifying and prioritizing high-emitting wells in mitigation strategies.

Geotechnical factors including gravimetric water content, clay content, and tortuosity all showed trends consistent with reduced gas transport to the surface, suggesting that compacted, clay-rich soils may provide an additional barrier to emissions. Chemical properties, including molecular weight, boiling point, and water solubility showed correlations with flux magnitude, though trends varied across chemical families.

From an engineering perspective, plug integrity and subsurface thermogenic gas availability are the primary factors governing emissions, with soil properties playing a secondary moderating role. Well plugging to standard did not show a significant reduction in emissions, though low emissions at many wells may reflect reservoir depletion rather than plug failure. Both high emitting wells had no production history, potentially increasing thermogenic gas availability. Future research should work to systematically identify and prioritize remediation of high emitting wells, and understand what subsurface conditions caused this behavior.