The University of Texas at Austin

Cockrell School of Engineering
Hildebrand Department of Petroleum
and Geosystems Engineering

200 E. Dean Keeton St. Stop C0300
Austin, Texas 78712
T: 512.471.3161 F: 512.471.9605

March 19, 2024
Dear Editors of Applied Energy:

We wish to resubmit the article titled "**Optimal monitoring design for uncertainty quantification during geologic CO_2 sequestration: A machine learning approach**" for consideration in *Applied Energy*. We appreciate the feedback from the editor and reviewers and have implemented the revisions to improve our manuscript. We confirm this work is original and has not been published elsewhere, nor is it currently considered for publication elsewhere.

In this paper, we propose a novel workflow for optimal monitoring design in geologic CO_2 sequestration projects. The approach is based on an Artificial Neural Network reduced-order model to estimate the cumulative CO_2 leakage from legacy wells from a set of uncertain geologic parameters. Filter-based history matching is done for pressure, saturation, and/or temperature measurements in the above-zone monitoring interval. The optimal monitoring design is determined as the monitoring location and measurement(s) that minimize the uncertainty in cumulative CO_2 leakage prediction. The workflow is validated with two cases with varying number of potential leakage pathways and the results show an uncertainty reduction in cumulative CO_2 leakage of approximately 73% and 62%, respectively.

We elected *Applied Energy* to publish this manuscript since the work aligns well with the Journal's aim and scope on environmentally sustainable exploration, characterization, and storage of CO_2 to support energy transition and net-zero carbon objective. Our goal is to provide the energy resource industries with general purpose tools to decarbonize the economy and create an environmentally sustainable future.

We have revised our manuscript in accordance with the provided editor and reviewer comments. We have no conflicts of interest to disclose. The article has been checked by a native tongue speaker with expertise in the field. The corresponding author confirms their availability as a reviewer. We appreciate your time and effort in reviewing our work. Please address all correspondence concerning this manuscript to Misael Morales at misaelmorales@utexas.edu. Thank you for your consideration of this manuscript. We look forward to hearing from you.

Sincerely,

Misael M. Morales
Graduate Research Assistant
Hildebrand Department of Petroleum and Geosystems Engineering
The University of Texas at Austin
Email: misaelmorales@utexas.edu