

An Emission Model for Volatile Organic Compounds from Unconventional Oil and Gas Development

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Background

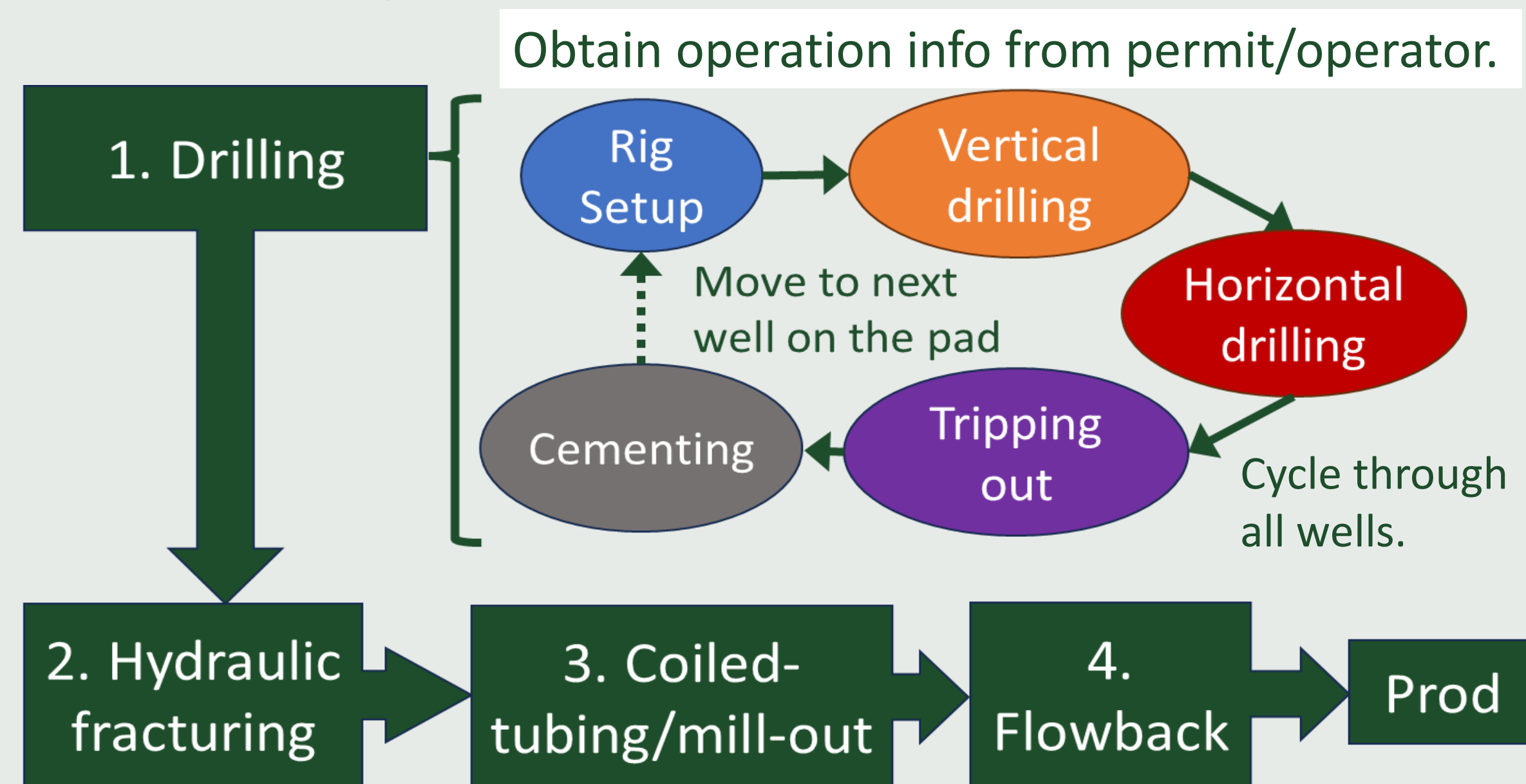
- **Volatile Organic Compounds (VOCs) from Unconventional Oil and Gas Development (UOGD):** Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), and other Nonmethane VOCs (NMVOCs) pose short- and long-term health risks and contribute to O₃ formation^{1,2}
- **Knowledge Gaps/Challenges:** Emissions from pre-production/early production activities are uncertain. Lack a tool that translates emissions into concentrations.

Objectives

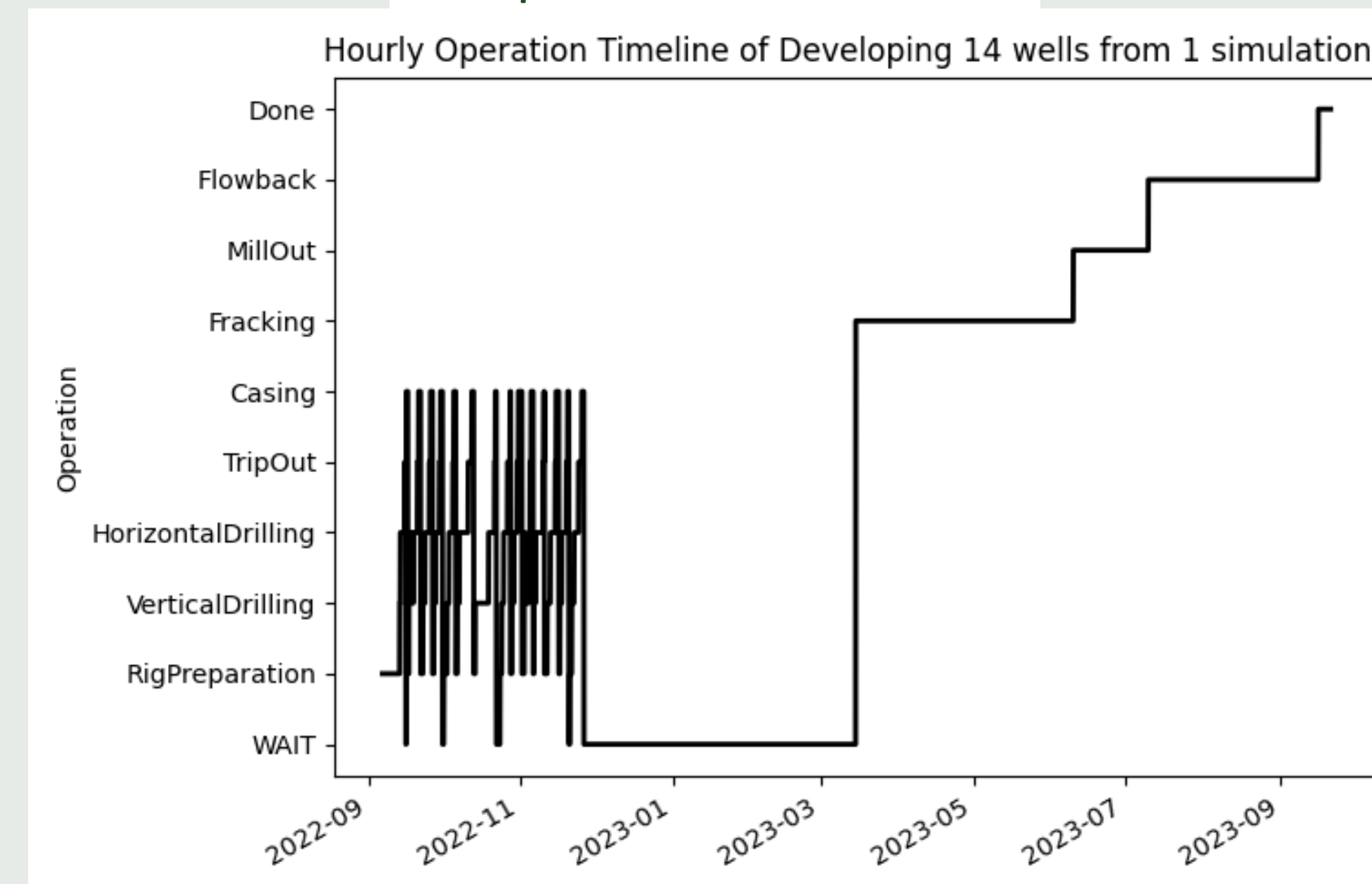
1. **Develop the TRacking Community Exposures and Releases (TRACER) Pre-production Model:** An emission model that incorporates **observation-based emission rates**.
2. **Create a user-friendly Interface:** Combine the emission model with atmospheric dispersion simulations for effective communication. Facilitate analysis of benefits from implementing best management practices.
3. **Evaluate model performance** – compare predictions to field observations.

Model Framework

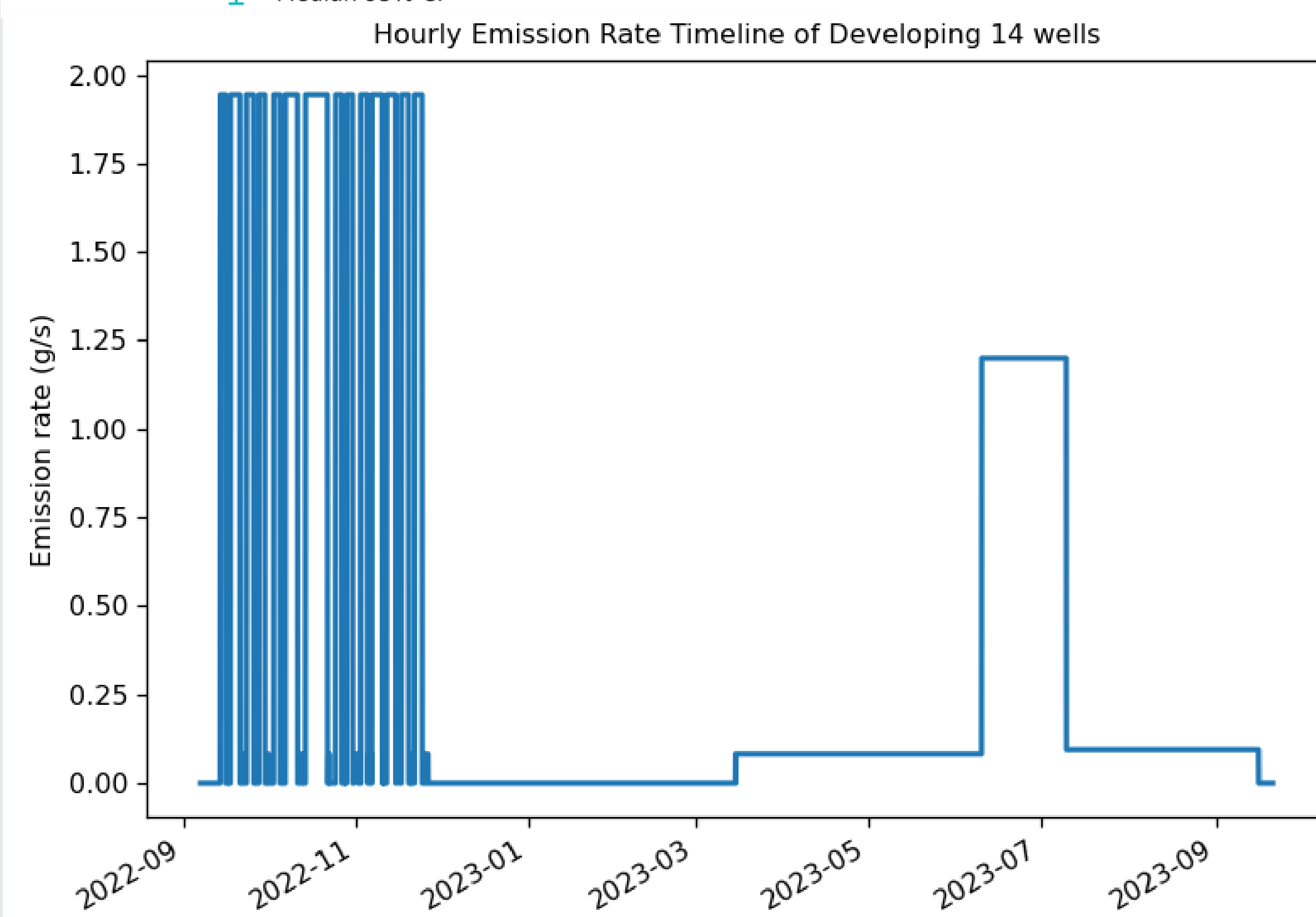
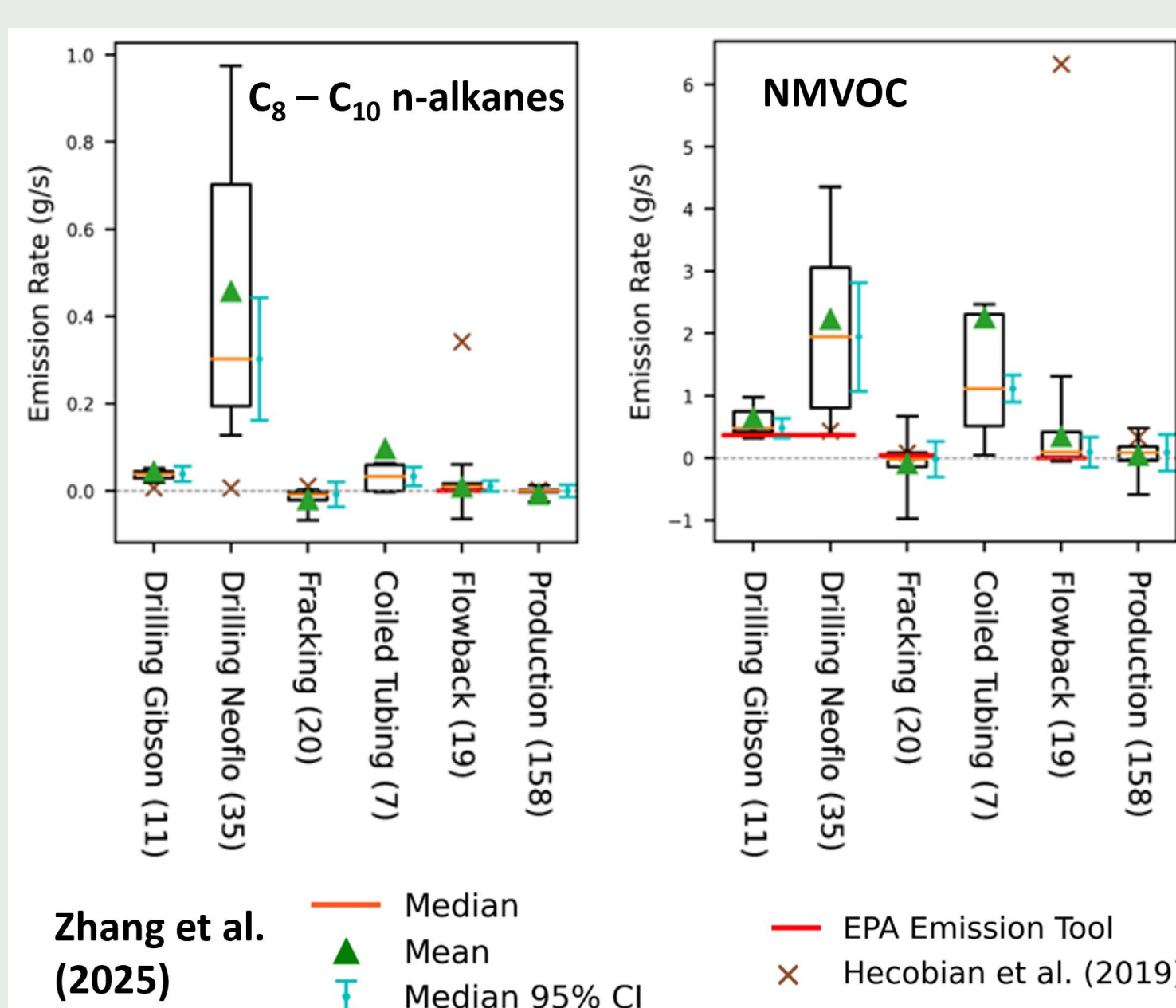
1. Generate operation timeline



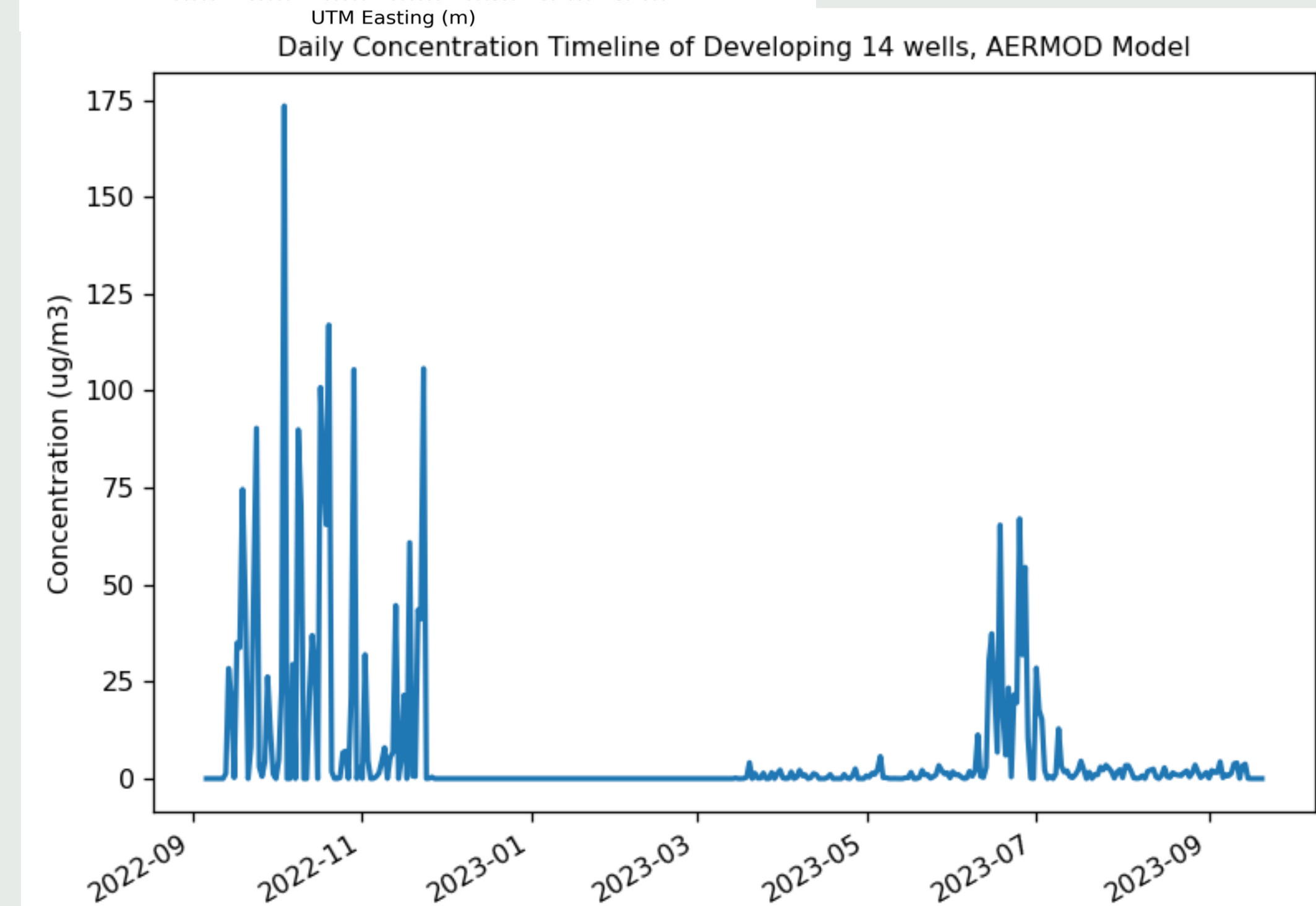
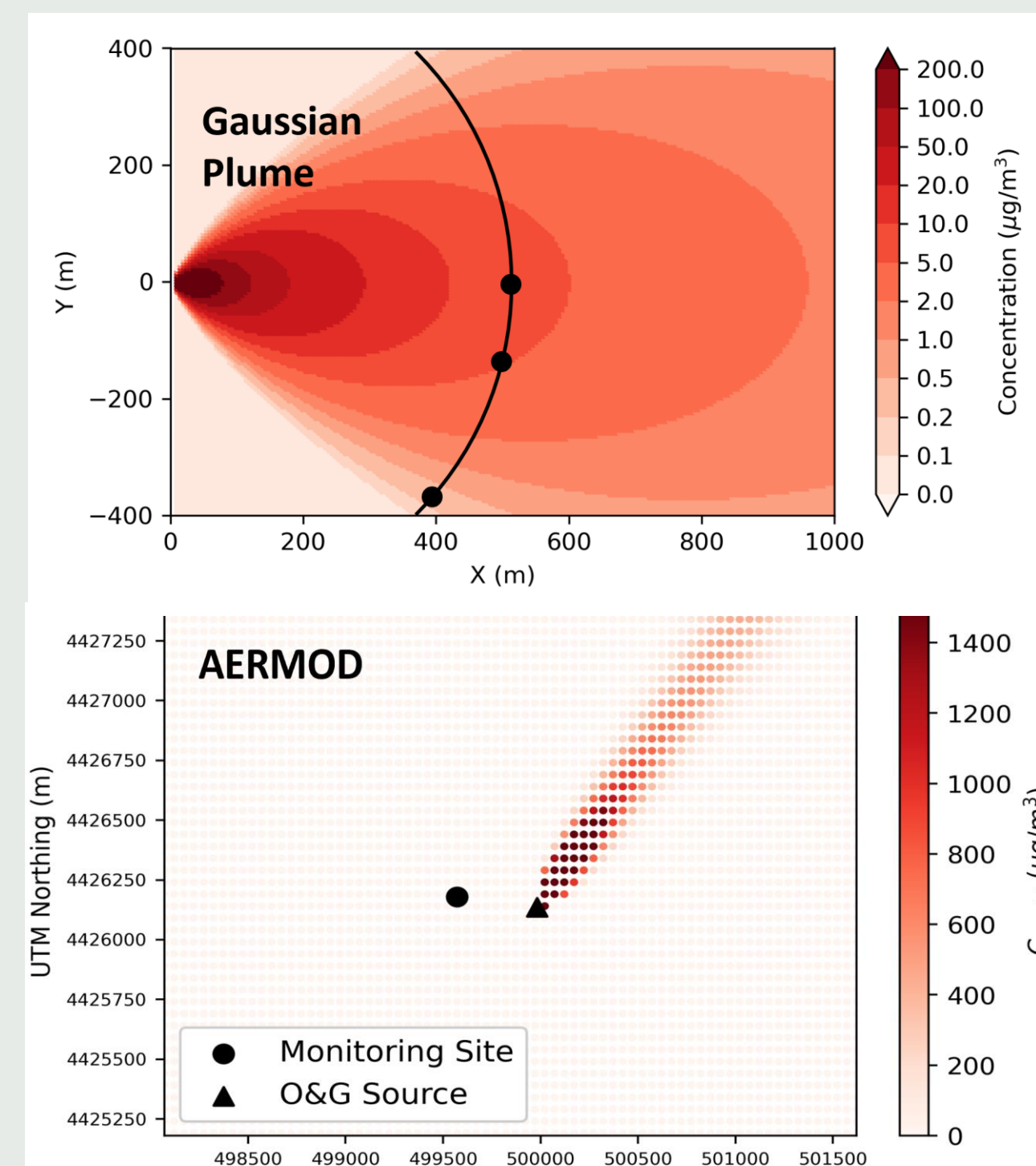
Operation timeline.



2. Obtain emission rate timeline



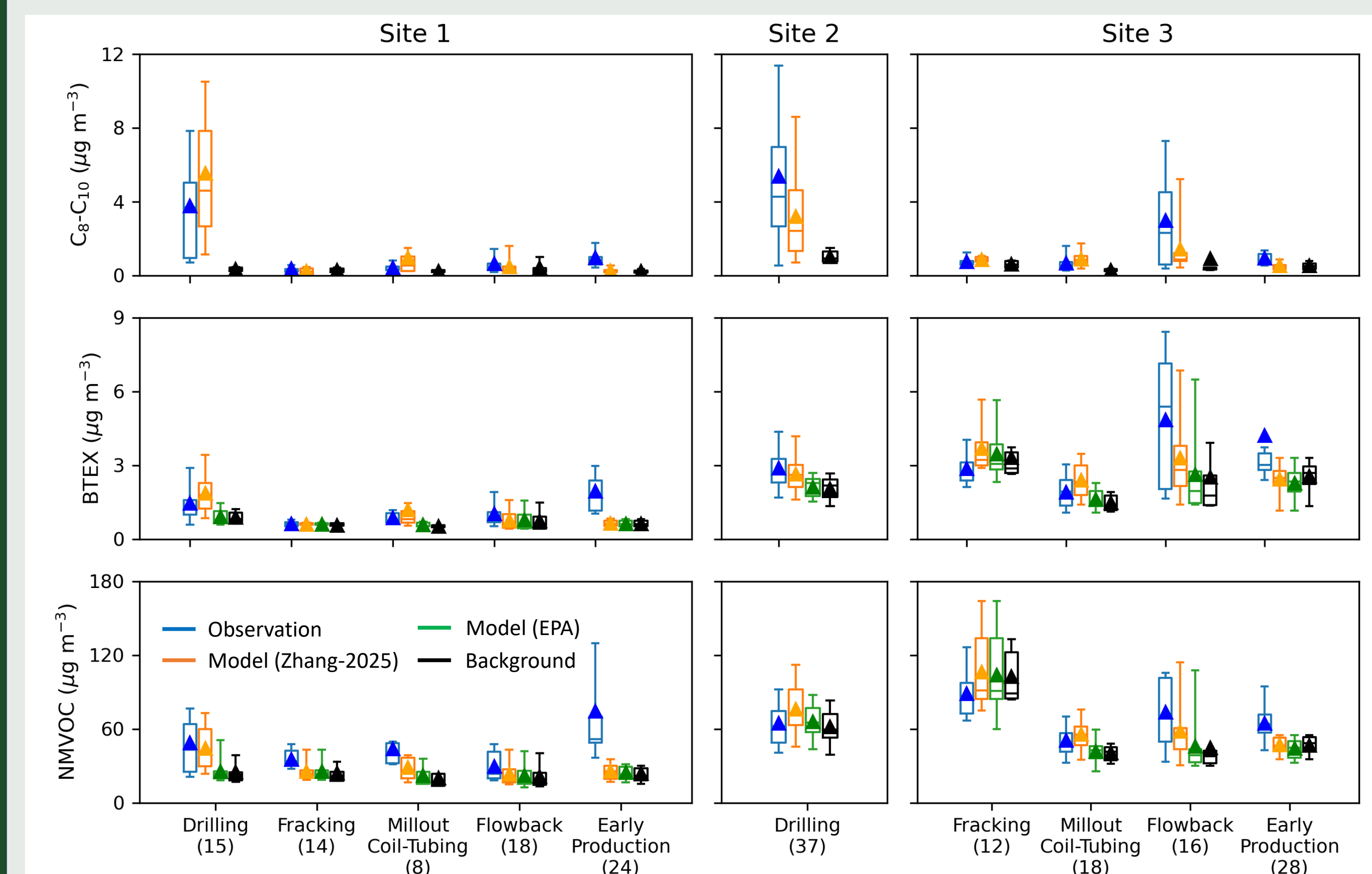
3. Simulate concentrations



Model Evaluation

Evaluation Against Weekly Integrated VOC Observations

- Simulations with Zhang-2025 emission factors consistent with pre-production observations. Emissions from early-production have large variability.
- EPA O&G Emission Tool underestimates drilling & millout/coil-tubing emissions.



Summary and Future Work

- New TRACER Pre-production model designed to simulate emission timelines during UOGD operations for input to a dispersion model.
- Emission factors from Zhang-2025 help close gaps but still under-predict some early production impacts.
- Further observations are needed in different O&G basins and to quantify impacts of recent practice changes.

References

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Acknowledgements

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