

CSU METEC Research Group

2022-23 Graduate Research Assistant Openings

Due to a number of incoming research projects, the Zimmerle research group at Colorado State University is recruiting 4-8 graduate students for projects in:

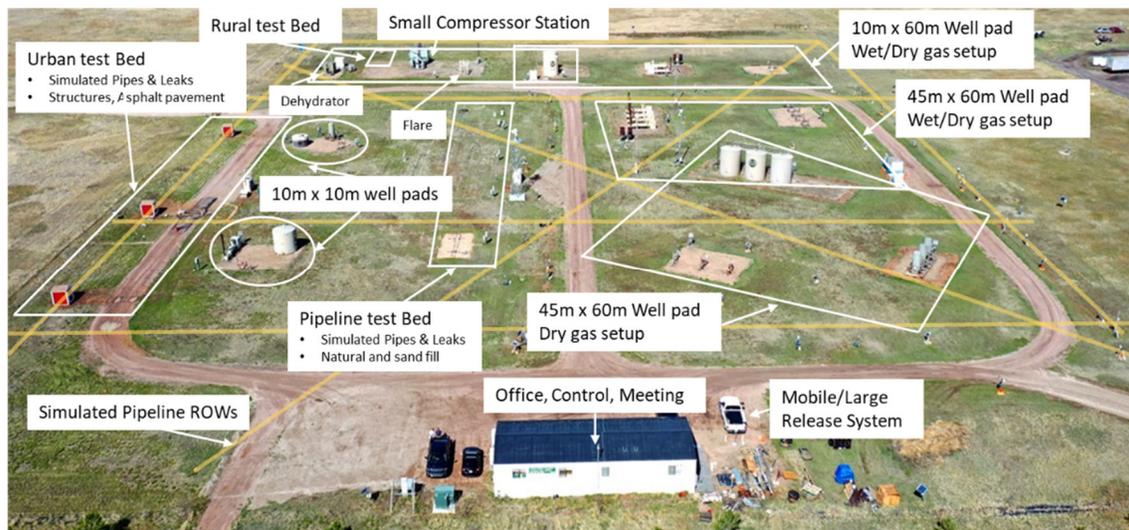
- 1) Simulation of emissions behavior from anthropogenic sources.
- 2) Field measurement of emissions
- 3) Testing of leak detection solutions

While all GRA assignments will emphasize one of the above areas, students generally have opportunities to engage in all others type of projects during portions of the graduate program. GRAs include both MS and PhD programs homed in System Engineering, Mechanical Engineering, and Computer Science.

Contact: dan.zimmerle@colostate.edu or wendy.hartzell@colostate.edu

Zimmerle / METEC Research Group

The METEC Research Group operates one of the largest test facilities, worldwide, for the development and testing of advanced leak detection and quantification solutions, underground gas migration from oil and gas infrastructure, and fundamental work on the near-field transport of emissions. Our main test facility, the *Methane Emissions Technology Evaluation Center* (METEC), is shown below. More information at: <https://energy.colostate.edu/metec/>



Graduate students in the research group have hands-on contact with emissions measurements, quantification, and control. Substantial portions of our work form fundamental inputs for regulatory, safety, and industrial protocols.

The group comes from diverse backgrounds, including Africa, India, Europe, locations across the North America, with educational backgrounds in engineering (mechanical, electrical, petroleum) and sciences (chemistry, atmospheric, environmental, computer).

GRA / Emissions Measurement and Simulation

Ideal candidates will have:

- 1) A solid grounding in the physics of gas transport, dispersion, fluid flow or similar fields, typically acquired in degrees such as mechanical engineering, engineering physics, environmental sciences, atmospheric sciences or similar undergraduate or masters' programs.
- 2) A solid ground in the development of research software coupled with a strong interest in stochastic simulation. We are looking for fundamental skills and interest – you'll be educated in the specifics of emissions simulation as part of your program.
- 3) Strong undergraduate and/or MS grades, with a strong preference for students have completed substantial capstone or research projects.

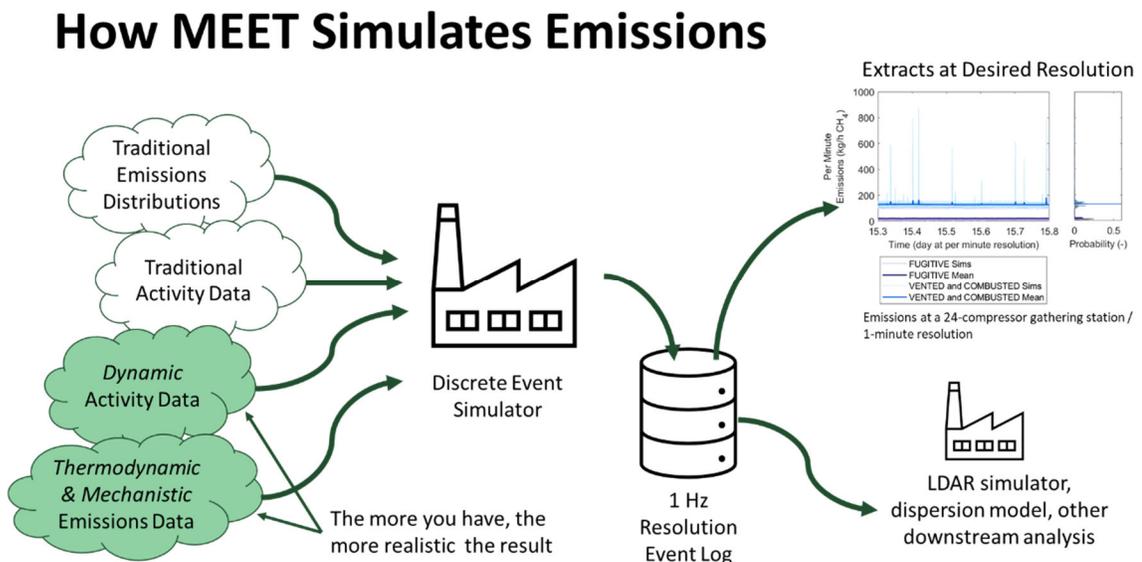
Projects:

Exact project assignments will be discussed with incoming students. Typical examples include:

- Developing emissions simulations of an entire region (e.g., a production basin), working with industry and university partners to understand emission sources, and comparing results to region satellite or tower estimates of emissions.
- Analyzing results for large-scale field deployments of leak detection solutions to assess performance, emissions characteristics, uncertainty, etc.
- Develop novel methods to assemble large models, display complex regional results, and extract unique learnings from analyses.

Graphics:

Example of one principal tool for emissions: The *Mechanistic Emissions Estimation Tool*



GRA / Field Measurement and Assessment

The research group generally conducts 1-3 field measurement campaigns every year. Recent field measurements have included marginally-producing wells, coordinated measurements with aircraft overflights, assessing emissions from orphaned wells, measuring emissions from renewable natural gas plants at landfills, and measuring emissions from wellhead compressor equipment.

Ideal candidates will have:

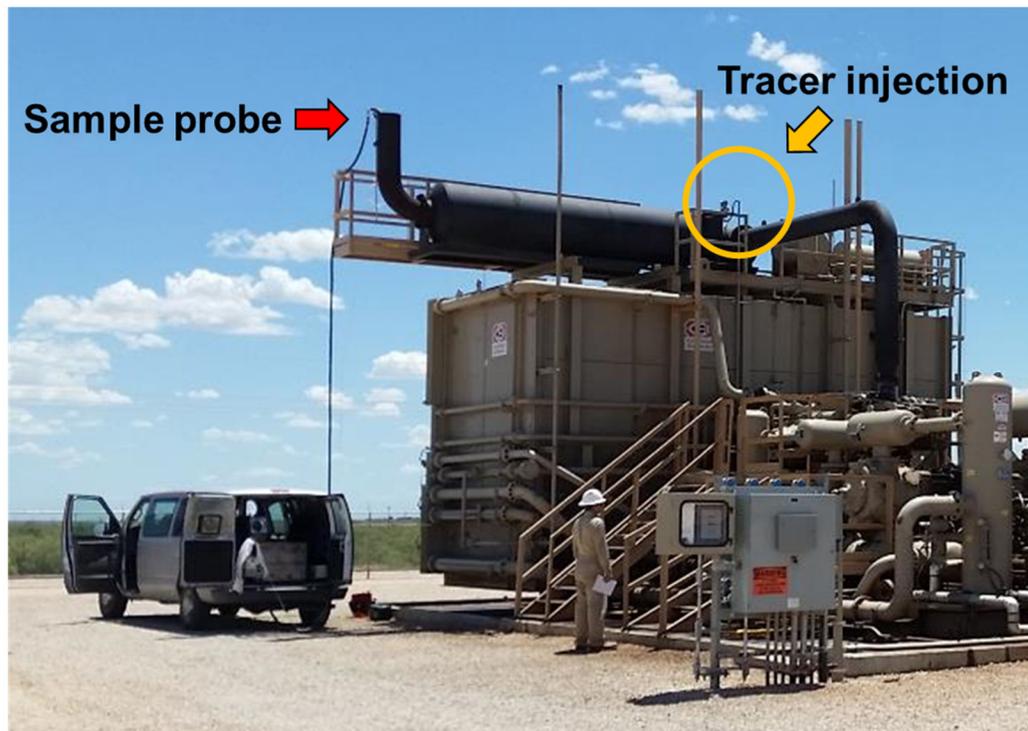
- 1) A solid grounding in the physics of gas transport, dispersion, fluid flow or similar fields, typically acquired in degrees such as mechanical engineering, engineering physics, environmental sciences, atmospheric sciences or similar undergraduate or masters' programs.
- 2) Strong analytic skills to acquire, quality-control, and analyze field measurement data collected by the CSU team or other partner teams.
- 3) Ability to interact with field partners in a highly professional manner. Prior professional experience is ideal.
- 4) Driver's license, or ability to acquire a driver's license, strongly preferred.
- 5) Strong undergraduate and/or MS grades, with a strong preference for students have completed substantial capstone or research projects.

Projects:

Exact project assignments will be discussed with incoming students. All field campaigns include a planning phase – often developing novel new methods of measurement, the field measurement campaign traveling to facilities across the North America for measurement, and extensive analysis of the results, reporting and publication. Exact field campaigns are unknown until projects are awarded, but are likely to include regional-scale emissions measurements and measurement of agricultural or waste emissions.

Graphics:

Field team measuring compressor engines.



GRA/Research Engineer – Testing of Leak Detection Solutions

The highly scheduled METEC facility is open to all interested parties, and is often booked months in advance to test emissions solutions ranging from new sensor types to fully integrated solutions. Increasingly, this testing is moving afield, including the possibility of developing specialty testing for different types of facilities at a variety of locations, coordination with test facilities in Canada or Europe, and comparison testing in field conditions.

In this area we are looking at both GRA positions and research engineering positions, depending upon applicants' interests.

Ideal candidates will have:

- 1) A solid grounding in the physics of gas transport, dispersion, fluid flow or similar fields, typically acquired in professional experience or degrees such as mechanical engineering, engineering physics, instrumentation, or similar undergraduate or masters' programs.
- 2) Prior professional experience highly desired.
- 3) Ability to interact with customers, solution developers and field partners in a highly professional manner.
- 4) Must have, or can acquire, a driver's license.
- 5) Strong analytic skills to acquire, quality-control, and analyze field measurement data collected by the CSU team or other partner teams.
- 6) Strong undergraduate and/or MS grades, with a strong preference for students have completed substantial capstone or research projects.

Projects:

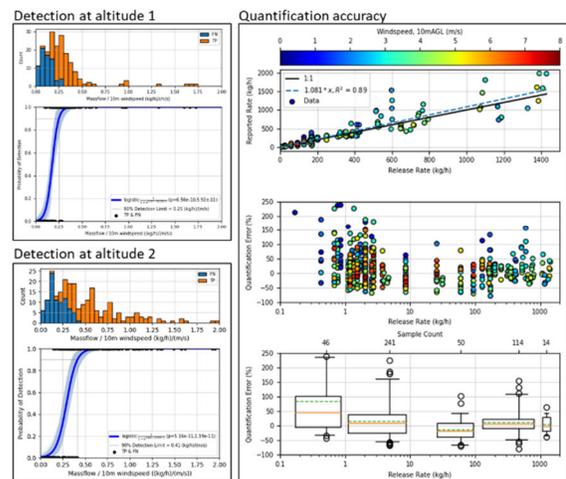
Exact project assignments will be discussed with incoming students or staff. Assignments may include designing and executing testing programs with diverse leak detection solutions, setting up novel testing capability in remote locations, or working with partners to do complex testing on working facilities. All assignments require exceptional professionalism, attention to detail, and ability to analyze the results.

Graphics:

Testing aerial leak detection and quantification solution at a remote location in Texas.

Controlled Testing

- Survey protocol revised for aircraft sensing techniques
 - Used by CSU in parallel project
 - Used by Stanford in multi-solution program



Degree Program Information

GRAs working in the research group will have their academic home in one of several graduate programs at CSU. Many graduate students select Systems Engineering, Mechanical Engineering, or Computer Science, although other academic programs may be possible.

GRA funding includes tuition, living stipend and associated fees. **Students with external funding, such as fellowships or scholarships from external sources, are encouraged to apply. We often add independently-funded students to projects in a variety of assignment durations.**

Master's degrees (Master of Science) include coursework and a research thesis. With a few exceptions, students are required to publish on research-grade journal paper in a peer-reviewed journal. MS programs range for 2-3 years in length, largely dependent on the amount of field work and the student's progress with coursework, research and analysis. Most MS students are employed on 12-month assignments.

PhD degrees include coursework and a research dissertation. Program requirements vary between academic programs, but always require preliminary and final defense of the students' research program. Students should expect to drive a minimum of two research-grade papers published in peer-reviewed journals, and are often co-authors on multiple other papers. PhD programs range from 3-5 years, after an MS degree, and are highly dependent on the student's progress with both coursework and research tasks.

In general, assignments in the group do not support coursework-only, or capstone-type master's degrees, such as 'master of engineering' or 'doctor of science' degree programs.

Links to typical degree programs:

Systems Engineering (Resident degree programs):

MS: <https://www.engr.colostate.edu/se/ms/> (Plan A)

PhD: <https://www.engr.colostate.edu/se/phd/>

Mechanical Engineering:

MS: <https://www.engr.colostate.edu/me/ms-mechanical-engineering/>

PhD: <https://www.engr.colostate.edu/me/ms-mechanical-engineering/>