## Fall 2025 EEE 49800 or EEE 59800 Research Credit

## Project: Sustainable Electronics

Due to the absence of a nationwide regulatory framework in the United States, only 23 states plus D.C. now impose explicit landfill bans on electronic devices. The USA continues to contribute massive volumes of e-waste: in **2018 alone, U.S. consumers discarded approximately 2.7 million tons** of electronic products into the municipal solid waste stream[[1]](#footnote-1). At the same time, landfilled e-waste poses risks of leaching hazardous materials—such as lead, cadmium and other heavy metals— threatening to contaminate groundwater, ecosystems, and finally impact human health. It is important to evaluate what materials leach from disposed electronics under variable landfill conditions. Understanding this leaching behavior is essential for informing safer disposal practices, refining regulatory frameworks, and unlocking resource recovery potential while mitigating environmental harm.

Prof. Nadya Zyaykina and Prof. Inez Hua are seeking a team of 4 students interested in earning 2 or 3 research credits (involvement 6-9 hours per week) during Fall 2025 in the frame of EEE 49800 (undergraduate) or EEE 59800 (graduate) to study leaching behavior of discarded electronic devices.

The students are going to support research towards characterization of e-waste leachate samples generated on the lab scale. The students will learn sample preparation and handling techniques, operation of the advanced lab equipment and instrumentation (ICP-OES, MWAD, IC), statistical data analysis and safe laboratory practices. Additionally, the students are expected to read, analyze and discuss relevant scientific literature.

The requirements are:

1. Willingness and ability to work in a wet lab with various physical and chemical hazards. Detailed safety training and PPE (Personal Protective Equipment) will be provided.
2. Ability to follow written experimental protocols (SOPs = standard operating procedures) to the letter.
3. Ability to keep to the pre-scheduled appointments to insure the team work. The experimental schedule will be developed together with the students accounting for everyone’s availability and will be limited to Monday-Friday, 8 am – 6 pm.

Prior experience in a wet chemistry laboratory is preferred, but not required.

Interested students should submit a resume and a short statement of interest to Prof. Nadya Zyaykina ([nzyaykina@purdue.edu](mailto:nzyaykina@purdue.edu)).

## Fall 2025 EEE 49800 or EEE 59800 Research Credit

## Project: Landfill Emissions

Municipal solid waste (MSW) landfills are the third-largest source of human-related methane emissions, preceded only by oil/gas systems and animal farming, respectively1. Given the correlation between greenhouse gas emissions and climate change, the development of approaches to quantify total landfill emissions accurately is essential to the landfill industry2. This project aims to contribute to understanding of how the GHG emissions from MSW landfills can be mitigated.

Prof. Nadya Zyaykina is seeking a team of 3 students interested in earning 2 or 3 research credits (involvement 6-9 hours per week) during Fall 2025 in the frame of EEE 49800 (undergraduate) or EEE 59800 (graduate) to study landfill gas emissions. The project will be performed in collaboration with Prof. George Zhou.

The students are going to grasp the basics of the complexity of MSW landfill gas emissions and to support day-to-day research tasks. The team will be involved in bench scale experiments containing low quantities of methane, CO and CO2, learn operation of the GC-TCD, GC-FID-methanizer and other lab equipment, get familiar with landfill gas emission models LandGEM and CALMIM. Additionally, the students are expected to read and analyze relevant scientific materials.

The requirements are:

1. Willingness and ability to work in a wet lab with hazardous chemicals, including low volumes of toxic and explosive gases. Detailed safety training and PPE (Personal Protective Equipment) will be provided.
2. Ability to follow written experimental protocols (SOPs = standard operating procedures) to the letter.
3. Ability to keep to the pre-scheduled appointments to insure the team work. The experimental schedule will be developed together with the students accounting for everyone’s availability and will be limited to Monday-Friday, 8 am – 6 pm.

Python and / or VBA programming skills are preferred but not required.

Interested students should submit a resume and a short statement of interest to Prof. Nadya Zyaykina ([nzyaykina@purdue.edu](mailto:nzyaykina@purdue.edu)).

1 U.S. Environmental Protection Agency. <https://www.epa.gov/lmop/basic-information-about-landfill-gas#methane>

2 Environmental Research & Education Foundation. Key landfill emissions research needs & knowledge gaps. Revised call for proposals 3/20/2025

1. Rachel A. Meidl, "Closing the Loop on the World’s Fastest-growing Waste Stream: Electronics" (Houston: Rice University’s Baker Institute for Public Policy, June 14, 2023), https://doi.org/10.25613/xc77-fk34 [↑](#footnote-ref-1)