

**Environmental Engineering**

**and Earth Sciences**

**EEES Department Seminar**

**Behavior of Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Agents/Materials in the Environment:**

**Characterization of Transport Processes and Development of Monitoring Methods/Tools**

**Dr. Christophe Darnault**

Department of Environmental Engineering and Earth Sciences

Clemson University

ABSTRACT - Understanding the behavior of chemical, biological, radiological, nuclear, and explosive (CBRNE) agents/materials in the environment is critical for a sustainable agriculture, the exploitation and management of natural resources (i.e., soil and water), the development of effective remediation procedures, and the protection of the human and ecosystem health. This presentation will discuss the detection, fate, and transport of CBRNE agents/materials in environmental systems as well as the development of monitoring methods/tools. First, experimental, theoretical, and modeling efforts have contributed to advancing knowledge on the behavior of chemical materials in the environment, such as the fate and transport of nanoparticles in soil-water-plant systems, and the nitrogen contamination within agricultural-karst landscapes and aquifers. Second, monitoring methods/tools are assisting us understand how physical, chemical, and biological processes, as well as environmental conditions govern the transport of biological agents – Cryptosporidium parvum and Toxoplasma gondii – in porous media. Third, the coupling of monitoring methods/tools and modeling is enabling us to advance our understanding of radiological and nuclear materials behavior in the subsurface environment, such as assessing the impacts of hydrological processes, soil solution chemistry, and biochemical compounds from plants and microbes on the fate and transport of uranium – U(VI), and uranyl phosphate doped with U-235 – in the vadose zone. Fourth, the use of analytical tools allow us improve our knowledge of the behavior of explosive materials in environment, such as the sorption behavior of the highly explosive compound 1,3,5 trinitrobenzene on soil. Our research results will contribute to the development and validation of fate and transport models of CBRNE agents/materials from pore scale to watershed scale for sustainable agriculture, management and protection of soil and water resources, public health, ecosystem sustainability, risk assessment, and life-cycle analysis.

**About Dr. Darnault:**

Dr. Christophe Darnault is an Associate Professor at the Department of Environmental Engineering and Earth Sciences at Clemson University. He is the Chair of the South Carolina Section of the American Society of Agricultural and Biological Engineers. He is one of Clemson’s representatives for the Consortium of Universities for the Advancement of Hydrologic Science, Inc. He was also a visiting scholar at Yale University. He received his Ph.D. in Environmental and Water Resources Engineering from Cornell University, and his combined M.S. & B.S. degree (Diplôme d’Ingénieur) in Agricultural, Environmental, and Biological Engineering from the Institut Supérieur d'Agriculture, Lille, France.

**2:30 PM**

**Friday, January 12, 2024**

**Brackett Hall 100**

***Attendance is mandatory for graduate students enrolled in***

 ***EES 8610, EES 9610, and GEOL 8610.***

***Refreshments following seminar.***