

GUIDELINES FOR THE PREPARATION OF WHITE PAPER

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Geoenvironmental Research Experience (list projects in progress or completed within the past 5 years):

- “In Situ PCE/TCE Biotransformation by Electrokinetic Injection of Lactate” EL-ERDC (USACE)
- “Development of a Processing Technique for Recycling Construction and Demolition Wood” (Co-PI)
- “SGER: Air Entrapment for Liquefaction Mitigation” (Co-PI), NSF
- “CAREER: Innovative Soil Remediation Methodologies” NSF
- “SoilBed Facility for Environmental Subsurface Characterization,” Center for Subsurface Sensing and Imaging Systems, NU, (NSF ERC)
- “DNAPL Imaging by Cross Well Radar,” Center for Subsurface Sensing and Imaging Systems, NU (NSF ERC)
- “Developing a Reactive Geocomposite to Remediate Contaminated Subaqueous Sediments,” (Co-PI), NSF

Geoenvironmental Teaching Experience (list related courses, including short courses, taught within the past 5 years):

- “Geoenvironmental Engineering,” Graduate course open for undergraduate enrollment
- “Groundwater Hydrology & Pollution,” Graduate course
- “Hazardous Site Remediation” Graduate Course
- Presented a Short Course on “Soil-Contaminant Interactions and Soil Remediation,” at Federal University of Rio de Janeiro, Brazil, (Sponsored by the Brazilian National Council of Scientific and Technological Development – CNPq).

Geoenvironmental Consulting Experience (list major projects only):

- DoD Army Corps of Engineer, Environmental Laboratory (EL) of the Engineering Research and Development Center, (EL-ERDC),
- Norsk Miljø og Gjenvinning AS (NMG), Trondheim, Norway
- Electrokinetics Inc., Baton Rouge, Louisiana;

Appraisal of Geoenvironmental Research, Education and Practice (limit to 1-2 pages):

Perspective on Emerging Geoenvironmental Issues and Technologies (limit to 1-2 pages):

The NSF Task force on the Environment produced a report in 2000 for guidance on activities related to research, education, and assessment on the environment. It is necessary to review this report to provide a prospective on geoenvironmental engineering research and education strategies before identifying emerging geoenvironmental issues and technologies. The executive summary of the report states: ***“Most environmental issues are interdisciplinary, and their drivers, indicators, and effects propagate across extended spatial and temporal scales. Increased resources are needed for interdisciplinary, long-term, large-scale, problem-based research and monitoring efforts.”¹***

Our research and education on geoenvironmental engineering should involve the following:

- High quality and sponsored interdisciplinary research to support our national and international needs in geoenvironmental engineering and restoration. This interdisciplinary research requires collaboration not only with civil and environmental engineers, but should include scientists and engineers from other disciplines, such as chemists, microbiologists, electrical engineers, mathematicians, among others.
- University, industry, state and federal laboratories collaboration: Our research, although fundamental at times, should target long-term, national and international needs. This will ultimately require involvement of academics, industry and federal laboratory partners. Example agencies: US Army Corps of Engineer, Engineering Research and Development Center (ERDC), the Idaho National Engineering and Environmental Laboratory (INEEL) and the Cold Region Research and Engineering Laboratory (CRREL).
- It is critical to maintain well-rounded and motivated graduate students in geoenvironmental engineering. The students should receive multidisciplinary education and their course work should not be limited to the civil and environmental engineering courses. It is also important to provide students with unified teaching methodologies (i.e., unify the engineering concepts and demonstrate with different applications). This allows versatile background, facilitates interdisciplinary research and enhances lifetime learning skills. It is also necessary to promote students participation in conferences and national activities. Undergraduate students should be exposed to geoenvironmental engineering through their participation in research and undergraduate course offerings. Finally it is critical that we place geoenvironmental engineering graduates at good positions in industry or academia after graduation.
- International collaboration is also necessary and broadens the scope of research and academic activities.
- Professional services in geotechnical and environmental engineering, such as paper reviews, editorial board duties and organization of conference sessions are necessary for the continuous development of geoenvironmental engineering.

¹ Report, Environmental Science and Engineering for the 21st Century, The Role of the National Science Foundation, February 2000.

Several geoenvironmental engineering issues or technologies should require elaborate research and development to support our national and international long-term needs. Since my expertise is site characterization and remediation, I will list few examples in such areas:

- NAPL's transport and remediation: even though significant research has been done to address this issue, there is a critical need for engineering technologies to tackle NAPL's free phase fate, risk and remediation.
- Noninvasive "maybe physics based" technologies for subsurface imaging and characterization of subsurface contamination. This could fit NAPLs contamination due to the contrasting physical properties of water, soil and NAPL's.
- Development of stable, reliable, miniature subsurface sensors for real-time monitoring of the subsurface
- Permeable reactive barriers.
- There is always a need to engineer innovative, low cost reliable remediation technologies. Of particular interest are the passive technologies, such as intrinsic bioremediation and phytoremediation. Target contaminants that are of national and international interest are the chlorinated solvents and PAH's.

It should be noted that interdisciplinary long-term collaborative research is critical to address these issues.