GUIDELINES FOR THE PREPARATION OF WHITE PAPER

Name: John Bowders
Affiliation: University of Missouri-Columbia
E-mail: bowders@missouri.edu
Webpage: www.engineering.missouri.edu/~geotech

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

- Settlement Modeling of Municipal Solid Waste
- Asphalt-based Barriers of Waste Containment
- Recycled Plastic Lumber for Slope Stabilization
- Bioreactor Landfill Evaluation
- Soy Foam for Lightweight Fill
- Compatibility of Geosynthetic Clay Liners with Cement Kiln Dust Leachate

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

- Environmental Geotechnics (UMC)
- Geotechnics of Landfill Design (UMC)
- Clay Liners & Covers for Waste Containment (Short Course)
- Geosynthetic Clay Liners (Short Course)

Geoenvironmental Consulting Experience (list major projects only)**:**

- Settlement Impacts for Landfills Placed on Soft Foundations
- Construction Demolition Debris Landfill Design
- Clay Liner with Gravel Evaluation

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

We've come a long way in a short time – perhaps! My entire Geotechnical career – 20 years, has been spent during the rise and plateau of the Geoenvironmental arena. I have performed research on non-destructive site characterization, waste material utilization, waste containment systems and in situ remediation technologies. I have developed and taught university-level courses covering all of these areas of research, and have consulted to industry, consultants and government agencies regarding Geoenvironmental issues. This background provides the basis of my observations and comments on the current state of research, education and practice of Geoenvironmental Engineering that follow.

Are we further ahead now (2003) than we were then (1980)? I believe the answer is yes – and no. With the exception of Geotechnical engineering in support of the nuclear power industry, no other area within Geotechnical engineering was driven through regulatory mandates to its current level of practice, research, or education as was the Geoenvironmental area. Mitchell and Filz (1995), Daniel (2000) and Mitchell (2002) all provide a concise "history" of how Geoenvironmental engineering was driven by regulatory mandates. This "regulatory" impetus certainly drove the research engine which in turn lead to further regulations which were almost immediately put into practice by the profession. The researchers, primarily from academia, also rapidly incorporated their findings into their classes, at least at the graduate level in Geotechnical engineering. What came of the Geoenvironmental emphasis? New materials, new technologies, improved analytical methods and better designs. Examples include: all types of geosynthetics, direct push technology with a myriad of sensors, improved contaminant transport modeling, and highly effective containment barriers just to name a few. In addition, a generation of highly focused professionals at all levels of the civil engineering profession have been educated and trained on the details of Geoenvironmental issues. These are the successes from the short history of Geoenvironmental engineering.

So, with all those successes, how could I suggest that we are not further ahead than we were say in 1980? We, Geotechnical engineers practicing in the geoenvironmental area, along with many, many others from a diverse spectrum of professions, worked to provide solutions for the environmental challenges that faced us. To a large degree, the problems have been solved or at least contained although as yet may be not in the most economically optimal manner. There remain plenty of issues and work to be done but the triage has been highly successful. The public policy and attention that are necessary to drive the economics that fuel the research, education and practice to develop more elegant solutions has simply moved on to other, more pressing areas, e.g., homeland security, defense industry, military operations. Taking all of this in whole, leads me to conclude that the rapid advance in Geoenvrionmental engineering is finished. Recently, I heard Geoenvironmental engineering described as a "mature" subdiscipline. To me this means the end of rapid advancement, and the beginning of a period of steady but incremental advancements. I don't necessarily think this is a negative thing since I believe that most engineering advancements are incremental, not quantum leaps as some media might have us believe. Further, the public attention and interest are not focused on Geoenvironmental topics so we cannot expect the funding levels, legislative interests and rapid advancements that we experienced through the 1980's and early 1990's to continue.

What I do see as a great setback is the rapidly waning quest for Geoenvironmental knowledge on the education front – both from the students' and from the teachers' perspective. I attribute this decrease in interest to two principal phenomenon. The first is the fact that as we progress in time further and further away from media coverage of Geoenvironmental issues, e.g., Love Canal, Freshkills Landfill, etc, students are less aware of the history of Geoenvironmental issues and less and less inclined to want to study in this area. The second phenomenon is that major research funding for Geoenvironmental issues has dropped off considerably and continues to decline. Thus, fewer faculty are working on research in this area, and although many were actively involved in Geoenvironmental research and actively incorporated it into their classes, their attention has now turned to other areas where research funding is more promising. And, current research tends to be emphasized in class.

While these phenomenon could lead to an under appreciation for Geoenvironmental issues among future graduate engineers, it is more likely that we are simply seeing the pendulum swing from an over-saturated market to one that is in balance with the public interest and need for Geoenvironmental specialists. I also believe that the current trend is one in which we will see the Geoenvironmental specialty fall into place as a sub-specialty within Geotechnical engineering which is in and of itself a sub-discipline of Civil Engineering, i.e., we are Civil Engineers first, Geotechnical engineers second and we may practice in the specialty area of Geoenvironmental engineering.

References: Chronologically

Mitchell JK and Filz GM (1995) "The Role of Soil Mechanics in Environmental Geotechnics," the 3rd Spencer J. Buchanan Lecture, Texas A&M University, College Station Texas, 27pgs.

Daniel DE (2000) "Contributions to Geotechnical Engineering from Geoenvironmental Engineering," in Geotechnical Special Publication No. 111, *Judgement and Innovation – The Heritage and Future of the Geotechnical Engineering Profession*, Eds. F. Silva and E Kavazanjian, pp.13-20.

Miller B (2000) *Fat of the Land, Garbage of New York The Last Two Hundred Years*, Publ. Four Walls Eight Windows, New York, 414pp.

Shackelford CD (2002) "Geoenvironmental Engineering," *Encyclopedia of Physical Science and Technology*, 3rd Edition, Vol. 6, Academic Press, pp. 601-621.

Mitchell JK (2002) "A Brief History of Environmental Geotechnics," *Geo-Strata*, October, pp. 26-30.

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

I argue that Geoenvironmental engineering will continue forward by incremental steps. It will not be a mainstream "discipline" and will not receive significant funding from governmental sources such as was seen in the 1980's and early 1990's unless there is a concerted and successful effort to tie this area to something of national interest. So, how do we make such a connection?

It is safe to argue that "homeland security" is currently, and will remain for the indefinite future, one of the "hot topics" of the media, government agencies and political forces. Current emphasis is definitely on "treating the symptoms" and not on curing the conditions leading to security problems. Civil engineers, this includes Geotechnical engineers practicing in Geoenvironmental engineering, are arguably *the* single most influential profession on improving the conditions that will dramatically lessen security issues. What is driving the security issues? Economics play a huge role – countries with lesser economies want a better standard of living. How are large-scale economic improvements gained? Through wholesale improvement in civil infrastructure – transportation, environmental, water and power supply. Who provides the technologies, designs and applications to develop such infrastructure? Civil Engineers (including those practicing Geoenvironmental engineering). Are there challenges to doing this for the world over? Yes, you bet. Is Geoenvironmental research needed? Yes. Is Geoenvironmental education required? Yes. Will Geoenvironmental practice be an important component to the solution of homeland security? Yes. Developing nations may need some of the most advanced Geoenvironmental engineering for existing conditions. Developing nations may also be ideal locations for solid geoenvironmental designs to alleviate future contaminated soil and groundwater problems, i.e., there is opportunity to set up good practices for waste contaminant and control *before* they cause environmental problems.

Will such an effort reduce homeland security issues? Yes. I believe it will improve as economies, health and education levels of all nations improve. Is there any evidence for this? Yes. Take the case of providing clean water for the masses. Primarily brought about by large-scale civil works and maintained by Civil engineers. Clean water systems result in better health of the public, a more productive population and less demands on health care systems.

Are Civil engineers (Geotechnical and those practicing Geoenvironmental engineering) responsible for homeland security? A quick check of the American Society of Civil Engineers' Code of Ethics (ASCE 2002) reveals that Fundamental Principle No. 1 states that "Engineers uphold and advance the integrity, honor and dignity of the engineering profession by: using their knowledge and skill for the enhancement of human welfare and the environment;….." In addition, the first Fundamental Canon of The Society states "Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties." Taken broadly, these two basic premises of The Society leave no doubt that Civil engineers are first and foremost responsible for the public welfare and safeguarding the environment.

I contend that unless Civil, and especially Geoenvironmental, engineers decide to lead the way to improving homeland security through research, design and construction of advanced

infrastructure for all nations, there will not be any significant funding to the Geoenvironmental area and the research and education modes in this specialty will remain on their current plateau.

References:

American Society of Civil Engineers (2002) Official Register, ASCE Press, Washington, DC, pp13-15 (Code of Ethics).

Just in case you wanted something more "traditional" in response to this question:

Education:
What form? How much? What coverage? Live? Who delivers it? At Universities in a traditional setting? Remote – distance education? Via the Web? Short courses? Self-study?

Practice:
How will the profession be driven? By regulations and regulatory bodies? By public opinion/Public policy? By sound technical arguments? Economics?

Research:
Who is impacted? How will it be funded? (Private case by case, government – focus), Who will do the research? (Universities, Research Institutes, Consultants?)

Technologies and Topics:
Biological systems
Smart systems
Long term monitoring
Monitoring Health Effects (coupled with NIH, CDC, WHO, public health profession)
Sustainable engineering solutions
Biodiversity
Natural hazards: floods, stormwater, sediment transport, erosion, water quality, earthquakes, tornadoes, hurricanes, forest fires).