Workshop on the Evolution of Environmental Engineering as a Professional Discipline: Final Report

Workshop Held August 9-10, 2002
Toronto, Ontario, Canada

Sponsored by the Association of Environmental Engineering and Science Professors

Supported by the National Science Foundation

Prepared by
Michael D. Aitken, John T. Novak, Gregory W. Characklis, Kimberly L. Jones, and Peter J. Vikesland

March, 2003

FOREWORD

Environmental engineering has emerged as a unique and mature discipline, yet no single professional society represents the discipline comprehensively. The lack of a unifying organization can hinder the advancement of the discipline in several ways. Individuals who consider themselves to be environmental engineers rather than specialists within a larger engineering field can lose a sense of professional identity and therefore may be less involved in activities that collectively move a discipline forward. The range of professional practice in environmental engineering and the core body of knowledge required for such practice remain poorly defined. There are no common meeting places or publication forums in which individuals representing the breadth of environmental engineering can interact. There is no unified voice to represent environmental engineering as a discipline to the public and to decision-makers, thus marginalizing its relevance to society.

On August 9 and 10, 2002, a group of environmental engineers from both the academic and practicing communities met to discuss the evolution and future of environmental engineering. The focus of the workshop was on the lack of a unifying organization for the discipline and its potential impact. Workshop participants discussed the definition of environmental engineering, the roles and responsibilities of a professional society, and ways in which education, research and practice can or should be linked.

Consensus was reached on several issues. Participants agreed that environmental engineering is fragmented and that both individuals and the discipline as a whole would benefit from a unifying organization. Benefits include a unified public voice; cross-fertilization of ideas, whether in practice, education or research; and the existence of a "home" for engineers who primarily consider themselves environmental engineers. Participants also agreed that interactions among academicians, practitioners, and government agencies should be strengthened as a key to advancing the discipline.

Although there was strong support for pursuing the concept of a unifying professional organization, there was no consensus on how such an organization would evolve. Participants agreed, however, that there are two likely paths to the establishment of a unifying organization: the expansion of an existing organization or the creation of a new society. Several concerns were expressed for both paths. Creation of a new society would require resources that are not readily available and would require a substantial commitment of time by a number of individuals in the absence of an existing infrastructure. Either an expanded organization or a new society could be perceived as competing with existing societies, which would dilute both the support and enthusiasm of potential members. If a unifying organization were to subsume existing organizations, these organizations may resist if they perceive a loss of identity or abandonment of their core missions. Given these concerns, there was general consensus that the success of a unifying organization would be strengthened by inclusivity and by coalition-building.

Workshop participants recommended that a followup workshop be held to explore the paths toward a unifying organization for environmental engineering, to define the factors that would lead to its success, and to identify and quantify whom the organization would serve.

A report on the workshop follows. We hope that this report stimulates discussion across the broad community of environmental engineers. If that occurs to the benefit of the discipline, our objective will have been met.

Michael D. Aitken and John T. Novak
Workshop Co-chairs

CONTENTS

Workshop on the Evolution of Environmental Engineering as a Professional Discipline (August 9-10, 2002, Toronto, Ontario, Canada)

Michael D. Aitken, John T. Novak, Gregory W. Characklis,
Kimberly L. Jones, and Peter J. Vikesland

Introduction

As environmental engineering has evolved as a discipline over the past several decades, its members find themselves increasingly fragmented into disconnected interest groups. The predecessor sanitary engineering discipline focused primarily on water and wastewater treatment, water distribution systems and wastewater collection systems. Through the 1960s, the primary organizations representing sanitary engineering were the American Society of Civil Engineers (ASCE), the American Water Works Association, and the Water Pollution Control Federation (now the Water Environment Federation).

Major changes in public concern about the environment and in legislation in the 1970s and 1980s expanded the scope of environmental engineering. The increasing complexity of environmental problems and their solutions led to an infusion of scientists and engineers from outside civil engineering into traditional university programs in sanitary or environmental engineering, and into consulting firms, manufacturing industries, utilities, and regulatory agencies. As concern over air pollution, industrial wastes and solid waste grew, chemical engineers and mechanical engineers began to play a more important role in environmental engineering. By the end of the 1980s, much of the education and employment in environmental engineering was expanded to include soil and groundwater remediation, toxicology, risk assessment, atmospheric modeling, regional- and global-scale transport of contaminants, and more fundamental process design. Today, engineers who work on environmental problems and environmental systems might affiliate with any of a range of professional organizations other than those identified above, including the Air and Waste Management Association (AWMA), the American Institute of Chemical Engineers (AIChE), the American Society of Mechanical Engineers (ASME), the American Chemical Society (ACS), the American Geophysical Union (AGU), the American Society for Microbiology (ASM), the Society for Environmental Toxicology and Chemistry (SETAC), and others.

There is no single organization that represents environmental engineering as a whole. The Environmental and Water Resources Institute (EWRI) of ASCE was created in an effort to fulfill this role, but it is still widely perceived to be a subsidiary of civil engineering and primarily focused on water-related issues. The American Academy of Environmental Engineers (AAEE) has broad representation from among the many constituencies in environmental engineering, but its membership is limited principally to registered professional engineers willing and able to undergo specialty certification. The Association of Environmental Engineering and Science Professors (AEESP) serves the academic community, not the entire discipline. None of the existing organizations offers a single forum where the full spectrum of environmental engineers meets to discuss relevant professional and educational issues. In the absence of a unifying organization, environmental engineers have a limited impact on issues of concern to the profession, and are unable to speak with one voice to governmental agencies, foundations or other professional organizations.

A workshop was held to discuss the status and future of environmental engineering, with a focus on whether there is a need for a single organization to represent the discipline. The workshop was sponsored by the National Science Foundation (NSF) and AEESP. Participants included both academicians and representatives from environmental engineering practice (Appendix 1). This report summarizes the discussion at the workshop, highlighting those areas in which consensus was reached among the workshop participants as well as issues that require further discussion. A background document that was circulated among the participants prior to the workshop is included as Appendix 2.

Organization of the Workshop

After a preliminary general discussion the workshop proceeded in three sessions, focusing on the following questions:

- What are the objectives and most important functions of a professional society?
- What are the ways in which education, research and practice in environmental engineering are, or can be, connected?
- What are the next steps?

Each of the first two sessions had breakout discussions followed by a general discussion by the whole group. The third session involved a whole-group discussion only.

Opening Discussion

The workshop opened with a general discussion on how to define environmental engineering accurately and comprehensively. Environmental engineering encompasses a broad range of professional practices, which are frequently defined by applications in specific media (such as air, drinking water, or soil) or by their inclusion as a specialty within other engineering disciplines (such as chemical engineering or civil engineering). The group acknowledged that cross-media issues such as risk assessment or sustainability tend to bridge media-specific activities.

There was a sense among participants that other engineering disciplines have established fundamental principles and core knowledge that define those disciplines, while environmental engineering still tends to be defined by example (by the types of problems environmental engineers work on). Environmental engineering has emerged, however, as both a mature and unique discipline. Goods and services provided by the environmental engineering community represent a significant fraction of U.S. and global economic activity. Environmental engineering is one of the disciplines accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET),[1] and professional registration in Environmental Engineering is available. It is important, therefore, to define the core body of knowledge that conveys the expectations of educational programs and encompasses the range of professional activities within the discipline.

The primary focus of environmental engineering is to apply engineering methods for the protection of public health and the environment. It is distinguished from other disciplines concerned with the environment by its focus on problem-solving through design and implementation of technological or management systems. Environmental engineering is unique among the engineering disciplines in the extent to which it is inherently multi-disciplinary. Environmental engineers work with natural and engineered systems and in the interface between the two. They are often required, more than in most other engineering disciplines, to work in teams with applied scientists and social scientists to solve problems that have important societal impacts.

Other engineering disciplines also have an interest in protection of public health and the environment and therefore participate in the development and implementation of environmentally relevant educational programs and professional registration. For other engineering disciplines, however, environmental impacts are a consequence of primary activities such as manufacturing or energy production and utilization. Many professional engineers are likely to consider themselves environmental engineers while also affiliating with other engineering disciplines. Membership in more than one engineering society is, therefore, common. Given the increasing number of undergraduate programs in environmental engineering, however, there is a growing number of graduates who will consider environmental engineering to be their primary discipline rather than a specialty area within another engineering discipline.

The group did not work further towards defining environmental engineering. However, there was a sense that the definition of environmental engineering needs to consider the range of

[1] The number of accredited undergraduate programs in environmental engineering reached 40 in 2002.

practice, the necessary core knowledge expected of the practitioners, the interactions with other professions, both inside and outside engineering, and the evolution of the discipline. These needs must be addressed by a professional society that has environmental engineering as its primary focus with respect to the discipline's professional status, responsibilities, and advancement.

What Are the Objectives and Most Important Functions of a Professional Society?

Professionals in any field find it beneficial to join societies in order to associate with other individuals with similar interests, gain new knowledge in their selected profession, identify employment and client opportunities, and many other reasons. These organizations in turn offer broad benefits to the profession and to society at large. An important part of the workshop focused on defining and articulating the specific benefits of a professional organization.

Benefits to Society. Environmental engineering is by definition linked to societal concerns such as protection of the environment and of public health. However, as we understand more about the sources of pollutants and their fate and transport, the complexity of environmental problems becomes more apparent. A broadly representative environmental engineering organization is needed to coordinate activities that address a host of environmental issues, to promote the development of new knowledge to solve such complex environmental problems, and to anticipate emerging issues of concern.

Benefits to the Discipline. Since environmental engineering is by nature interdisciplinary, it is important that a single organization bring together different subdisciplines and perspectives for cross-fertilization of ideas and approaches to studying and solving problems. Fragmentation of the discipline among various organizations hinders such cross-fertilization.

A unifying professional society would provide a vehicle to define the existing field of environmental engineering and to update this definition as the discipline evolves. Related to defining the field is defining what constitutes "good professional practice." While the various organizations in which environmental engineering is currently represented have produced well-regarded, easily accessible manuals of practice, a new organization can serve to coordinate the development of these manuals and to identify significant needs where no guidelines for practice exist.

There is a great need for environmental engineers to speak with a unified voice to advance the discipline, to enhance the visibility of environmental engineering among other engineering disciplines, and to provide information to the public, government agencies, legislators, industry, the media and other interested parties. No current organization can represent the various constituencies and perspectives in environmental engineering to interested parties in a coherent fashion.

Other engineering societies, such as AIChE and ASCE, have the ability to develop accreditation criteria for educational programs and practices. A unifying society for environmental engineers could work with AAEE to develop accreditation criteria for environmental engineering and therefore allow a broader range of professionals to be involved in the accreditation process.

A unifying society for environmental engineering should also take on the important function of benchmarking demographic trends in the field, both in education and in the workforce. It is important to know how many people characterize themselves as environmental engineers (or scientists) so that the size of the discipline can be conveyed accurately to decision-makers whose actions can influence the practice of environmental engineering, its outcomes, or the education of its members.

The future of any discipline relies on the recruitment of younger people into the field. A professional society should focus on such recruitment, and can nurture the continuing viability and relevance of the discipline by providing for and encouraging the involvement of younger members in professional activities.

Benefits to the Member. The ability of a professional society to attract and retain members is directly linked to the perceived benefits of membership. In addition to offering a sense of identity to an individual, the types of benefits most often provided by such organizations can generally be grouped into two broad categories: intellectual development and career development. Through conferences, workshops, and other sponsored events, members of professional societies have an opportunity to exchange technical information, research ideas, and educational approaches with their peers. The collective benefits of interacting with individuals from within one's own sub-discipline, as well as those that occur as a result of cross-fertilization from other sub-disciplines, can be particularly rewarding. These benefits can be further amplified in settings that foster greater interaction among academicians, practitioners, and those in the public sector. The same settings can also provide attractive venues for career development through opportunities to network with fellow professionals. Relationships built through these interactions can lead to productive collaborations, whether in business, research or education. These forums also allow individuals to make clear their interests and expertise to a broad audience in ways that enhance individual reputations and promote career development.

Facilitating Communication. Due to its fragmented nature, environmental engineering is represented by a number of different professional organizations and societies that generally serve a narrow range of constituencies within the field. Cooperative efforts with some of these organizations or their environmental divisions (such as AIChE, ASCE, and ASME) could draw not only a comprehensive mix of technical expertise, but provide a greater diversity of interested parties from within academic, industrial, consulting, and government sectors. In addition to the benefits that such a broad coalition could afford individual members, a society integrating the expertise from diverse groups within the field could provide tools and services of use to the entire environmental engineering community. One example would be an internet-based clearinghouse for collecting and disseminating technical information or job-specific information.

Principal means by which a professional organization fosters communication and disseminates information of interest to its members include conferences, journals and newsletters. Conferences and other meetings are the major forums through which communication among members can lead to advancement of the discipline. However, no single organization currently sponsors a conference or offers a journal that represents the full breadth of environmental engineering.

In summary, the value of an environmental engineering society will be determined by its ability to be inclusive of a range of technical expertise as well as a broad representation of professional perspectives (academic, practice-oriented, and government). No such organization currently exists, and the opportunities for contributing to both the development of individual members and the field as a whole are abundant.

What Are the Ways in Which Research, Education and Practice in Environmental Engineering Are, or Can Be, Connected?

As in other professions such as medicine, there is a formal system of education to train engineering practitioners. Unlike medicine, however, extensive and direct involvement in practice is usually not incorporated into the engineering educational system. Instead, most of the practical training in engineering is on-the-job. Furthermore, faculty in many engineering programs are neither hired nor promoted on the basis of their experience in engineering practice. The forces that influence faculty at a particular institution (promotion, tenure, institutional recognition, and salary adjustments) and the availability of funding to support specific research or educational activities do not necessarily favor the advancement of engineering practice. It is important, therefore, to articulate the ways in which education, research and practice are connected in engineering in general and in environmental engineering in particular. More importantly, ways in which these connections can be strengthened must be identified. Strengthening such connections should be one of the highest priorities of an engineering society.

Breakout groups were asked to consider the balance between fundamental and applied research in environmental engineering, ways in which academics and practice are connected, how to improve these connections, and the importance of different levels of education (bachelor's, master's and doctoral) in environmental engineering practice.

Research. Workshop participants agreed that the most common and most important way in which academics and practice are linked is through applied research. There is, however, a perceived imbalance in favor of funding for fundamental research over applied, or problem-driven, research at U.S. universities. The vast majority of funding for research in engineering is from the federal government (Figure 1). With the exception of support for hazardous waste research from several federal agencies – the Environmental Protection Agency (EPA), Department of Defense, Department of Energy, and the National Institute of Environmental Health Sciences – there is limited support for and coordination of research relevant to environmental engineering at the federal level. While EPA is the federal agency best positioned to support applied research and development in environmental engineering, it has limited resources to do so beyond its support of hazardous waste research.

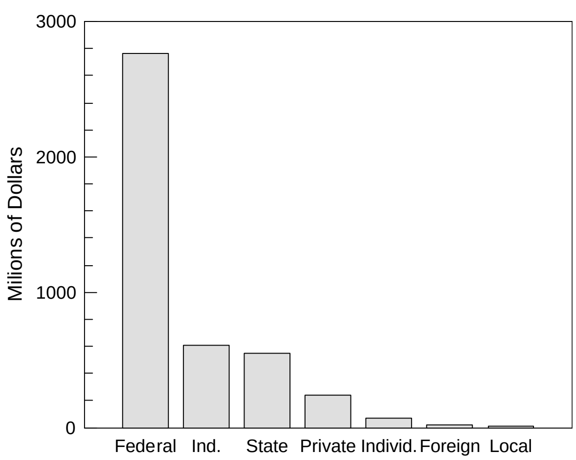

Figure 1. Total expenditures in engineering research in the U.S. by source. Ind. = industrial, Individ. = individual. Data from the American Society for Engineering Education, *Profiles of Engineering and Engineering Technology Colleges*, 2001 edition.

In the manufacturing, defense, and energy-related industries, industrial and private investment in applied research and development is a substantial source of support for engineering research. Many of the issues that require the involvement of environmental engineers, however, are in the public sector. While difficult to quantify, it is likely that funding for applied research and development by public utilities is significantly lower than by the private sector. Two of the most significant sources of support for environmental engineering research relevant to public-sector issues are the American Water Works Association Research Foundation (AWWARF) and the Water Environment Research Foundation (WERF). Industry-based groups that also support research in environmental engineering include AIChE's Center for Waste Reduction Technology and the Electric Power Research Institute (EPRI).

The imbalance in the amount and type of research support available in environmental engineering has led to a preponderance of what one participant described as projects that are either relevant without depth or deep but with limited relevance. It appears, therefore, that funding to support research with both relevance and depth is a limiting factor in advancing environmental engineering in the United States. One recent exception is in hazardous waste management, an area in which research has moved from the laboratory to practice relatively quickly.

Workshop participants emphasized that it is important to support research that focuses on long-term concerns as well as short-term needs. The group acknowledged that academicians are best positioned to focus on long-term issues and that the private sector or utilities are unlikely to support research on such issues. It was also recognized that an academician's research career often begins with a focus on fundamental issues and shifts towards more applied work as his or her career progresses. Such a progression is generally desirable, and tends to occur as a result of increased maturity, broader familiarity with the needs in the field, greater freedom to pursue a wider range of research projects, increased job security, and recognized expertise.

The entrepreneurial nature of academic research in the U.S., combined with the fact that the majority of available research support is from the federal government, makes it more difficult to work on relevant problems in environmental engineering. Requests for proposals announced by federal agencies often focus on specified topical areas, which may not represent the highest priority needs perceived by those in practice. The relevance of academic research requires not only that the funding agency understand and support the needs of the field but that the investigator understand those needs as well. Even if an investigator understands and articulates an important need in environmental engineering practice, it can still be difficult to obtain funding if the agency and/or the reviewers of a research proposal do not appreciate the practical significance of the work. Thus, the participants agreed that it is vital to foster three-way communication among academic investigators, funding agencies, and practitioners. A good model for this kind of synergy is found in Europe, where there is a more direct connection between industry, government and university research than in the U.S. One suggested mechanism to improve the connection is for funding agencies to engage more people from the practicing community in advisory boards and review panels.

Conferences and Publications. Workshop participants also discussed structural barriers that impede communication between academicians and practitioners. For example, the primary outlets for dissemination of applied research or case studies are not always as accessible to academicians as is the peer-reviewed literature. Most practitioners publicize their work at conferences and document it in conference proceedings, which generally are not available in university libraries in print or electronic form, and are not indexed in the electronic databases used by academic researchers and educators to retrieve information on a particular topic (such as the Web of Science, Chemical Abstracts Services, or Medline). In turn, there is a disincentive for academic investigators to publish in proceedings because they usually are not peer-reviewed and hence are given less credit in promotion and tenure evaluations. Proceedings are also cited less frequently than the peer-reviewed literature. Conference proceedings can be made more accessible if they are serial publications, such as the *Proceedings of the Purdue Industrial Waste Conference*. They can be made even more valuable to academic researchers if published as a peer-reviewed serial, such as *Water Science and Technology*.

An interesting issue also emerged while discussing the extent to which academic research published in the peer-reviewed literature is used in practice. Several participants indicated that many such publications are used extensively in practice, but there currently is no way to gauge this use. In other words, it is often difficult to quantify or even identify the impact of any academic investigator's work on environmental engineering practice. Since practitioners publish infrequently in the peer-reviewed literature, published work that is used in practice is not necessarily cited. Citation has become, however, an increasingly important metric in evaluating a given professor's research record for tenure and promotion decisions. It is also the basis on which a journal's "impact factor" is rated. The lack of correlation between a publication's value in engineering practice and its extent of citation can lead to false perceptions about the impact of a given publication or of the journal itself.

There was agreement that forums designed to bring together academicians, practitioners, funding agencies, and regulators, such as focused conferences and workshops, are needed in environmental engineering. A professional society could, for example, coordinate co-sponsorship of events with a variety of groups and other organizations to promote a dialogue and interaction between the research community and the users of the research. If these events are not oriented around specific media, they could facilitate an exchange of ideas across traditional boundaries. Another concept that could link academics and practice would be to develop a journal or magazine that addresses the needs of the field as a whole and not just the academic or practicing sectors. Current journals in environmental engineering are not perceived to balance coverage of fundamental and applied research. The participants acknowledged that practitioners should publish more, but that there are limited incentives and time to do so.

Education. Workshop participants generally agreed that an education in environmental engineering should be grounded in fundamentals, which will prepare graduates to work on a broad range of problems in practice. It is also important, however, to augment those fundamentals with real-world experience, such as in a co-operative training program or through a project. The group also agreed that it is less important to ask what level of education is necessary to enter practice than it is to define the body of knowledge required to enter practice. A bachelor's or master's degree in environmental engineering without relevant project experience is perceived to be less desirable by employers.

Coupled with the trend towards more fundamental than applied research in environmental engineering, the number of project-based master's degrees in environmental engineering has declined at large research universities. Nevertheless, these degrees are still highly valued by employers. The project experience is valued because it provides students with the opportunity to focus on a defined problem, integrate various skills, and organize the results in writing. PhD graduates are becoming more important in environmental engineering practice, particularly in consulting. While doctoral graduates are thought of as highly specialized, such specialization can provide advanced expertise within a firm that in turn can create new business opportunities.

Mechanisms to connect education and practice in environmental engineering include the appointment of practicing engineers as adjunct faculty members or as members of departmental or school-wide advisory boards, service of practitioners on student thesis or dissertation committees, and seminars relevant to practice. One suggestion to protect against misperceptions about the impact of a given professor's work in environmental engineering practice is to involve practitioners in tenure and promotion decisions.

Summary Consensus

The workshop participants agreed that environmental engineering is fragmented and that no existing organization represents the breadth of the discipline while also providing open membership opportunities. Thus, a consensus was reached that the discipline would benefit from a unifying organization, which should be inclusive – open to any party interested in contributing to promoting and advancing the discipline, regardless of credential or disciplinary background.

Interactions among academicians, practitioners and government (both funding agencies and regulators) were identified as important, but were acknowledged not to exist to the extent they should. Such interactions are critical to the evolution of the discipline and to its ability to respond to current and emerging challenges.

Among the negative impacts of fragmentation of the discipline, workshop participants agreed that there is no unified voice, or "public face", of environmental engineering. As a result, our ability to communicate with the public and with decision-makers is constrained, as is our ability to maximize the relevance of our professional activities to society.

Organizational Models and Next Steps

While workshop participants agreed that a unifying organization representing environmental engineering is desirable, there were different perspectives on the best structure of such an organization. Models could range from a society that serves primarily to coordinate activities of other organizations to an independent professional society. There was also disagreement on the extent to which existing organizations would need to "buy in" to the concept of a unifying organization. There was, however, general consensus that inclusivity and coalition-building are factors that would lead to success of such an organization. Success will also depend on the ability to engage and meet the needs of younger professionals.

It is possible that no unifying organization for environmental engineering will emerge in the near future. If such an organization were to evolve, participants agreed that there are two likely paths:

(1) One path would be through the involvement of AAEE. For example, AAEE could become, or could create, a more inclusive professional organization not requiring professional engineering registration or specialty certification as a condition of membership. Alternatively, AAEE could work with AEESP, and possibly other groups, to develop such an organization

while maintaining the identities of the existing organizations.

(2) A second path is for a stand-alone organization to be created independent of any other existing professional organization. This approach would be more challenging because of the lack of an existing infrastructure and financial resources. Important questions in this case are who would lead such an effort, and what would be the source(s) of funding? One suggestion was that a private foundation might be interested in supporting such an effort. SETAC was identified as a successful example of a relatively new organization that began through a grass-roots effort.

Participants agreed that both of these approaches should be explored in detail at a followup workshop, with a possible outcome that an optimum alternative to these two paths might exist. The followup workshop should include participants representing academics, government, and practice, and should include a range of professional experience and expertise. The workshop should also focus on identifying whom the new organization would serve, how many prospective members might be included, and further defining the factors that will lead to its success. Additional NSF support will be sought to conduct this workshop.

Acknowledgments

We thank each of the workshop participants for dedicating their time to prepare for and participate in the workshop, for their insights, and for their collegiality. We also thank them for comments on the draft report, which greatly improved the final version. We thank the National Science Foundation for providing financial support, and especially thank Dr. Nicholas Clesceri of NSF for encouraging us to organize the workshop. The seeds for this workshop were planted by the work of a Blue Ribbon Committee of AAEE and by an editorial in AAEE's newsletter written by the Executive Director, William Anderson, who asked the simple but important question, "Is it time?" Robin Autenrieth of Texas A&M University had the foresight, while serving as President of AEESP, to encourage a dialogue between AEESP and AAEE to explore the recommendations of the Blue Ribbon Committee report. We hope this workshop and its successor will continue the momentum.

Feedback

Anyone interested in commenting on this report should send the comments to either of the following:

Michael D. Aitken
Department of Environmental Sciences
and Engineering
CB 7431
University of North Carolina
Chapel Hill, NC 27599-7431
mike_aitken@unc.edu

John T. Novak
Department of Civil Engineering
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061-0105
jtnov@vt.edu

We will consider all comments as a guide to discussions at the followup workshop.

Appendix 1. Workshop Participants
(affiliations at the time of the workshop are provided)

Michael Aitken
President, AEESP;
Professor, Department of Environmental Sciences and Engineering
University of North Carolina – Chapel Hill

Robin Autenrieth
Professor, Department of Civil and Environmental Engineering and Department of Environmental and Occupational Health
Texas A&M University – College Station

Jeannette Brown
Vice President, AAEE;
Executive Director
Stamford (CT) WPCA

Gregory Characklis (rapporteur)
Assistant Professor, Department of Environmental Sciences and Engineering
University of North Carolina – Chapel Hill

Lenore Clesceri (NSF observer)
Program Director, Bioengineering and Environmental Systems Division
Directorate for Engineering
National Science Foundation

Nicholas Clesceri (NSF observer)
Program Director, Bioengineering and Environmental Systems Division
Directorate for Engineering
National Science Foundation

Yoram Cohen
Chair, Environmental Division, AIChE;
Professor, Department of Chemical Engineering
University of California - Los Angeles

Richard Corsi
Associate Professor, Center for Energy and Environmental Resources
University of Texas - Austin

Glen Daigger
Board of Trustees, AAEE;
Senior Vice President
CH2M Hill
Greenwood Village, CO

David Dzombak
Professor, Department of Civil and Environmental Engineering
Carnegie Mellon University

Cynthia Ekstein (NSF observer)
Program Director, Bioengineering and Environmental Systems Division
Directorate for Engineering
National Science Foundation

Domenico Grasso
Past President, AEESP;
Chair, Picker Engineering Program
Smith College

James Hawkins
Office Manager
Black & Veatch
Greenville, SC

Sam Jeyanayagam
Associate
Malcolm Pirnie, Inc.
Columbus, OH

Kimberly Jones (rapporteur)
Associate Professor, Department of Civil Engineering
Howard University

Byung R. Kim
Staff Technical Specialist
Ford Motor Company
Dearborn, MI

John Novak
Professor, Department of Civil Engineering
Virginia Polytechnic Institute and State University

Catherine Peters
Vice-President, AEESP;
Associate Professor, Department of Civil and Environmental Engineering
Princeton University

Albert Pincince
Senior Vice President
Camp, Dresser, & McKee
Cambridge, MA

Bruce Rittmann
Director, Environmental Engineering Program
Department of Civil Engineering
Northwestern University

Richard Siegel
Consultant
Waltham, MA

Louis J. Thibodeaux
Professor, Department of Chemical Engineering
Louisiana State University

Peter Vikesland (rapporteur)
Assistant Professor, Department of Civil Engineering
Virginia Polytechnic Institute and State University

Thomas Waite (NSF observer)
Program Director, Bioengineering and Environmental Systems Division
Directorate for Engineering
National Science Foundation

Appendix 2. Background Document Provided to Workshop Participants

WORKSHOP ON THE FUTURE OF THE ENVIRONMENTAL ENGINEERING PROFESSION

Co-Organizers:
Michael D. Aitken, University of North Carolina – Chapel Hill
John T. Novak, Virginia Polytechnic Institute and State University

It is not unreasonable… to use the historian's gift of hindsight in order to diagnose the troubles of the British engineering profession in the twentieth century as attributable, in large measure, to a pattern of development in the nineteenth century which was ultimately divisive, in so far as it encouraged engineers to magnify their specific skills at the expense of the greater unity of the whole profession.[1]

INTRODUCTION

As the environmental engineering profession has evolved over the past two decades, its members find themselves increasingly fragmented into disconnected interest groups. In the 1950s and 1960s, the predecessor sanitary engineering profession focused primarily on water and wastewater treatment, water distribution systems and wastewater collection systems. As such, three organizations most appropriately represented the profession: the American Society of Civil Engineers (ASCE), the American Water Works Association (AWWA) and the Water Pollution Control Federation (WPCF) (now the Water Environment Federation). ASCE served the critical role of the contact organization for accreditation of undergraduate programs in civil engineering, and its Sanitary Engineering Division provided a journal for publication of research and engineering studies relevant to the profession. Both AWWA and WPCF also published journals focused on research and practice in areas relevant to drinking water and wastewater, respectively. These organizations, together with their publications and annual conferences, provided the major outlets for academicians and practitioners in environmental engineering to meet, exchange ideas, disseminate emerging knowledge, and develop approaches to educating newer generations of environmental engineering professionals.

Major changes in the profession occurred in the 1970s and 1980s. Engineering practice and research activities expanded because of increased environmental legislation, the emergence of air pollution and hazardous waste as major issues, and an increased interest in environmental protection by the public. The increasing complexity of environmental problems and their solutions resulted in an infusion of scientists and engineers from outside civil engineering into traditional environmental engineering university programs and into consulting firms and regulatory agencies. By the end of the 1980s, much of the education and employment was refocused toward soil and groundwater remediation, toxicology, risk assessment, atmospheric modeling, and more fundamental process design. Today, environmental engineers might affiliate primarily with any of a range of professional organizations other than those identified above, including the Air and Waste Management Association (AWMA), the American Institute of Chemical Engineers (AIChE), the American Society of Mechanical Engineers (ASME), the American Chemical Society (ACS), the American Society for Microbiology (ASM), the American Geophysical Union (AGU), and others. Nevertheless, the majority of environmental

[1] R.A. Buchanan, *The Engineers: A History of the Engineering Profession in Britain, 1750-1914* (Jessica Kingsley Publishers: London, 1989)

engineering programs in the U.S. and Canada are still located in departments of civil engineering (many now called Civil and Environmental Engineering).

Because of the broadening of the profession, there is no single forum where environmental engineers meet to discuss relevant professional and educational issues. As a consequence, environmental engineers have a limited impact on issues of concern to the profession, and are unable to speak with one voice to governmental agencies, foundations or other professional organizations.

ORGANIZATIONS CURRENTLY REPRESENTING ENVIRONMENTAL ENGINEERING

The Association of Environmental Engineering and Science Professors (AEESP) represents over 600 environmental engineering and science faculty at more than 200 academic institutions, primarily from the United States and Canada. Members represent almost every major academic environmental engineering program in the U.S. and Canada, including the top 20 graduate programs ranked by *US News & World Report* (Table 1). The AEESP mission is to serve the research and educational interests and activities of its members. It also represents the academic side of the professional community, but has neither the resources nor membership base to represent the broader profession. The AEESP sponsors periodic conferences that are attended by academics but very few practicing professionals.[2]

The American Academy of Environmental Engineers (AAEE) attempts to serve the broader environmental engineering profession, and is the lead professional organization under which accreditation of environmental engineering programs at the undergraduate and advanced levels are administered. AAEE is a certifying body for those environmental engineers who already have an engineering license and are willing to undergo a specialty exam in order to become a member. These restrictions may have contributed to a severe decline in the numbers of young environmental engineers willing to join AAEE. In an editorial in a recent AAEE newsletter, Executive Director William Anderson indicated that the Academy's members include only 2,600 of an estimated 60,000 to 70,000 environmental engineers in the U.S. He also stated explicitly that "Of all the engineering disciplines, only environmental engineers are without their own professional society, a society they can call home."

The Environmental Engineering Division of ASCE recently was combined with other divisions within ASCE with interests related to water to form the Environmental and Water Resources Institute (EWRI). Coupled with this change was the elimination of the Annual Conference of the Environmental Engineering Division. This, in the opinion of some, has led to a dilution of environmental engineering interests within ASCE. Environmental engineers without civil engineering backgrounds feel they have little in common with ASCE and recent changes make

[2] Until now, the meetings focused alternately on education and on research needs. The education conferences have been jointly sponsored by the American Academy of Environmental Engineers (AAEE). Beginning with the conference in 2002, all subsequent conferences will combine education and research, and are planned to be held every two years. AAEE is co-sponsoring the 2002 conference but co-sponsorship in subsequent years has not been discussed.

Table 1. Top 20 Graduate Programs in the U.S. in Environmental Engineering/Environmental Health Engineering, as Ranked by US News & World Report[3]

University	Name of Department
Stanford University	Civil and Environmental Engineering
University of California - Berkeley	Civil and Environmental Engineering
University of Michigan	Civil and Environmental Engineering
University of Illinois	Civil and Environmental Engineering
Johns Hopkins University	Geography and Environmental Engineering
University of Texas - Austin	Civil Engineering
California Institute of Technology	Environmental Science and Engineering
Georgia Institute of Technology	Civil and Environmental Engineering[a]
Massachusetts Institute of Technology	Civil and Environmental Engineering
University of North Carolina - Chapel Hill	Environmental Sciences and Engineering
Virginia Tech	Civil Engineering
Cornell University	Civil and Environmental Engineering[a]
University of Washington	Civil and Environmental Engineering
Northwestern University	Civil Engineering
University of Florida	Environmental Engineering Sciences
Carnegie Mellon University	Civil and Environmental Engineering
University of Wisconsin	Civil and Environmental Engineering
University of California – Davis	Civil and Environmental Engineering
Purdue University	Civil Engineering[a]
Clemson University	Environmental Engineering and Science

[a] Name of School, not Department.

this organization even less desirable as the lead organization for the profession. Among the most serious divisions in the environmental engineering profession is the long-standing divide between those whose focus is on water or wastewater and those whose focus is on air. The move by ASCE to combine environmental engineering with water resources can only serve to reinforce this division.

Organizations that represent other engineering disciplines, such as AIChE or ASME, have legitimate environmental interests. Although they both have environmental engineering divisions, they do not serve the profession broadly. Likewise, ACS and other scientific societies are unable to serve the broader community, are arguably not dedicated to engineering education nor the professional advancement of engineers, and cannot participate in engineering accreditation programs.

[3] Rankings for 2001 from *US News & World Report* web site, www.usnews.com/usnews/edu/grad/rankings/eng/premium/specialties/engsp7.php (accessed 4/5/02).

THE NEED FOR A PROFESSIONAL ORGANIZATION

Although environmental engineering remains largely an academic subsidiary of civil engineering (Table 1), it has emerged over the past two decades as a unique discipline. Environmental engineering is now a separate subject area on the professional engineering licensure exam used in many states;[4] 40 universities offer ABET-accredited undergraduate degrees in environmental engineering or a related program;[5] and there is a large employment sector for environmental engineers, with many large consulting firms in particular focusing almost exclusively on environmental engineering and related services.

In 2000, AEESP surveyed its members on a wide range of issues. Among the questions asked in the survey was: “Should AEESP actively contribute to efforts to form a professional society that represents environmental engineering and science?” Of the 115 responses received, a slight majority (54%) answered yes, 35% answered no, and 11% did not answer. The survey data are much more revealing, however, when stratified by age or rank of the members. Responses by specific age group and faculty rank are shown in Figure 1. Clearly the younger members (under age 50) of AEESP feel a need for a professional society that represents environmental engineers and scientists.

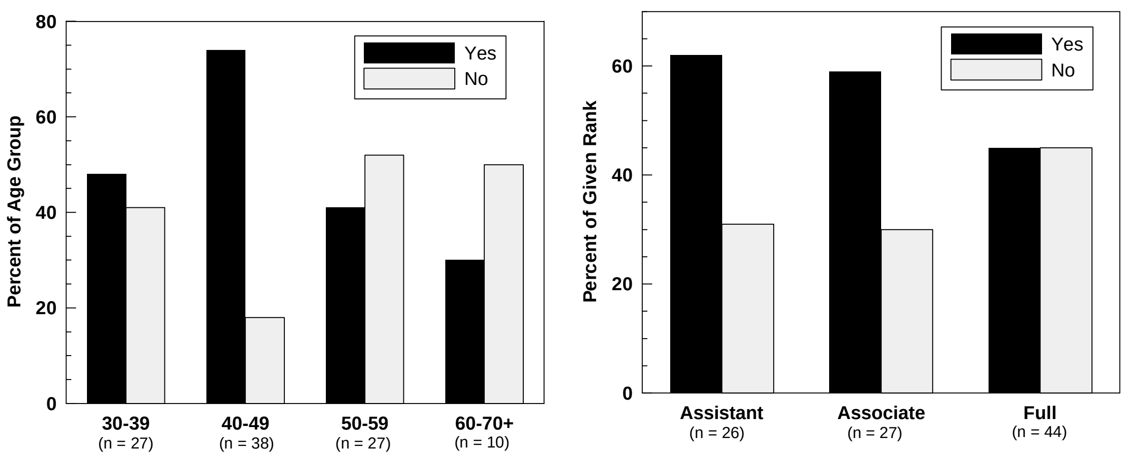

Figure 1. Responses to AEESP survey question on whether AEESP should participate in the formation of an environmental engineering and science professional society, by age of respondent (left) and by faculty rank of respondent (right).

In 1999, a blue ribbon committee of AAEE prepared a document titled *Plan for the Future*, which considered the possibility of creating three new organizations under the umbrella of AAEE leadership.[6] Among the proposed organizations was a Society for Environmental Engineers and Scientists, a more open membership organization representing environmental engineers and scientists. AAEE invited AEESP to begin discussions on the desirability and feasibility of creating such a society, but such discussions have not taken place.

---

[4] National Council of Examiners for Engineering and Surveying web site, www.ncees.org (accessed 9/26/01).
[5] Accreditation Board for Engineering and Technology, Inc. web site, www.abet.org (accessed 7/18/02)
[6] American Academy of Environmental Engineers, *Environmental Engineer*, April 2000, pp. 17-19.

FUNCTIONS OF A PROFESSIONAL ORGANIZATION WHICH ARE NOT BEING MET

The lack of a common meeting place for environmental engineers and scientists, alluded to above, is a significant barrier to the integrative development of the field. There are other important needs that also are not being met, however.

Representation to the Larger Engineering Profession. The American Association of Engineering Societies (AAES) is a coalition of individual engineering societies, both large and small, whose mission is to advance "the knowledge, understanding, and practice of engineering in the public interest."[7] Through its Public Policy Council, AAES is actively engaged in influencing public policy on issues relevant to engineering and engineers.

Beginning in 2002, no organization whose primary focus is environmental engineering will be represented in AAES. The American Academy of Environmental Engineers is no longer a member society of AAES, although it was in the past.[8] AEESP has been a member society for the past two years, but its Board of Directors recently decided to terminate the membership.[9] This decision was based in part on a reorganization of the AAES Board of Governors which essentially resulted in more favorable representation of the larger member societies.[10]

While other organizations such as ASCE, AIChE and ASME have legitimate interests in environmental engineering and environmental policy, it can be argued that these organizations each serve a range of constituencies with potentially conflicting views. Since none of these organizations represents environmental engineering as a whole, there is no unified voice for environmental engineering within AAES.

Demographics. Despite the emergence of environmental engineering as a unique discipline, our ability to track demographic data in environmental engineering enrollments and jobs is severely limited. Accurate demographic information is important in any profession because the influence of a profession in decision-making processes is proportional to size, or rather perception of size; the representation of engineering disciplines within AAES noted above is a good example.

Probably the most well-respected data for trends in engineering education and employment are those collected by the Engineering Workforce Commission (EWC) of AAES and by the National Science Foundation (NSF). Neither of these organizations accurately categorizes environmental engineering in their data collection efforts.

---

[7] American Association of Engineering Societies web site, www.aaes.org (accessed 11/13/01).
[8] American Academy of Environmental Engineers brochure, *How to Stand Out in the Crowd*.
[9] Association of Environmental Engineering and Science Professors Board of Directors meeting, Atlanta, GA, October 13-14, 2001.
[10] L. Graef, American Association of Engineering Societies, Memorandum to Board of Governors, October 1, 2001. Approved changes to the AAES Constitution and Bylaws provide for a nine-member Board of Governors representing two different "caucuses." Any AAES member society can belong to only one caucus. Five of the Board members would be from a caucus which would elect Board members through a vote weighted in proportion to the size of the society's membership, while four Board members would be from a caucus in which the societies represented would have one vote per society.

The Engineering Workforce Commission does not usually include environmental engineering among the engineering disciplines for which it reports employment and education data. It does, however, report data for disciplines that appear to be significantly smaller, as shown in Table 2. The EWC must *collect* data on environmental engineering, because such data have been published by ASCE.[11] The data that are collected on graduate enrollments in environmental engineering, however, are highly inaccurate; a large number of universities with environmental engineering programs are indicated not to have any graduate students in environmental engineering or are not included in the database (Table 3), including 12 of the top 20 programs listed in Table 1.

Table 2. 1998 U.S. Employment in Selected Engineering Disciplines[12]

Discipline	**1998 Employment**
Materials Engineering	20,000
Mining Engineering	4,400
Nuclear Engineering	12,000
Petroleum Engineering	12,000

The National Science Foundation collects data on science and engineering demographics in the U.S., including enrollments at the undergraduate and graduate levels, detailed data on doctoral graduates, and employment statistics. The extent to which environmental engineering is represented in these databases varies. In comprehensive NSF demographic reports, engineering is subdivided only among the largest fields (aerospace, chemical, civil, electrical, industrial, mechanical, and metallurgical/materials engineering) with all other fields combined as "other."[13] In some reports, the "other" (presumably smaller) engineering fields are identified. However, environmental engineering is categorized inconsistently in these reports; in some it is identified as "environmental health engineering" and is listed as a subfield of civil engineering,[14] while in the SESTAT database it is listed as "environmental engineering" among the "other" engineering fields.[15]

---

[11] American Society of Civil Engineers, *1999 Civil & Environmental Engineering Enrollment Data, November 2000*. Original data source cited as *Engineering and Technology Enrollments, Fall 1999,* Engineering Workforce Commission of the American Association of Engineering Societies.

[12] Engineering Workforce Commission of the American Association of Engineering Societies, *Engineers*, Spring 2000, pp. 4-5. Employment data are rounded to two significant figures.

[13] For example, *Graduate Students and Postdoctorates in Science and Engineering, Fall 1999, Detailed Statistical Tables*, National Science Foundation Division of Science Resource Studies, Directorate for Social, Behavioral, and Economic Sciences, February 2001.

[14] For example, S. T. Hill, *Science and Engineering Doctorate Awards: 2000,* NSF 02-305, National Science Foundation Division of Science Resource Studies. Accessed at www.nsf.gov/sbe/srs/srs02401/start.htm, 11/14/01.

[15] SESTAT on-line database, National Science Foundation Division of Science Resource Studies, Directorate for Social, Behavioral, and Economic Sciences. Accessed at http://srsstats.sbe.nsf.gov/preformatted-tables/1997/ (accessed 11/13/01). See, for example, Table B-1, U.S. Scientists and Engineers by Detailed Field and Level of Highest Degree Obtained: 1997.

Table 3. Universities for which Graduate Enrollments in Environmental Engineering are Not Accounted for in the 1999 EWC Database[11]

Auburn University[a]	Texas A&M – College Station[b]
California Institute of Technology[a]	Tufts University[a]
Carnegie Mellon University[b]	University of California – Berkeley[a]
Colorado State University[a]	University of California – Davis[b]
Cornell University[b]	University of California – Los Angeles[b]
Duke University[b]	University of California – Riverside[a]
Louisiana State University[a]	University of Colorado – Boulder[a]
Massachusetts Institute of Technology[a]	University of Delaware[a]
Montana State University[a]	University of Kansas[a]
North Carolina State University[a]	University of Massachusetts - Amherst[c]
Northwestern University[a]	University of Notre Dame[a]
Oregon State University[a]	University of Texas at Austin[a]
Purdue University[b]	University of Washington[b]
Rice University[a]	University of Wisconsin[b]
Stanford University[b]	Utah State University[a]
Syracuse University[a]	

[a] All graduate enrollments indicated to be zero (inferred from blank cells in data table).
[b] University not listed in the data table. There may be other such unlisted universities not identified here.
[c] Zero PhD students indicated (inferred from blank cells in data table).

The SESTAT database indicates that there are 30,700 environmental engineers in the U.S. workforce.[15] Given the uncertainty in how environmental engineering is categorized, it is difficult to know how accurate this number is. Nevertheless, this number suggests that environmental engineering is larger than agricultural engineering, bioengineering/biomedical engineering, metallurgical engineering, mining/minerals engineering, naval architecture/marine engineering, nuclear engineering, petroleum engineering, and geophysical engineering.

The number of doctoral degrees in "environmental health engineering" in 2000 is compared to the number in other small engineering fields in Table 4. The number appears low given the number of graduate programs in environmental engineering in the U.S., but we have no firm data against which to compare it; at the very least, the name of the field should be updated to reflect the term (environmental engineering) used by the vast majority of graduate programs in the U.S.

Table 4. 2000 Doctoral Graduates in the U.S. in the Smaller Engineering Fields[14]

Field	Doctoral Graduates in 1998
Agricultural	60
Bioengineering/biomedical	252
Engineering physics	26
Engineering science	34
Environmental health	76
Mining/mineral	10
Nuclear	98
Ocean	18
Operations research	51
Systems	34
Engineering, general	43
Other	170

Links between education, practice and research. In the absence of a representative professional society, the advancement of environmental engineering as a discipline and its ability to serve society are hampered. Practicing environmental engineers often lament the breach between practice and research; it seems that one function of a professional society would be to explore the etiology of such a gap and work towards a cure, rather than bemoaning its symptoms. Long-term trends in research funding at the federal level, combined with increasing pressures to reward fundamental rather than applied research in promotion and tenure processes at many universities, have weakened links between research and practice. Furthermore, large-scale support for graduate education in environmental engineering no longer exists. From our own experiences and in discussions with colleagues at other institutions, there is a sense that the project-based master's degree in environmental engineering is declining towards extinction. This degree has been the cornerstone for employment in environmental engineering almost since the field's inception, and its decline is viewed with alarm by the practitioners who are aware of it. We can only begin to overcome these problems if we meet, talk, and act as a profession with a sense of common purpose.

None of the existing organizations appears to be positioned to represent the environmental engineering profession. A new professional organization could be created to represent the broader environmental engineering community, including those scientists who work with engineers on applied environmental problems. The society proposed by the AAEE blue ribbon committee could be such an organization. As originally conceived by the committee, this society would be an open membership organization managed under an AAEE umbrella; the AAEE itself would still serve to recognize the mid-career advancement of licensed environmental engineers. Other alternatives may also exist.

WORKSHOP SCOPE, OBJECTIVES AND FORMAT

We will conduct a workshop to discuss the desirability and feasibility of creating a broadly representative and inclusive professional organization for environmental engineers. Co-organizers of the workshop are Professor Michael Aitken (University of North Carolina - Chapel Hill) and Professor John Novak (Virginia Tech). The workshop has been formally endorsed by the AEESP Board of Directors, and therefore we consider this to be an AEESP-sponsored event.

Specific objectives of the workshop are:

- To build consensus towards broadly recognizing the need for a professional society for environmental engineers that is not based on restricted membership;
- To identify approaches to fulfilling such a need; and
- To begin working towards fulfilling such a need in a manner that minimizes animosity and competition, engages as diverse a cross-section of the environmental engineering community as possible, and best serves the needs of society.

Format. The workshop will take place over one and one-half days. The first day is Friday, August 9, 2002 and the workshop will be completed on Saturday morning, August 10.

The workshop would begin with opening remarks by John Novak and Mike Aitken. Novak will discuss the functions of and value in being a member of a professional society, and Aitken will discuss gaps between education, research and practice in environmental engineering.

Following the opening remarks there will be three sessions, each corresponding to approximately one-half day. Each session will consist of breakout discussions in smaller groups, followed by a re-gathering of the entire group to share ideas and thoughts that emerged in the breakout groups. Each breakout group will be assigned a rapporteur, and all three rapporteurs will take notes during the combined group discussion. The proposed sessions will focus on the following three major questions:

Session 1: What are the objectives and most important functions of a professional society?
There will be two breakout groups for this session, corresponding to academic participants and non-academic participants; this would be the only breakout session in which academics and non-academics will be divided along those lines. The main reason for doing this will be to illustrate that both groups have significant differences in perspective but that they may have common goals as well. Each group will be asked to consider the following, among other issues that each group considers important to address:

- Given a broad definition of the scope of environmental engineering, is the discipline currently fragmented (along specialties) at (a) the practice level and (b) the academic level?
- If we were starting from scratch, what would the ideal environmental engineering organization look like?
- How does such an organization best serve (a) society in general; (b) the discipline in general; and (c) the membership? Do any of the existing organizations best serve these constituencies?

- How important is it for a professional organization to be involved in public policy that directly influences the discipline?
- How important is it for a professional organization to be involved in tracking and/or influencing federal policies for funding education, research and development relevant to the discipline?
- How important are demographic data to a given profession?
- How important is it for a professional organization to develop mechanisms that promote the integration of education, research and practice?
- How important is (a) professional engineering certification and (b) specialty certification in being permitted membership in a professional organization for environmental engineers? Are these credentials important in fulfilling the most important functions and objectives of the “ideal” organization identified in response to the questions raised above?

Session 2. How do we improve the connection among education, research and practice in engineering (in general) and in environmental engineering (in particular)? There will be three breakout groups for this discussion, with participants in each group selected to combine academics with non-academics. Since there are a relatively large number of issues to be considered in this session, we will ask each breakout group to focus only on a subset of these questions, as well as other issues that each group considers important to address, as follows:

The Balance of Research, from Fundamental to Applied:

- Is the majority of research in environmental engineering relevant to the needs in the field? What is the best way for academic researchers to identify or discern needs in the field?
- Is there currently an imbalance between fundamental and applied (or problem-driven) research in environmental engineering in the United States? How important is applied research in linking the practicing community with the academic community?
- Is there adequate funding for applied research in environmental engineering in the United States? What are the current sources of such funding? What are the most *appropriate* sources of such funding?
- Are results of applied research projects disseminated in the same ways, and to the same extent, as more basic research? If not, are the results still accessible by academicians?
- Is applied research rewarded to the same extent as basic research in the promotion and tenure process at universities with the largest environmental engineering programs?
- To what extent does federal funding drive directions in research? How in turn does this shape the nature and content of education in environmental engineering?

Linking Practice and Academics

- What is the appropriate role of the federal government in promoting linkages among education, research and practice? What mechanisms are available to promote such linkages?
- Are descriptions of innovative engineering projects disseminated in the same ways as the results of research projects? Do academicians have the same access to the literature on engineering projects as practitioners? Is the literature retrievable by modern tools of library and information science?

- How important are conferences in building links among education, research and practice, and in disseminating knowledge? Do current major conferences attended by environmental engineers promote such linkages?
- How important are journals in building these links and in disseminating knowledge?
- How important in connecting education and practice is the engagement of practitioners in teaching at academic institutions? What are the limitations of such engagement?
- How quickly do new knowledge or new methods become assimilated in practice?

Level and Scope of Education

- Is an undergraduate degree in environmental engineering an adequate preparation for professional practice?
- How important is master's-level education? If it is important, how is it funded? How important is the project-based master's degree?
- How important are PhDs in practice? Are such PhDs in a better position to move emerging knowledge into practice than their counterparts with less formal training in research methods?
- How important are academic institutions or individual professors in the continuing education of practitioners?

Session 3. If we build it, will they come? This session will also include three breakout groups that mix academics with non-academics. The session will focus on limitations of existing organizations that purport to represent environmental engineering and steps that would need to be taken towards achieving the "ideal" professional society; each group will be asked to consider the following, as well as other issues that each group considers important to address:

- Does AAEE represent the "ideal" organization for environmental engineers? Is there merit in considering implementing the blue ribbon committee's recommendation to form a more open general membership organization for environmental engineers and scientists? If so, are there significant barriers to doing so?
- Is EWRI capable of being the ideal organization for environmental engineers and scientists? If so, how would this be accomplished?
- Is there merit in attempting to start a new organization from scratch? If so, who would undertake this?
- Is there merit in promoting a coalition of existing organizations rather than creating a single organization that might compete with existing organizations?
- Are the mechanisms identified to promote the objectives of the "ideal" organization less applicable to a coalition of organizations than to a single organization?
- Has any consensus been achieved? What are the next steps?

Schedule:

Day 1

8:00 – 8:45 Opening Remarks

Session I

8:45 – 9:00 Charge to breakout groups
9:00 – 10:30 Breakout discussions
10:30 – 10:45 Break
10:45 – 12:00 Full group discussion

12:00 – 1:00 Lunch

Session II

1:00 – 1:15 Charge to breakout groups
1:15 – 3:00 Breakout groups
3:00 – 3:15 Break
3:15 – 5:00 Full group discussion

6:00 – 8:00 Dinner

Day 2

7:30 – 8:30 Breakfast and overview of discussions from Day 1 (Aitken and Novak)
8:30 – 8:45 Charge to breakout groups
8:45 – 10:00 Breakout groups
10:00 – 10:15 Break
10:15 – 12:00 Full group discussion

Dissemination of Results. With the assistance of the three rapporteurs, we will develop a report of the workshop that will be made available to members of the participating organizations. The report will be made available for downloading from the AEESP web site, but we will also print 250 hard copies for distribution on a first-come, first-served basis. In addition to advertising the availability of the report in the AEESP newsletter and by email to the AEESP membership, announcements will be submitted to the AAEE newsletter; the ASCE newsletter and *Civil Engineering* magazine; the AIChE environmental division newsletter; the ASME environmental division newsletter; and *Environmental Science & Technology*.