

The Gap Ahead: The Pending Conflict Between “*Engineering Geology*” and “*Environmental Geology*” and What It Means for AEG

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ABSTRACT

The current debates about the mission, vision, and values of a nearly half-century old professional organization are healthy, and certainly needed. The profession of engineering geology has come far in the 100+ years since it began as a service for engineers, enlightened enough to understand that W.O. Crosby could help prevent their water projects from failing. Today, geologists have a whole suite of clients who appreciate the value that geology adds to their projects, many of which have little or nothing to do with dams or even engineering. In order to appreciate this evolution of our profession, we need to be considerably more open to a paradigm shift in our professional practice areas, and be more open to address this in our society’s mission, vision, and values than the recent web discussions would indicate. Where is the profession going, where is AEG going, and is there adequate common ground between their two directions to support the success of both? I contend that there is not. Engineering geology has clearly been encompassed by the growth of environmental geology, and now finds itself as a small subset of the environmental or applied geology arena. AEG has less than a 10% toehold in the environmental geology profession, and has no basis to claim a leadership position, even in applied geology. I believe that until AEG recognizes that its real mission is to be an advocate for the evolving profession of environmental [including engineering] geology, it will continue to set a divergent path from the actual professional practice of the applied geoscience community, and will continue to struggle for relevancy to attract and retain its members. To this end, AEG needs to be aware that its definition of engineering geology has been superseded by time and events. In order to survive, AEG must open itself up to the new paradigm of environmental geology, and to those who see themselves as environmental geologists, and not engineering geologists. Instead we find ourselves with a Strategic Plan that emphasizes the existing member over the profession, and as engineering geology fades away in academia and practice, AEG may find itself with neither at the end of the day.

INTRODUCTION

The Association of Engineering Geologists began its life as the California Association of Engineering Geologists, approximately 50 years ago, and approximately 50 years after the general inception of the practice of “engineering geology” by W.O. Crosby in the early 1900’s (Kiersch, 1991a). The field of “environmental geology” began about 25 years ago in response to the sweeping legislation required by the Clean Water Act, and California’s strong mandate to clean up the leaking underground gas tanks (Kiersch,

1991b). In 1990, in an attempt to respond to this sudden invention of a whole new practice area for geoscientists, AEG leadership put forth a proposal to change the name of the association to the “*Association of Engineering and Environmental Geoscientists*”. Vigorous Board discussion ensued, and for good or for bad, the name change idea was tabled. Instead, as a compromise, AEG added “*Serving Professionals in Engineering, Environmental, and Ground-Water Geology*” as a by-line to the cover of the Bulletin and NEWS. Although a definition of Engineering Geology has long been published in the Directory, a definition of Environmental Geology has never been prepared by AEG, other than to claim it in passing as a subset within the Engineering Geology definition.

As a counter-example, the National Water Well Association, a relatively small organization born in 1948 to serve the water well drilling community, changed its name to the National Ground Water Association in 1991, and now has 15,000 members, a \$7M annual budget, and a PAC. They are highly successful in bringing together all of the people involved in ground water, including drillers, suppliers, engineers, chemists, geologists, and agencies, and are viewed by nearly everyone in the environmental side of geology as a must-join organization.

"I hold the NGWA up as an example on how a national organization should perform. The strides we are making are phenomenal. A good example is our lobbying efforts. I feel we are making a difference and we get a little more recognition by our legislators each time we show up"

Contractor Member [quote taken from NGWA web site]

This paper will attempt to put forth, and defend, some interpretations of the evolutionary path of the profession of applied geology over the past two decades. The primary weakness of the interpretations presented probably lies within the author’s relatively limited geographic and technical practice. Nevertheless, the purpose of this paper is to test the AEG claim to be a leader of the environmental geology profession. Data have been extracted from an AAPG survey (Katz, 2004), ENR (formerly Engineering News Record) magazine (Wright et al., 2004), from the AEG membership database, and from the author’s personal experience, conversations, and observations. The data may have been used in a manner that could be viewed by critics as advantageous and selective. If so, they are encouraged to enter the debate and present alternative viewpoints and interpretations. This is after all, a responsibility of the professional, as opposed to the tradesman.

“The Association of Engineering Geologists (AEG) contributes to its members' professional success and the public welfare by providing leadership, advocacy, and applied research in environmental and engineering geology.” **AEG MISSION STATEMENT - 2004**

THE CLIENT / EMPLOYMENT BASE

Engineering geology began as a profession long before it received its name. The primary use of geologists began as a way for engineers to better predict the future of their projects, both the short-term construction future and the long-term performance future. The “client base” for the engineering geologist was those who built large projects and who wanted their projects to last (Kiersch, 1991a). This was primarily the Federal and State governments and their respective agencies tasked with design or oversight of large construction projects, or the large engineering design companies who worked for those agencies (McLure et al., 1991). Eventually, this began to trickle down to the smaller and private commercial, industrial, and residential projects, leading to the founding of hundreds of small consulting companies to serve this new market. This was the essential core market of engineering geology, providing geologic input to engineers during the siting, design and construction of civil projects.

As the core market continued to mature, small subsets of engineering geology were invented to capitalize on the core market. These included the companies and individuals who specialized in the review of the work completed by the core companies, and the companies and individuals who specialized in the litigation support activities for loss claims made against the core companies. Although not as large an employment base for engineering geologists, this market did provide an alternative to the engineering market.

Other professional opportunities began to open up for engineering geologists in the land use planning field. As the importance of geologic hazards became an integral component of the environmental impact review process, it became important for land planners to be aware of the significance of geology early in their planning process. In California, incorporation of a geologic hazard mitigation “Element” became a mandatory component of a municipal General Plan. Today, quantitative and prioritized Disaster Management Plans are a federal law for every city in the country, and geologists are an integral part of their successful completion.

At the extreme end of the planning scale, geologists are involved in the attempt to model (predict) the consequences of global climatic change, and use their geologic backgrounds to provide some constraints on the modeling results. This program, known academically as “*Earth Systems Science*” was frequently the sole domain of climatic modelers and geographers, but has increasingly come to rely upon geologists for their longer-term perspectives and ability to read the past. The Tilford Scholarship used the question “*How should engineering geologists participate in the global climatic debate, and how will your field study better prepare you for it?*” on the scholarship application for several years.

Although many of the early founders of AEG had strong expertise in hydrogeology, most of this expertise was applied to understanding and solving the impact of groundwater on the design and construction of civil structures. Very few engineering geologists were truly involved in the exploration for, and delivery of, clean water. With the advent of the Clean Water Act in the 1970’s and its increased enforcement in the 1980’s against

subsurface water contamination, geologists found themselves in tremendous demand to try to predict the movement of contaminants using their knowledge of stratigraphy, sedimentology, and structural geology (Kiersch, 1991b). This demand was filled at the collegiate level by the introduction of various new earth science programs focusing on a more generalized and broadly multidisciplinary curricula (chemistry, biology, hydrology, meteorology, oceanography, ecology, etc.) that became known as environmental geology. AEG continued to call it engineering geology.

ENVIRONMENTAL GEOLOGY AND AEG

The Association of Engineering Geologists considers environmental geology to be a subset of engineering geology. AEG also claims to be in a leadership position of environmental geology based on the new Mission Statement. How can we test that impression? The rest of this section attempts to test the hypothesis that environmental geology is considered a subset of engineering geology by the world outside of AEG.

THE WORLD WIDE WEB REFERENCES

In the 21st century, the simplest is to look first at Google:

- A Google search for “*environmental geology*” produced 1,200,000 hits.
- A Google search for “*engineering geology*” produced 1,300,000 hits.

Although an impressive number of hits, this looks more like a tie than a subset of each other. A second test would be to check on the academic offerings:

- A Google search for “*environmental geology classes*” produced 206,000 hits.
- A Google search for “*engineering geology classes*” produced 180,000 hits.

Another near-tie, this one slightly favoring environmental geology. Clearly, if environmental geology was a subset of the greater engineering geology profession, the web site references should not be quite so balanced. From this simple test, the two fields seem to be balanced equally against each other.

AAPG GEOSCIENCE DEPARTMENT SURVEY

This section looks at some recent data from the American Association of Petroleum Geologists (AAPG). Their new report “*2003 Report on the Status of Academic Geoscience Departments*” contains some fascinating information of relevance to AEG’s position on environmental geology (Katz, 2004).

- The top three reported academic strengths are environmental geology, stratigraphy, and hydrogeology (Figure 1)
- Environmental geology replaced stratigraphy as the most frequently reported departmental strength (30 departments, down from 32 in 2002)

- Engineering geology was reported as a strength by only 8 departments, up from 6 in 2002 (Figure 1)
- At least 3600 students are in geoscience departments (Figure 2)
- 55% of the graduates were reported to be taking jobs in the environmental geology sector (Figure 3)
- 18% of the geoscience departments reported.

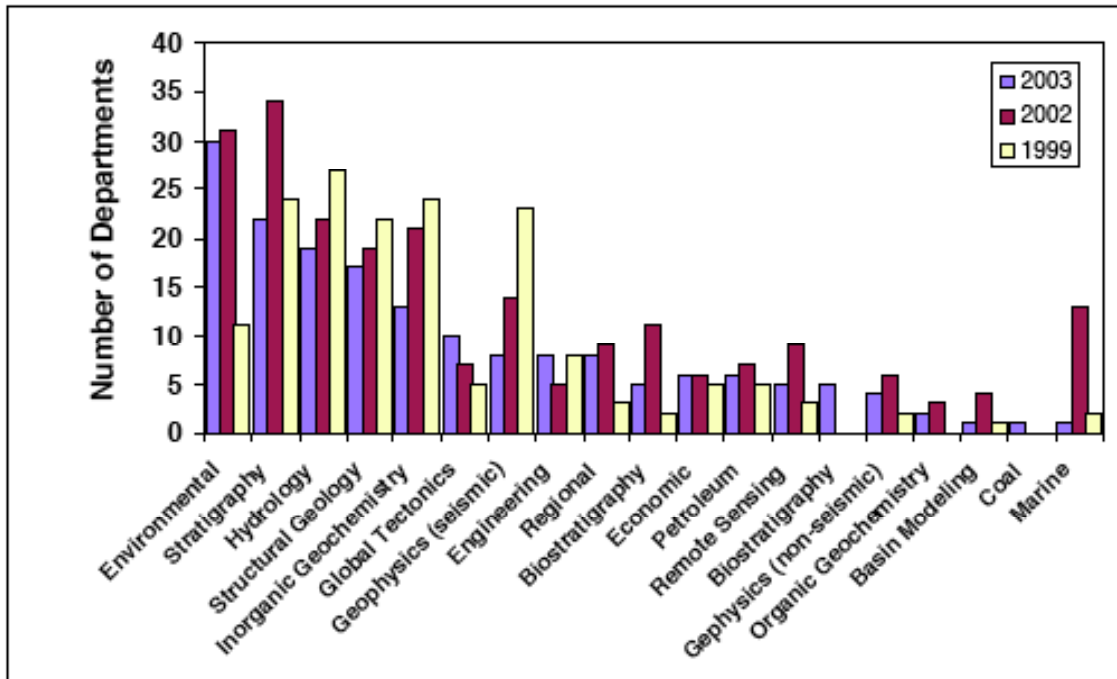


Figure 1: Departmental academic strengths, reported by geoscience discipline (Katz, 2004). Environmental geology was reported to be a departmental strength by 30 departments, versus only six reporting engineering geology as a strength.

In the AAPG survey, there were 2200 undergraduates and 1400 graduate students reported from the 18% of reporting institutions (Figure 2). Therefore, a maximum interpretation of the student population would be to multiply the 3600 students counted by five, producing 18,000 geoscience students in the US. This is probably unrealistic, because the biggest and best departments probably did respond. To present a point, I am going to simply use the student population reported, fully aware that the correct student population is probably at least double, and potentially as much as five times greater. Furthermore, assuming that there are more freshmen and sophomores than graduating seniors, the senior population from the counted population of 3600 is probably about 20%, or at least 720 people graduating. Of these, 400 new geologists (55%) are entering the environmental field every year from these geology departments (Figure 3).

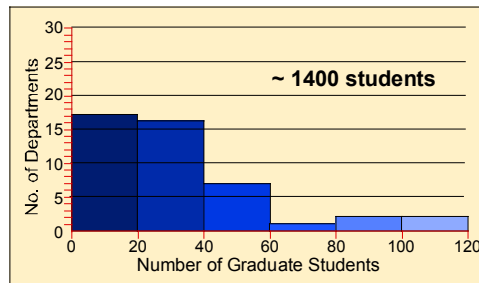
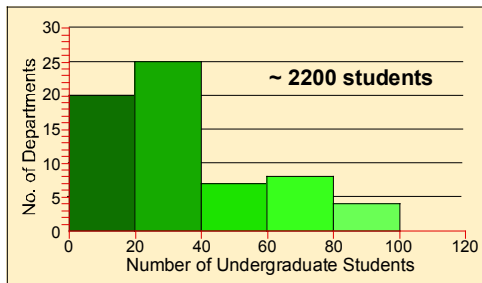


Figure 2: 2003 Student geoscience populations from the reporting colleges (Katz, 2004).

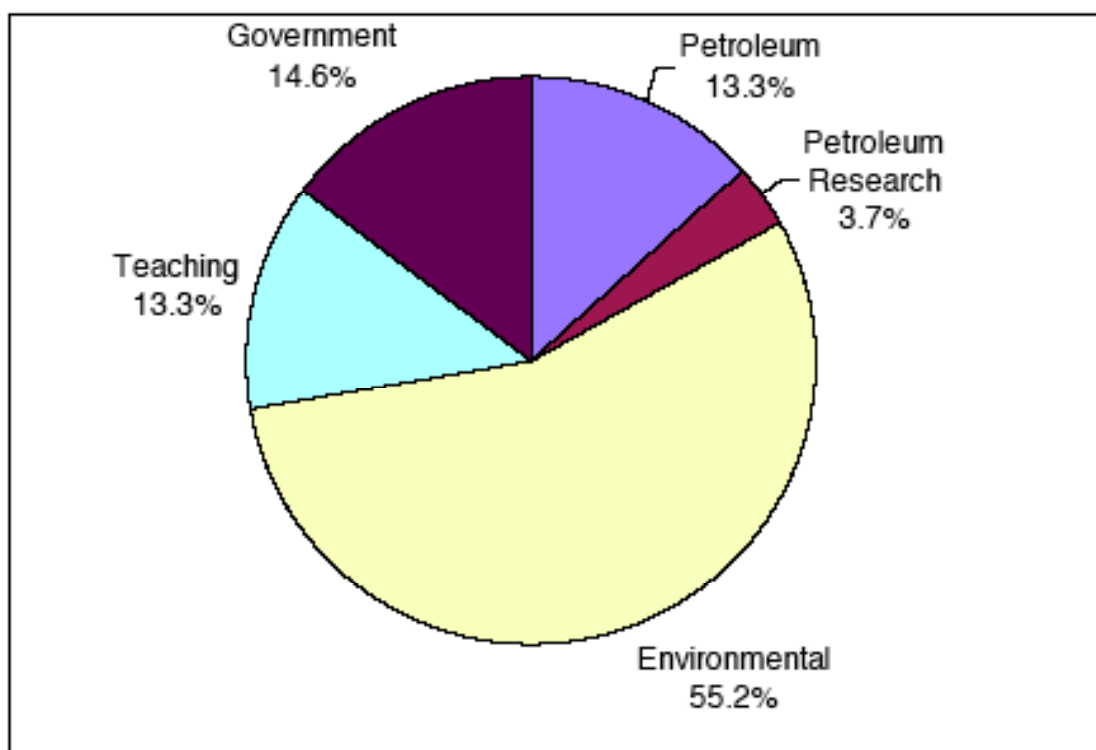


Figure 3: Employment trends reported for 2003 geoscience graduates, normalized to exclude non-geologic employment (Katz, 2004). Over 55% of the graduating students report themselves as going into the environmental market.

Environmental Geology has a 5:1 lead in the world of academia (Figure 1), and when a student graduates from these colleges, where do they go for employment? They go into the environmental industry, by over 2:1 (Figure 3).

Figure 4 shows that the percentage of students entering the environmental geology field has remained between 40 and 60% of all geology graduates for the past 11 years. Not shown is that the population of all geoscience students is actually down 50% in 2003, from the peak in 1996. AEG has fewer than 50 student members, yet at least 400 new graduates are entering the environmental field each year. I do not have data on the

percentage of AEG student members who transition to members upon landing a job, but the belief is that it is a very small number. Since AEG has only managed to hook less than 12% of the students entering the environmental field anyway, AEG's percentage to land them as professionals is even lower. Over the past 11 years, well over 4000 new geoscience professionals have entered the environmental geology field, and yet AEG's membership has remained essentially static through the entire period.

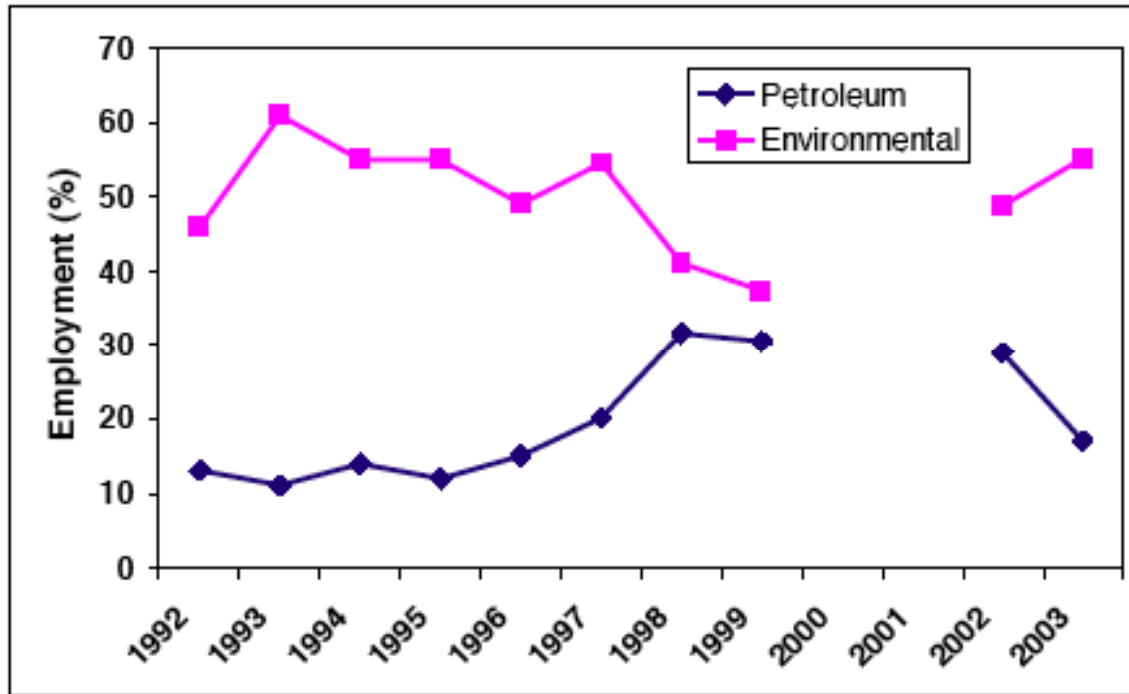


Figure 4: Temporal trends in employment in environmental and petroleum fields showing a clear relationship (Katz, 2004). As petroleum jobs increase, fewer students chose the environmental market.

Clearly, the AAPG findings are overwhelming in their presentation of environmental geology as the dominant choice of emphasis for both geoscience departments and their graduating students (and future professionals). These results alone should give AEG pause to consider an alternative paradigm of the profession.

GSA EMPLOYMENT ADVERTISEMENTS

Still another way to evaluate the battle between engineering and environmental geology in academia is to categorize the help-wanted ads for geology faculty at universities. In a less than definitive analysis, I looked through eight months of GSA Today for all faculty advertisements that specified either environmental or engineering geology, anywhere in the position description. Those eight GSA Today issues were not all sequential, nor even within the same year, but should still be indicative of the hiring trends. The universities were searching for 37 new professors to teach environmental geology, and only of the 7 advertisements even mentioned engineering geology. The 2 positions that definitively specified “engineering geology” in the position title, then added “teach environmental

geology” to the position description. Clearly, the trend in academia is to the environmental geology side of the debate, and it will be a very difficult trend to reverse.

ENR TOP 200 ENVIRONMENTAL FIRMS

Another way to examine the engineering versus environmental market is to look at the results of the 2004 ENR (formerly Engineering News Record) survey of the *Top 200 Environmental Companies* (Wright et al., 2004). These 200 companies reported \$31.4 billion in revenues from environmental services related work in FY-2003, and probably account for a substantial percentage of all environmental work done. To examine AEG’s penetration into these companies, the AEG membership database was queried for a listing of the membership’s work affiliations, and the resultant histogram plotted to get a visual perspective (Figure 5).

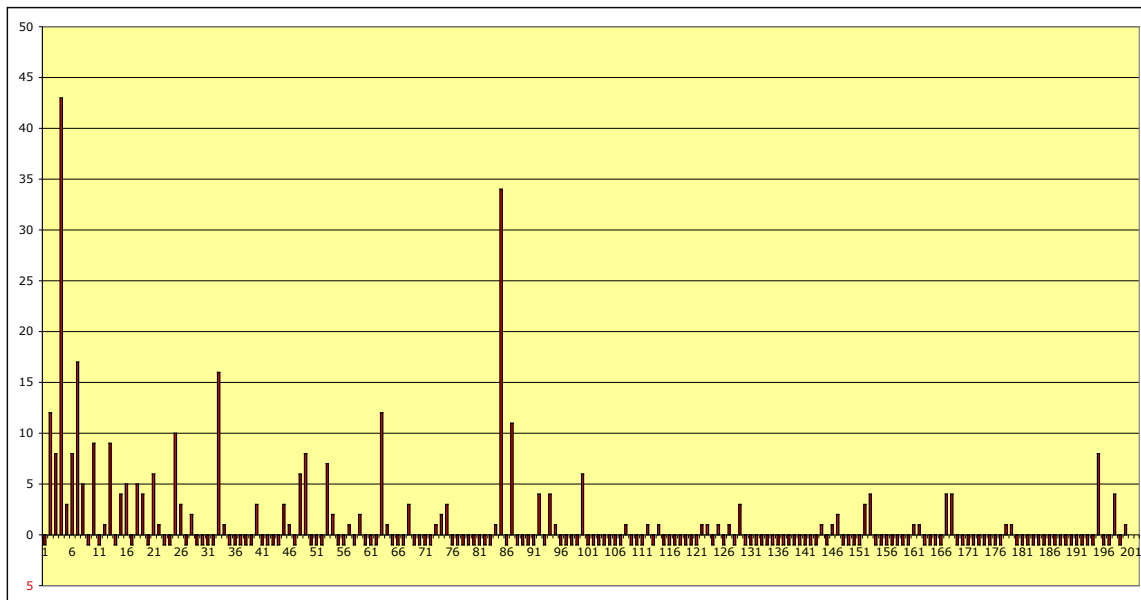


Figure 5: Number of AEG members working for the ENR Top 200 Environmental Firms (Wright et al., 2004). The company ranking is shown on the X-axis, and the number of members is shown on the Y-axis. Those companies with zero members are shown as a negative one below the line to make them more visible. URS with 43 members and Kleinfelder with 34 are the two largest populations of AEG members in the ENR Top 200.

Figure 5 shows how AEG members are distributed throughout the 200 largest environmental firms. There are 334 AEG members out of the total 2869 membership who are employed by the Top 200. This is less than 12% of the AEG membership. URS with 43 members, and Kleinfelder with 34, are the two companies with the largest number of AEG members. I am personally familiar with some of the members in both of those companies, and I know that those members are not involved in the environmental services side of their respective companies. Consequently, I believe that AEG’s 12%

membership involvement in environmental work is a maximum penetration of the environmental field, and probably even a substantial over-estimation.

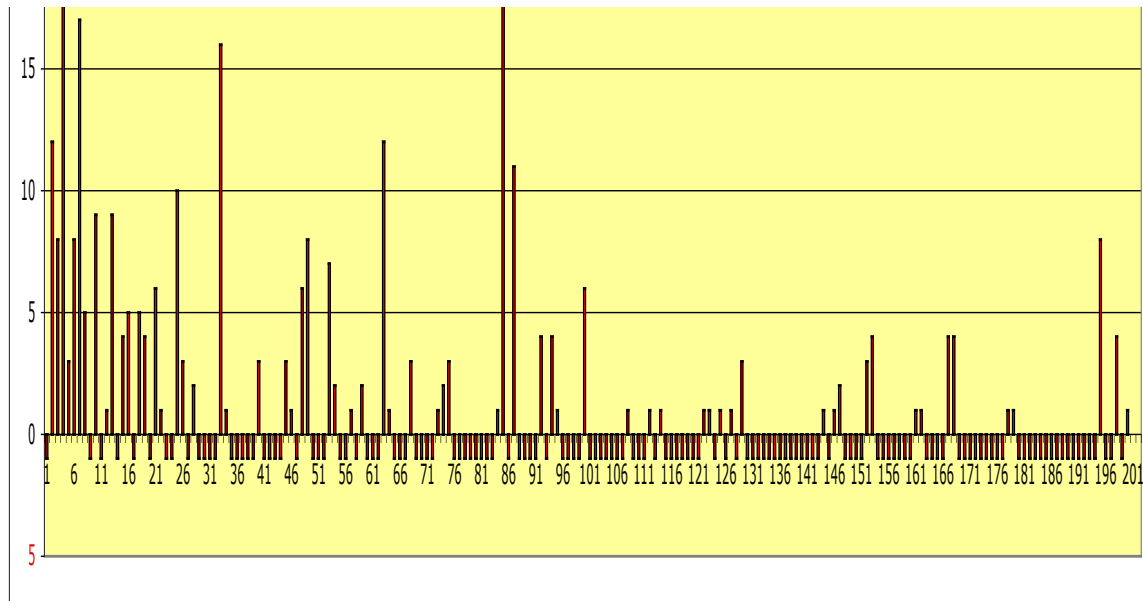


Figure 6: Same figure as above, but cropped and expanded to better illustrate the lower end of the employment spectrum (Katz, 2004).

Figure 6 shows that 135 of the ENR Top 200 Environmental Companies do not employ any members of AEG, and 20 of the companies employ only one. Perhaps, those companies without AEG members hire consulting companies with AEG members on staff to provide their needed geological services. Alternatively, perhaps those AEG members in the Top 200 companies are doing the engineering geology portion of their companies' work, and not the environmental geology portion. But, alternatives aside, it is instructive nevertheless that 68% of the Top 200 companies do not have any AEG members on staff, and another 10% have only one member. AEG has one corporate member from the Top 200, Burgess & Niple Inc. (#144). It is difficult to see how AEG has more than a toehold in the environmental geology profession.

THE AEG STRATEGIC PLAN

The AEG leadership embarked on a very comprehensive process to prepare new Mission, Vision, Values, and Strategic Plan documents to help determine the future of AEG. This was a very intense and productive process that resulted in a complete rewriting of the prior AEG Mission and Values statements and Strategic Plan. The old plan had essentially been set aside during the past several years as other priorities dictated the attention of the leadership. The new plans were presented to the membership several times and a brief but interesting discussion exchange was generated for the first time over the AEG's new web accessed discussion board. Based on their several meetings and comments received, the AEG Board formally adopted the Association's new Strategic Plan at the mid-year Board meeting.

Over 40% of the membership responded with comments to the initial drafts providing the Board with a membership mandate to build the strategic plan upon. Based on these comments, eight goals were developed to support a broad member-driven goal of *"helping AEG members succeed professionally"*. It sounds good on paper, and makes the member warm and fuzzy, but the question is: does the *"Strong Mandate from the Membership"* really mean anything with respect to closing the gap between AEG's vision of applied [engineering] geology, and the professional practice of those actually doing applied [environmental] geology? Let's now look at the new Strategic Plan and see if this gap is going to open wider or begin to close.

AEG's 2004 STRATEGIC PLAN GOALS

Goal #1 is to provide training and training materials for engineering geologists.
Goal #2 is to assist the Sections.
Goal #3 is to enhance the web site to provide the members with even more materials
Goal #4 is to strengthen the publications to provide the members with yet more material.
Goal #5 is to grow the membership.
Goal # 6 is to advocate the role of engineering geology.
Goal #7 is to strengthen the internal governance of the organization.
Goal #8 is to build bridges to other organizations, all geological in nature.

Very clearly, the Strategic Plan's goals strongly support the overall goal of helping the membership to succeed. As such, this is strictly an internal plan with the exception of Goal #6. It is a plan developed by AEG members for AEG members. But, if the future of engineering geology is in doubt, is not the future of AEG in even more doubt? I contend that AEG must recognize that engineering geology is near death, and that the future of applied geology will be called environmental geology. It is the reality of the future that the Strategic Plan must address, and to do so, it must build AEG into an organization for all environmental geologists, not strictly those who are trapped within the obsolete engineering geology paradigm.

If AEG is to survive as a relevant professional organization it must develop a strategic plan that is both relevant to the new world realities, and able to attract and retain those thousands of environmental geologists who are practicing applied geology or just entering the field. Quite bluntly, who cares what the existing membership wants, they have nowhere else to go, and are less than 10% of the applied geoscience professionals anyway. The purpose of AEG must be to ensure the growth, evolution, and survival of the profession of applied geology, by whatever name, and not strictly devote itself to the tender care of its few members. The goals of the current strategic plan are fine if you have a ship heading in the right direction. This plan however, in this time of AEG denial, is more like rearranging the deck chairs on the Titanic.

"If we build it, they will come" should be the mantra of AEG, and *"IT"* is the profession that applies geology and geological principles in a multidisciplinary [technical, social, political, and financial] environment to ensure the best possible result to the end project.

Ensure me a job first, and then teach me what I need to know to be better at it. I think this is the better path for AEG to take. If there are jobs, there will be students graduating to fill them. Just because there are trained workers does not mean there will be jobs for them, unless Yellow Cab is hiring.

SUMMARY

This paper has attempted to test AEG's claim that environmental geology is a subset of engineering geology, and as such, AEG has a leadership position in environmental geology. The attempt to prove the positive has definitively proven the negative; that engineering geology is a minor, and probably declining, subset of environmental geology, and that AEG's toehold in environmental geology is insignificant, and probably also declining.

- Google has engineering and environmental geology scoring approximately equal numbers of hits.
- Environmental geology has a 5:1 lead over engineering geology on the reported strengths of geoscience science departments.
- Universities are hiring environmental geology faculty approximately 6:1 over engineering geologists.
- Environmental geology is the career of choice for 55% of the students graduating in 2003.
- At least 4,000 new geologists have entered the environmental geology field in the past 10 years.

And yet:

- AEG has less than 50 student members
- AEG's membership has remained static over the past 10 years.
- Less than 12% of the AEG membership work for the largest 200 environmental companies.
- AEG does not have any members who are employees of 70% of the 200 largest environmental companies.
- AEG has only one corporate member on the Top 200 list of environmental firms.
- AEG's new strategic plan pays little attention to the outside realities of the applied geological professions.

In 1962, when the California Association of Engineering Geologists voted to drop the word "California" from its name to embrace engineering geologists from all over the world, AEG was born as a true representative of the applied geosciences profession. Today, more than 65% of AEG's members are outside of California. In 1991, when a similar proposal to modify the name to embrace the new environmental industry was rejected by the Board, AEG chose a path that has led it slowly but steadily downhill. Clearly, the decision by AEG in the early 1990's to remain stubborn and insular in failing to recognize the opportunity before it in embracing the environmental geology industry,

must rank as one of the most momentous decisions in AEG history. I was there, and I voted with the majority.

Consider instead the path taken by the NGWA. In 1991 NGWA did change its name to be more inclusive, and now it wields a powerful voice in all things environmental, and is probably the organization joined by most of those 4000 new environmental geology graduates in the last decade. It certainly was not AEG. NGWA has 13 Corporate Members on the ENR Top 200, AEG has 1; NGWA has 17,000 members, AEG has less than 3,000; but AEG claims to be the leader of the environmental geology profession. Saying it will not make it so; that will require determined and visionary action.

While I understand that a mission statement is intended to be visionary, and a bit of a stretch, AEG's new mission statement is laughable by the inclusion of environmental geology in it. Environmental geology has become the leading area of focus for college geology departments, while engineering geology has nearly become extinct at the university level. Over half of the geology students graduate to jobs in the environmental industry, yet AEG has a maximum penetration of 12% in the environmental industry, and virtually no student members. It seems inconceivable that an organization representing such a tiny fraction of the large and growing professional practice of environmental geology can even understand it, let alone profess to be the leader of it. This arrogance can only lead to widening the gap between those professionals actually practicing applied geology, and those claiming to lead it. As that gap widens, and as AEG responds by becoming even more insular and isolated from the realities of the professional practice world, AEG will pass into the night. And that would be a real shame, but not the end of the applied geology profession since most of its tens of thousands of practitioners are already proving.

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