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8th Annual Report on the International Status of
Engineering Geology—Year 2002–2003

Encompassing hydrogeology, environmental geology and the applied geosciences

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Abstract

The year began with a good deal of international tension as well as various indications of recessionary economics. Two weeks into the new year, a rash of bankruptcies visited the geoenvironmental consulting industry, in which some of the very companies that had grown by expansion in takeover of smaller firms were the unstable targets. The year ended with the demise of many established geotechnical and geoenvironmental consulting firms and the establishment of new entities, generally by the more substantial of the personnel becoming castaways in the reorganizations.

Employment in the private sector remained brisk but much adjustment was going on because of a generally shrinking work load related to shortfalls on taxes collected by government as the basis for public-works construction, especially in the infrastructure. All nations were in deficit spending and retraction of major projects.

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1. Noteworthy events

We tend to remember the overall context of our professional careers by the more striking events of each year as they impinged on our own work. The year 2002 was not short on memorable events.

1.1. World Trade Center rehabilitation

Veteran New York City geotechnical and structural engineer, George Tamaro, PE, has always been known as an astute user of geology. His January 2002 summary of the geologic and structural engineering characteristics of the 4.4 ha “bathtub” basement includes enough geology and groundwater notation to make a real attraction for engineering geologists (Tamaro, 2002). Without the recovered subsurface geologic details, reconstruction at the site would not have been feasible, especially considering its broad-area depth of as much as 22 m.

On 15 July 2002, the U.S. Army Corps of Engineers began dismantling the special screening equip-

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ment that had been used to detect human remains at the final disposal site of World Trade Center (WTC) debris at the venerable old Fresh Kills Landfill. An appropriate ceremony was held.

1.2. Rebuilding Afghanistan

Afghanistan's infrastructure, already largely destroyed by the totalitarian Taliban rulers in the 14 years of vacuum after departing Russian forces, saw further destruction by WTC antiterrorist retaliation of America. This is now a daunting wasteland for reconstruction. Hapless Afghans now are being returned to democratic government under the watchful United Nations peacekeeping force. Returning expatriate nationals will have their hands full in assisting the democratic government of Karmal Kahn, which is the work of unity. Nominally, in the 19th century British sphere of influence, the nation looked to London for assistance, while American Special Forces Civil Affairs soldier teams were roaming the country tallying the places and needs for humanitarian aid. The focus was on water wells, roads and bridges, and simple electric generation, all as the highest return in humanitarian assistance. The long-term estimates add up to \$15 billion over the next decade. World contributions at the 23 donor-nation meeting in Oslo pledged an additional \$1.24 billion in addition to the \$5.1 billion pledged at a Tokyo meeting in January. Applied geologic needs will be basic to most of the grass-roots needs.

1.3. Volcanism in the Congo

The 18th of January brought an eruption of volcano Mount Nyiragongo, near Goma, on the eastern border of the Democratic Republic of The Congo, also marking the Great African Rift. Television coverage of the rapidly advancing lava indicated a low-silica basaltic composition, the fluidity of which destroyed much of the city by fire or inundation.

1.4. Mangla Dam is heard from again

On September 30, 2002, President of Pakistan General Pervez Musharraf performed the groundbreaking ceremony of raising the level of Mangla Dam by 13 m. The project will be completed by the

year 2007 at an estimated cost of US\$ 883 million. Mangla Dam was completed in 1967, on the river Jehlum, under the Indus Basin Treaty between Pakistan and India. Originally, the dam had a gross storage capacity of 5.88 million-acre feet (MAF), but due to sedimentation, this capacity has been reduced to 4.68 MAF. The justification for raising height is to make room for an additional 3.1 MAF and an additional hydroelectric output of 1000 GWh/a. Mangla Dam is considered the fourth largest earthfill dam in the world and creates a lake that spreads over a surface area of 259 km². While the extension of Mangla Dam project will generate engineering geosciences work, it will also help in reducing the 24 MAF flood-water annual losses to the Indian Ocean.

1.5. Abu Dhabi urbanization

On the other side of the Indian Ocean in the Arabian Gulf, Abu Dhabi Municipality has initiated work in extending its Corniche area, 150 m inward from the current seawater defense wall. The last phase of the Corniche extension was in 1998, and for it, the city received international accolades and two international awards. The new extension is part of the comprehensive development plan for Abu Dhabi Emirate, to be fully implemented by 2010, including a number of projects to be carried out in cooperation with the United Nations Development Program (UNDP). The plan is designed to reduce pressure on the capital by developing and populating outlying areas.

1.6. Canada landslide initiative

Mass wastage is such a universal threat to human life and welfare that it sometimes becomes as ordinary to the citizen as risks associated with travel. Unfortunately, however, about each 1 or 2 decades, a strong mitigation initiative has to be mounted somewhere in the world. The latest contribution is that of Canada's Ministry of Natural Resources in its funding of the Geological Survey to launch the Canada Landslide Project. Dr. Peter Bobrowsky has been hired as head of a full-time staff of 11, to include a quantitative modeler and GIS specialist. These geologists will place national focus on slope stability, with confirmatory field work planned at a number of identified type

locales. While this is in motion, the group will hold provincial workshops and will fund cooperative ventures with agencies, industry and international partners. A new web site with significant outreach capacity is also being introduced for significant outreach capacity. Canada has a strong reputation for grappling with geoenvironmental issues as it used to wrestle wild bears on its frontier. Nothing but good can come of this venture, internationally.

1.7. One-time mining of endangered aquifers

We should have predicted that urban water demands eventually would arouse the interests of natural resource developers. That time has now arrived and the big money is about to plunder the long-noticed Pliocene-aged Ogallala aquifer of the American Midwest and the obscure Tertiary basin aquifers of the Mojave Desert of California. The Ogallala deposits do experience some recharge, but already the center-pivot well demand, placed in the 1960s, has placed this supply in a net deficit. Now Texas oil baron T. Boone Pickens has his eyes on supplying Dallas, TX, with Ogallala water. Off in the water-deficient California desert, the Metropolitan Water District of Southern California, eager to serve water even before asking for its consumer conservation, has attracted British entrepreneur Keith Blackpool who owns water rights around Cadiz, the historic Union Pacific rail siding. Blackpool has surrounded himself with prominent politically oriented Democrats, including former Interior Secretary and one-time geophysicist-turned lawyer Bruce Babbitt, ex-Governor of Arizona. The opposition is lining up behind the Sierra Club and Sen. (D.) Dianne Feinstein.

This is a one-time “no-brainer” consideration, but the long-term geologic implications are impressively negative, especially in light of the huge body of accumulated literature (since the 1950s) indicating that deep-draft water-mining produces consolidation-induced growth faults and disruption of the overlying saline-bearing stratigraphy. Something must be done quickly to martial the thousands of years of Southern California water basin expertise held by our senior professional engineering geologist colleagues who joined the great Class of 1950 at the California (then) Division of Water Resources, from California, UCLA,

USC, Stanford and CalTech. This was the crew that mapped, drilled, measured and delimited water basins like that at Cadiz and its neighbors.

Worldwide water export is taking on immense proportions. America’s three largest water supply companies have French and German owners: USFilter (Vivendi), United Water (Suez) and the historic American Water Works (RWE).

1.8. Arctic circle natural gas developments

Route siting engineers and geoscientists in Western Canada remain in a holding pattern for decisions to whether or not a large pipeline will be constructed to carry gas from the Arctic down to the southern North American markets. Uncertainties with respect to the potential for U.S. Government subsidies for the American producers and partnerships between the Canadian producers, the First Nations and the Canadian Federal government continue to cloud the issue. There is a consensus that gas will be transported down from the Arctic, but the location of the line is in doubt.

1.9. Keeping earthquakes in their proper perspective

For most practitioners, the most efficient method of keeping track of world seismicity is to take advantage of America’s National Earthquake Information Center web site (<http://neic.usgs.gov/eqlists/significant.html>). The deputy director of the Center is engineering geologist William K. Smith. The center tallies all identifiable earthquakes, but its “significant” list is comprised of those events that are generally above $\geq M 6.5$ and/or which create substantial havoc, casualties and damage. With this handy reference in mind, we have dropped our annual table of major earthquake activity.

Meanwhile, the newly renamed California Geological Survey (CGS) also has entered the seismic safety arena with a web site containing a routinely updated summary of Statewide seismicity.

Following this measure, CGS also promulgated its own guidelines for earthquake risk assessment, which has served only to fuel the debate between mathematically oriented probabilists and those of geological backgrounds who would base assessments of seismic threats and withstand-design mitigation on sound geologic evidence.

Stalwart among the determinist camp have been the Army of Corps of Engineers, the U.S. Bureau of Reclamation and the California Department of Transportation. These agencies have a strong institutional ethic to seek and employ actual historic seismic and geologic structural and fault zone engineering geologic mapping in their efforts to protect public health and safety.

Caltrans places its State seismic hazard map before the public and the professions at http://www.dot.ca.gov/hq/esc/earthquake_engineering/Seismology/seismicmap.html.

There are no secrets nor are there smoke and mirrors surrounding the Caltrans Seismic Design Criteria, which are available at http://www.dot.ca.gov/hq/esc/earthquake_engineering/SDC/SDCPage.html.

1.10. Leaning Tower of Pisa

Imperial College's Professor John Burland, after having been selected in the world competition to arrest the ongoing tilt of the Tower of Pisa, has apparently accomplished just that fact. Sixteen earlier concepts had been rejected. While the tower would not appear less tilted to most of us, the geotechnical instrumentation points to not only an arrestment of the tilt but a slight return toward verticality. The reverse motion has been caused by Burland's testing and computation-based assessment of the geotechnical properties of Tower foundation soils. Soil is carefully extracted from the off-tilt side of the tower by controlled drilling.

1.11. Reservoir sedimentation remains a critical concern

Periodically, this problem gains momentum and reappears to cause much consternation. Not only does watershed sedimentation often lead to quality degradation of the stored water, but of course the reservoir capacity is also steadily decreasing. Japan's Ministry of Transportation (MoT) has oversight authority over reservoirs managed by local government agencies, electric generation companies and the Water Resource Development Public, as well as the Japanese Federal government. MoT has completed a national survey and has pointed out that sand is being deposited in reservoirs at rates far faster than projected. Japan has 782 intermediate-scale dams, each impounding more than a million cubic meters. At 44 of these dams, about half

of the reservoir volume is now taken by sand. Another 124 have sand deposits occupying 20–50% of reservoir volume. Most of these dams were constructed for the purpose of electric power generation.

A comprehensive Dam Design Standard was established by the former Ministry of Construction (now the Ministry of Transportation) in 1957. The governing philosophy at the time was that dams should have a hundred-year life and that the reservoir would not be impaired in that time. Now the philosophy is being challenged and also the sediment in filling is causing some excess flooding where floodwater storage has been diminished by sedimentation.

Due to Japan's unique coastal conditions, the sand sediment formerly brought to the coasts by the rivers has diminished, and some sand beaches are now disappearing and coast erosion increasing where the wave energy is not moderated by beach sands.

1.12. Flooding in Central Europe

It is usually regarded that 2 centuries of hydraulic mitigation has protected most of the urbanized areas of the First World. Not so! Summer flooding of the Elbe and other rivers have cost Europe some \$20 billion. The effects of global weather fluctuations, or changes, however they may be viewed, are a warning to the profession that we must sharpen our skills in field assessments of areas subjected to potential flooding.

1.13. Japan halts some construction works

The Japanese government decided to stop construction at 92 dam sites after fiscal 1996. The main reason for this decision was an excess of stored water, due to a reduction in demand for drinking water as well as for industrial and agricultural use. Because of the reduced demand, the construction costs for these dams could no longer be justified.

The Ministry of Transportation in Japan has also changed its road construction policy from a policy of quantitative expansion to one of effective modification of pre-established roads. The Ministry reconsidered its old policy, which strove to extend road networks equally all over the country. The new policy encourages broadening of existing roads for relaxation of traffic jams and these policies will be finalized in fiscal 2003.

1.14. *Water resources of the Arabian Gulf*

Water is the most scarce commodity in the Arabian Gulf region. Three regional conferences addressed this problem in 2002. The Water Resources Division of the Kuwait Institute of Scientific research hosted a UNESCO International Conference on Water Resources Management in Arid Regions from 23 to 27 March 2002. An impressive array of hydrogeologists, gathering hydrologists, environmentalists, ecologists, water resources planners, modelers, managers, and policy and decision-makers gathered under one roof at Sultan Qaboos University, Muscat (Oman), from 25 to 27 March 2002 in collaboration with UNESCO, an activity that will continue this year as well. A follow-up 3-day conference also was convened at Muscat in September 23, under the sponsorship of Ministry of Regional Municipalities, Environment and Water Resources, UNEP, UNIDO, WHO and UNICEF. This was to commemorate the year 2002 as the year of the environment, declared by the Sultanate of Oman. From 6 to 9 October, a related international conference was held at Riyadh, Saudi Arabia, on Geotechnical and Geoenvironmental Engineering in arid lands. The conference was organized in collaboration with the Gulf Society of GeoEngineering and included 57 papers by 96 authors from 26 countries.

2. Future of the profession

We must presume that our profession is largely controlled by external forces, but that we can influence our own future through astute thinking and concentrated actions.

With this forward vision, AEG convened a 2002 Annual Meeting Symposium on *Visioning the Future of Engineering Geology: Sustainability and Stewardship*. Ten speakers and five panelists represented a total of 23 authors, dealing with challenges critical to the future of the profession. Convenor Robert E. Tepel found that no association has yet accepted or declared stewardship for the profession as a whole, and therefore their missions and visions are both limited and not suited to the task of creating the future for the profession. He proposed that AEG accepts the stewardship challenge. A proceeding's CD may be purchased from AEG headquarters.

3. Conduct of the profession

Again, the progress and machinations of government held heavy sway around the world influencing conduct of the profession. Where we are fortunate, we will have preplaced active members in roles of counsel or governance so that our story may be heard.

3.1. *Census of Canadian geoscientists*

In 2001, the Canadian Geoscience Council, a group representing approximately 10,000 geoscientists in Canada, went after the hard facts that define the greater profession in that nation. A census brought in more than 3000 responses as to age, gender, salary, education, level of responsibility, employment sub-sector and membership in provincial and national societies. It became apparent that geoscience in Canada is a male-dominated discipline but that the demographic profiles of the two genders will change slowly as retirements take place.

Canadian geoscientists have high levels of education, most at the master's degree in the public sector. Private sector professionals work mainly in the mineral and energy sectors, where higher degrees are not necessarily indicative of higher annual remuneration or greater responsibility. The census does not predict above-average rates of retirement in the next 10 years, but the minerals sector may suffer a significant loss of experienced personnel in that time frame.

Engineering Geologist Professor Dr. Doug Stead has been chosen President of the Canadian Geoscience Council. He is with the Department of Earth Sciences at Simon Fraser University in Vancouver, British Columbia.

3.2. *Government*

Government influences our profession through its regulatory policies, its services-procurement policies and on its social engineering programs. In 2002, all three of these influences were felt.

3.2.1. *Federal procurement of professional services*

A new move has emerged in Federal procurement circles to thwart or otherwise circumvent the Qualifications-Based Selection (QBS) requirements of the Congressional Brooks Bill of 1972. Members of the

profession generally are solidly against the continued moves of government to hire professional services at the lowest bid, based on the misconception that all professional engineers and geologists are created equal. Nothing could be further from the truth and we understand that again the consulting engineers have organized to resist the latest of these “bid-shopping” moves. No longer can we count on the strong support for QBS recognition of quality over price that once was at the center of the U.S. Army Corps of Engineers.

3.2.2. *Federal outsourcing of professional employment*

With 2002, a new phenomenon in Federal employment has arisen in the United States. We regard this as an unfortunate development and it is likely that it will be adopted in Canada and then in the EU. This is the replacement of permanent, career-type civilian technical positions in the military by “outsourced” positions filled by “Beltway Bandit” firms operating in urban Maryland and Virginia, but staffing at the far ends of the nation. This impacts our profession mainly in the environmental engineering and science support roles of military commanders of training and garrison bases in the Army, but this is soon to spread throughout the American military and elsewhere. The impact is clear in that career stability of the professions has been given another jolt.

The Republic of Ireland has created Science Foundation Ireland (SFI) to fund basic research as the basis for the national emergence of the Irish Republic as Europe’s bright center of manufacturing technology. Management is topped off by three American big-science types who hope to transfer the best of US science support to the new Irish base. Ireland, a young republic established in 1921, was a far-sighted early member of the EU 30 years ago. We do not know how this will cut for applied geology, but the base can only be a good omen for our Irish brethren.

3.3. *States and provinces*

California Division of Mines and Geology became California Geological Survey and launched the California Integrated Seismic Network (CISN) (www.cisn.org). Missouri’s Division of Geology and Land Survey became the Missouri Geological Survey and Re-

source Assessment Division as the legislature turned the agency ever more toward inventing its own cash support.

3.4. *Military geology*

By year end, the two most virulent dictators yet in power had become fully bellicose, and the stage was set for a reactivation of the Gulf War of 1991, pitting the American–European–Middle East coalition once again against Iraqi President-for-Life Saddam Hussein. Movement toward this engagement had been carefully routed through the halls of the United Nations, the Security Council of which had authorized the new coalition to undertake military action over Hussein’s continued indulgence in development and stockpiling of weapons of mass destruction.

On the Korean peninsula, dictator-son-of-dictator Kim Jung II (a two-man communist dynasty since 1947) had become fully outrageous in his reactivation of the North Korean nuclear reactors at Pyongyang. He then withdrew from the United Nations disarmament accord and was threatening to attack the token American infantry and combat-support forces along a portion of the western segment of the Demilitarized Zone (DMZ) directly north of Republic of Korea (ROK) capitol of Seoul.

Furthermore, the Israeli–Palestinian confrontation edged closer to outright warfare, with hit-and-detonate suicide bomb attacks on Israeli territory nearly by the week. Master world terrorist Osama bin Laden remained at large 14 months after his heinous destruction of the World Trade Center (WTC) Towers in New York City, 11 September 2001.

Resulting from these inflammations, the resisting forces had no other choice but to respond to the taunts and to do so with the maximum application of technologically superior weapon for their fighting personnel and all of the wide spectrum of intelligence-gathering techniques for the battlefield. Military geology represented that packet but the lid of secrecy was so tight as to leave us mostly in speculation.

Unclassified military geology has been a popular field of expertise for dedicated applicationists in the US and the UK, and their two national society engineering groups were again active in releasing two new books. The US group produced Reviews in

Engineering Geology, no. XIV, edited by Drs. Judy Ehlen and Russell Harmon, as “The Environmental Legacy of Military Operations. (Ehlen and Harmon, 2001)” From the UK, Drs. Peter Doyle and Matthew Bennett produced “Fields of Battle: Terrain in Military History,” published by Kluwer, and based on a conference held at the University of Greenwich in January 2000 (Doyle and Bennet, 2002).

There is little doubt that coalition combat will occur in the Middle East in 2003, and we will monitor military geologic input such to the extent of our ability.

3.5. *Geotechnical work*

The breach between large and small projects has grown immeasurably. We find it difficult to tract the major developments on the one hand, while small developments are so numerous as to be difficult to encompass with summary remarks.

4. Consultants

We remain enthusiastic about the role of consultants as cost effective sources of expertise over specialty problems and, certainly, for owners and agencies that cannot justify specialists on staff. There is a huge endemic problem abuilding for consultants and that is the increasing degree of set-asides of public sector project awards for individuals and companies considered to be somehow disadvantaged. The least defensible of these special situations, of course, are the not-for-profit institutes that engage in direct competition with the consultants. As well, the First World has enacted laws setting aside work for categories of individuals that are routinely subverted by sham ownership and titles. Result: hard times for the consultants and a string of corporate failures are noted below.

4.1. *Employment situation*

Worldwide, there is one unique solution to maintaining one’s employment security, that is “getting a job tomorrow, when you find you need to do so today.” That is to have developed all of the skills that we all know about: technical competence, managerial expertise and the ability to market professional

services. Year 2002 again proved this out. An additional sweetener for engineering geology, of course, is to secure not only geological but also engineering licensure. The market for these triple-qualified members of the profession was brisk!

4.2. *Architectural/engineering (A/E) firms*

Two realms of activity were prominent in 2002: the area of small-to-medium practice and the world of struggle between the giants. A/E firms nearly all now have strong environmental practice commitments. A sickness has crept into large practice, that of unconstrained growth and subsequent toppling failures. Like the dinosaurs, the feedstock problem is endemic, keeping a large corporate infrastructure fed while dealing with the bid-shopped marketing environment that has now pervaded our discipline. As long as “bigger” is deemed “better,” the growth then death of firms will continue. We believe that it is important to report the casualties as a matter of history and for the overall sensitivity of our readership.

Bechtel, still secure in its family ownership, has taken the positive move of close inspection of the present-day worth of the universities who nominally supply its entry-level professional staff. Gone are the days of the Chief Geologist, but fortunately, Peter Yen has been identified as the discipline leader for engineering geology and hydrogeology. Yen is launching a program of evaluation of North American and UK geology departments with the goal of developing an internal rating system of which sources are most valuable to the company in terms of its supply of bright and talented new blood. We applaud this move as it sets the traditional and emerging departments on notice of the new sophistication inherent in the A/E firms.

4.3. *Other major A/E disruptions*

On the heels of the economic impact of the World Trade Center attack (11 September 2001), the US energy giant ENRON collapsed in January. The ENRON impact was totally negative and extended far beyond the scandalous fraud of its own employee investments, with the collapse rippling through the energy, construction and consulting engineering industries. Much of the damage traveled on the tsunami of bid-shopped contracts warped by late

payments for services and then bankruptcies (<http://money.cnn.com/news/specials/enron>).

Another aggressive conglomerate, URS, San Francisco, now carrying both of the most senior geotechnical firms in America, Dames and Moore and Woodward-Clyde Consultants, spent the year amid rumors of financial straits, a situation that had not reversed by year's end. The board chairman blamed the situation on the widely recognized tax deprivation among the cities, Provinces and States, a worldwide condition leading to financial constraints in the engineering consulting community worldwide.

4.4. *Geoenvironmental firms*

Geoenvironmental firms generally have the constituency for survival in hard times. Many of the firms operate as if they were professional engineers, yet their ownership does not have such participation and such firms cannot legally advertise or operate as “consulting engineers” under the North American licensure laws of the States and Provinces. Their levels of competence and sophistication are as broad as the imagination. Unfortunately, much of the clientele is incapable of making accurate judgements of the ability of the smaller firms to serve client needs.

4.5. *Individual and small practice*

We noted during the year that the greater Houston area of Texas had become the scene of high activity in small firms. One of the attractions was incidental damage to home, driveways, roads and underground utilities from the area's famous growth faults. Around Houston, the small firms are known as “boutique” consultants.

4.6. *Complicity in bid-shopping*

Meanwhile, we understand that purchasing agents for industrial clients continue to gloat over their successes in pitting consultants against each other in bid competition. Surely, the goose is about to be sacrificed, but more birds step forward for slaughter. The next stage of bid-shopping is the new industry policy of multiple-pooling of environmental service work by groups of industrial clients. Among the chemical industry, Ashland and Dupont are now noted

for having signed a non-binding procurement agreement to further bash the consultants with combined bid-shopping power. This less-than-brilliant scheme should net a few more financial failures among the environmental service consultants.

One of the remaining larger players in the bid-shopped consulting environment is TRC (Windsor, CT), the modern no-name descendent of Travelers Research, the one-time subsidiary of the Insurance company.

The unfortunate outcome is that industrial clients presume that the consultants will do anything and take any action required to gain more business. In the end, this ruinous policy of providing insufficient funding for site and waste characterization has two direct outcomes. Firstly, professional staff members and middle managers are forced to work long, uncompensated overtime and bear the burden of delivering project completion against the insufficient bid-shopped budgets brought in by the marketers and certain of the executives. Inherent in this delivery is all manner of short-cuts, use of marginally competent field staff and less than full disclosure of actual field conditions. Secondly, the already overworked staffs of the environmental compliance agencies are faced with less than candid assessments of actual hazardous waste and geologic pathway conditions at uncontrolled hazardous waste sites (UHWS). Peer review, just a costly add-on, remains unperformed. The taxpayer, citizen and the environment suffer the long-term burden of deferred health and environmental degradation risks.

An accessory evil embraced by the bid-shop consultants is their shift from permanent professional staffs to “outsourced services,” the weasel term for temporary staff provided by “job shops” for which the unfortunate youth and above-fifty members of our profession are faced with hourly pay without social benefits. These assignments must, of course, be kept at less than 40 h a week in order to circumvent the protection offered by national employment regulations.

4.7. *Corporate environmental deaths: RIP (Rest in Peace)*

One of the unfortunate signs of progress are the passing of A/E and consulting firms with which we

have become familiar, and in all too many cases, prior employers. The diagnosis usually is the same: growth to protect position and to provide for valued professional staff, then passage of a point of sustainability and the inevitable takeover by the competition.

4.7.1. *IT corporation (1927–2002)*

In 2001, we witnessed the passing of the venerable Stone and Webster Engineering (established in 1889). This year's first corporate death was that of IT Group (Monroeville, PA), filing for bankruptcy in mid-January. IT's death can be ascribed to the gross effects of responding to bid-shopping (priced competition) as frequently noted in these reports as a disease of modern professional practice.

IT, lately known as the International Technologies, counts its heritage to the 1927 establishment of the Industrial Tank Company, of Richmond, CA. From its humble origins at Richmond, CA, the firm took on an aggressive takeover and merger path about 1985, absorbing many high-profile regional and national firms. The original IT was a prominent hazardous waste discharger in the pre-RCRA years, but slowly morphed into a highly successful environmental cleanup firm. The modern IT Group was caught up in the "bigger is better" syndrome and acquired many firms among its own competition before bleeding to death from participation in "low-ball bids" for professional assignments. IT management siphoned off cash income from environmental remediation to leverage "premium cost" purchases of higher-margin subsidiaries that did not deliver the anticipated profits. Shaw Group, Baton Rouge, LA (savior of the remains of Stone and Webster), was the successful bidder at bankruptcy. At year's end, Shaw had expunged the "IT" name from the operation, which had become known as Shaw Environmental and Infrastructure.

4.7.2. *Hanson engineers (1954–2002)*

In the American Midwest, Hanson Engineers was the respected off-campus arm of the geotechnical engineering faculty at the University of Illinois. Founded in 1954 by Professor Walt Hanson, still alive today and remembered also through from the text by Peck, Hanson and Thornburn, the firm was overly buffeted by the transition from geotechnical to geo-environmental. Most of the damage came from its involvement in the attempt to cleanup at the Taylor-

ville, IL, former manufactured gas plant, which became the target of a neuroblastoma cancer litigation in the name of a few of the town's children. In February, the judgment against Central Illinois Power System (CIPS) was upheld by the State Supreme Court just as Hanson was taken over by Professional Services (PSI), the historic leading national proponent firm of priced competition for geotechnical services. The firm is now known as Hanson Professional Services.

We began to receive rumors at the beginning of 2002 that environmental service giant URS Greiner (San Francisco), now the home of the fading image of Dames and Moore and Woodward-Clyde Consultants, is under the gun by its acceptance of impossible bid-shopped budgets.

4.7.3. *Law Companies Group (1947–2002)*

Known mostly by what it became after acquiring the partnership of the late Professor George F. Sowers, at the time he completed MS studies with Karl Terzaghi at Harvard University and joined the soil mechanics faculty at Georgia Institute of Technology in 1947, Law became history in January 2002. The transition was by way of a merger into the shadow holding company MACTEC, of Golden, CO, itself unknown for participation of its senior engineering geological staff in professional society undertakings. George was a "giant" (taken from the title of his ASCE Terzaghi Paper) and so was Law Engineering.

4.7.4. *Ground engineering—American southern states*

A defection from the old Law Engineering and Testing organization, Ground Engineering merged with Atlanta Testing Labs in and then morphed into the new QORE Property Sciences and remains in the general geo-environmental business that has, of necessity replaced geotechnical engineering, on a worldwide basis. QORE remains headquartered at Birmingham, AL.

4.7.5. *Arthur D. Little, Cambridge (1886–2002)*

Claiming to be the world's first consulting firm, founded in 1886, ADL employed 2000 people in 30 countries, from its Cambridge, MA, headquarters. ADL never had a geological staff as such, but was adroit at identifying geological expertise for relevant participation in its projects, such as the 1978–1979

siting and conceptual designs for what was to have been a state-of-the-art (also defined by the project) steel mill at Conneaut, OH. U.S. Steel was the client and its own bankruptcy cancelled completion of the project, conducted with a high-level of engineering geologic participation. ADL was auctioned off in pieces, including the separate sale of its own name in April 2002.

4.7.6. TAMS

Reduced from one of the few top dam builders of the post-WWII era, TAMS Consultants (Formerly Tibbets, Abbot, McCarthy and Stratton) has been taken over by Earth Tech, the highly successful North American representation of the Dutch shadow holding company TYCHO. With the sale, TAMS moved from New York City to Long Beach, CA, which affected 440 employees in 12 worldwide offices.

4.7.7. EMCON (1964–2001)

We recall that EMCON was truly the first multi-talented environmental consulting company, founded at San Francisco, CA, by engineering geologist Peter Vardy. Vardy had all the necessary talents and built the firm even beyond his own imagination and then sold it and went off to guide the original Waste Management (Chicago) toward its excellence in employing qualified engineering geologists to develop and maintain its landfill regulatory compliance. Now we note that EMCON/OWT Solid Waste Services has been acquired by the burgeoning Shaw Group (Baton Rouge) as an operating unit of Shaw newly purchased IT Group, of Mahwah, NJ.

4.7.8. Weston environmental solutions (1957–2002)

We have a soft spot for the venerable Roy F. Weston (founded 1957), which like Camp, Dresser and McKee (CDM, established 1947), were the two premier granddaddy environmental consultants, worldwide. Weston this year completed a sweeping reorganizational buyout from within, complete with a name change. We grieve for the many top-level corporate officers (including several engineering geologists) who were sacrificed after the untimely 1989 cancer death of President Tom Swoyer, the affable son-in-law of yet-active founder Roy F. Weston (now aged 92). The Weston family retired from active control of the company, \$51 million the richer.

4.7.9. Geraghty and Miller (1946–2002; late of ARCADIS)

We recall that G & M was the second American hydrogeological consulting firm, after Leggett, Bra-shears and Graham, created in the late 1936. Ex-USGS founder Ellis Geraghty left the firm in the early 1980s, for retirement, leaving co-founder USGS alumnus David Miller to follow his own destiny of corporate expansion through a general stock issue and some 50 offices nationally. This was acquired in 1993 by Heidemij NV of Arnhem, Netherlands. Erasure of the old name was completed in 2002.

Duke Engineering Group's promising gas works and groundwater remediation group has been sold to Interra, also of Austin, TX, where many of the innovative staff continue to ply their insights on surfactant flooding to some of the PAH phases found around former manufactured gas plants.

4.7.10. Halliburton

Halliburton, familiar to us all as the major geophysical oil-field exploration contractor and sometimes environmental survey participant, has been charged with \$30 million for health-based asbestos liabilities associated with its acquisitions, namely, Dresser Industries. The damage hardly affects the balance sheet here.

4.7.11. ABB-combustion engineering

A major actor in US environmental remediation, for a 10-year period, Swiss-based ABB has seen its old-American Combustion Engineering (CE) fade to obscurity. ABB was a constant favorite for placement of engineering geologist graduates with groundwater capabilities. Most of the hundreds of young people so placed have scattered to the wind in the profession, well trained for their years at ABB.

4.7.12. Earth Tech

Here is an unusual story. The original company, FUGRO USA was founded in Los Angeles on the spur of the 1971 San Fernando earthquake, by a small cadre of dissenters from the established firm of Converse-Davis, of Pasadena, CA. The firm operated on a Dutch shoestring investment and employed aggressive marketing. It soon migrated to large Federal contracts and earned a reputation for hire-and-layoff employment. After a meteoric rise, the original partners fell

out and later the founding president suffered an internal takeover in the early 1990s. In 2002, the firm bought the venerable A/E dam-building consultant TAMS, of New York City. Earth Tech's transition from a specialty geotechnical–geological consultant to an international planning and A/E firm was quickly brought about by its early 1990s takeover by its marketer-president Diane Creel who has grown the company to its present size and form. There is a shadow financial relationship between Earth Tech and the Dutch investment giant TYCHO. We no longer recognize the Earth Tech professional staff for participation in engineering geologic professional society activities.

4.7.13. AMEC

Sensing the location of the bulk of its highly successful emergence in the US, UK's AMEC, formerly of Canada, has set up North American headquarters at Phoenix, AZ, and has now expanded its marketing into the American Midwest. As with many modern geotechnical firms, AMEC has appeared on the Interstate-93 highway relocation as a subcontractor now speeded up for considerations of protecting the great Hoover Dam from terrorist attack. AMEC is constructing rock retention systems in connection with 30-m cuts on approaches to the new four-lane, 1200-m-long bridge that will pass traffic over the 270-m-deep chasm between the States of Arizona and Nevada. Most of the rock involved in good quality tuff and basalt, it will be the joints that control the rock retention.

4.8. International market

In the early 1980s, it was widely predicted that multinational corporations would come into existence to control most of the deployment of engineering geologists on soil foreign to their origins. This situation has come to be in 2002 and it abets the bid-shopped market for engineering services.

4.8.1. Enter the Indians

India declared several years ago an orchestrated attempt to produce a broad spectrum of “computer engineers” and this has come to be at two levels. Beyond the expected pressure of Indian nationals to emigrate to the first-world nations, Indian financing

has been brought to bear in the United States, the minority advantage laws of which were devised to promote economic achievement among its own historic minorities, native Americans, Hispanics and Afro-Americans. Now this unguarded door has been found by the financiers of India who have caused legally fostered and legally advantaged firms to sprout in the US, and no doubt, in the European Union. In America, the charade employs 49% native or naturalized ownership and fronts its marketing with employees judged by the market to be “American” nationals. The Indian shadow firms receive many advantages in gaining Federal and other public sector contracts and then farm the intellectual work product out to engineers and technicians who live in, and remain citizens of, India. Meanwhile, those firms concentrating on fields such as information technology (IT) and geographic information systems (GIS) undercut the home market with low-bids in today's rampant bid-shopped market. This is especially rampant with “Beltway Bandits” of Washington, DC, who compete for Federal contracts under bid-shopping procurement sanctioned by the Congress. Meanwhile, we understand that marginally qualified American technicians demand \$60,000 yearly salaries on the inflated urban Virginia economy, while better-qualified Indians are pleased to have \$2000 on their economy.

Even with their low-bid tactics, these pseudo-minority firms are becoming rich while learning the American way, including “living high on the hog.” We understand that massive English-speaking programs of instruction are underway in Russia and in China to prepare their citizens for this venue.

4.9. Employment situation

By year's end, there was the usual general shortage of geologists and engineers in the profession who could provide the usual formula: competence, management and sales ability. These people will never go without good work prospects. ASFEE canvassed its geoenvironmental consulting firm membership to learn that some 80% of firms claimed that business had increased or was doing no worse than for year 2001.

An important facet in the remuneration equation for private sector professionals remains the nagging question of payment for overtime. Even the most advanced (we hesitate to use the term “liberal”)

employers, those who pay for overtime, still insist that the rewarded hours be chargeable, in that a client is paying for the time. In this sense, *CE News*, a private sector journal, reports (June 2002) that 39% of respondents to its recent salary questionnaire claimed to receive overtime pay.

4.10. ASFE provides self-help to the consultants

ASFE is the Association for the success of professional firms engaged in improving the natural and built Environments (www.asfe.org). Aggressive unionizing activities are under way in Illinois and California. Reports indicate Alabama, Minnesota, Tennessee and Washington are next. In Illinois, at least, union officials have been quoted as saying they intend to organize even field engineers. ASFE's Labor Relations Task Force is assembling resources. ASFE has also released a position paper.

5. Litigation

It has been a long North American tradition for suitably prepared and experienced applied geologists to provide expert testimony in litigation over issues affected by geologic conditions. This role has not diminished in our time and continues to provide essential information for the court. One matter has changed, however. That is the role played by depositions, the recorded pre-trial testimony and the fact that with year 2002, there was a distinct recognition that most litigation is played out through mediation (AKA arbitration or Alternative Dispute Resolution) conducted by rules specified by the court.

Professional geologists remain yet as important to the process as ever. In fact, within our profession, the profound embrace of the concepts of Conceptual Geologic Model, Site and Waste Characterization and Cause-and-Effect constitutes the optimal manner in which our clients can present the substance of their case.

For those of our profession who are employed by consulting firms, the first personal opportunity to provide expert testimony generally comes as a project assignment from marketing efforts of the firm. For those who are not so employed, particularly solo practitioners and applied university faculty, initial

opportunities are not so regular or frequent. Not all practitioners are suited to the demanding breadth and depth of experience nor to the high psychological pressures of opposition deposition and trial testimony. Law firms are nearly oblivious to most marketing and prefer strongly to gain personal references from other lawyers.

Hence, for members of our profession, if one is interested in making an appearance for recognition as a technical geological expert, breaking into the work is difficult. Perhaps the best approach is to become an Associate Member of the American Bar Association and to begin to take on relevant volunteer committee work, during which efforts your talents will be exposed for review.

5.1. Liability risks intensify during a slow economy

It is true, as grizzled ASFE veterans will aver: as the economy slows down, liability risks become far more severe, because owners', contractors' and others' budgetary shortfalls are that much more difficult for them to deal with, therefore clients look to limit their profit shortfalls through litigation.

6. Universities

As a profession, our links with the universities seem more and more strained each year. Around the world, legislative bodies are short-changing the public universities, preparing to place decreased tax dollars elsewhere, usually in the name of direct social welfare programs.

6.1. State-sponsored research universities

There are basically three types of universities: private vs. public and within public, research universities and teaching universities. Among the private campuses, there is a simple dichotomy, large and wealthy vs. smaller and poor. This is not to imply that the first public category (such as the University of California) does not have a strong teaching role, but that it is perhaps concentrated at the graduate level. The second category (such as the California State Universities) is a separate system, emphasizing twice as heavy a teaching load for faculty.

Year 2002 saw the beginning of truly hard times for the state research universities. Standing without large endowments and burdened like all universities everywhere, with fat cadres of nonteaching doctoral-level administrators, these campuses have been hit with tax-based income shortfalls. Legislatures everywhere are cutting funds drastically and campus leaders are clueless about where to cut, as they are swaddled with comfortable, nonproductive administrative fat.

Letter pleas have gone out to the alumni to “save the alma mater,” replete with plans for paring down operating expense, but never the mention of laying off the administrators!

Morphological changes in applied geology continue to occur. A surprising twist is the time-honored and well-endowed mineral engineering program at Columbia University (New York City) in its search for budget-minded relevance. Newly minted from the early 20th century, Henry Krumb endowment is a Department of Earth and Environmental Engineering. “The Krumb Chair is a prestigious char endowed in the 1960s by a prominent mining engineer.” (www.columbia.edu).

As public university funding decreases, university management becomes more and more resistant to paring the overhead of administration. We have seen how the administrators look to the faculty to magically raise the shortfalls in funding. In 2002, distraught Deans were turning to the alumni to raise funds trimmed by legislative bodies. Expensive fund raising consultants continue to devise more and more means by which alumni are tapped as patrons; a policy that has been present for over 20 years but which has dramatically increased. The latest scheme is the incredible shrinking year, in which annual fund drives now appear at frequencies of 9 months and new names are assigned to individual fund drives, thus confusing alumni donors to make additional pledges in the same year.

While the administrators are preoccupied with flogging the faculty to ever-higher levels of performance, and begging for money from alumni, graduating seniors must face the bid-shopped downside of marketing their services as entry-level geologists.

One new opportunity is herewith noticed, to make up for the negative side of learning under those faculty who have not had the energy or concern to develop

employment contacts within the profession. Next to personal contacts gained from faculty members, the next step is to visit the web to identify and learn of prospective employers in areas of geographic interest to the graduating geologist. Of course, any university worth student tuition will allow graduating seniors to advertise on its web page, but then, you are taking the same path available to your entire graduating class!

6.2. *New geological engineering program in Pakistan*

The University of Engineering and Technology, Lahore, has moved to introduce a first ever undergraduate geological engineering degree to Pakistan and to the Middle East. Currently, a few institutions offer graduate programs in Engineering/Hydrogeology (e.g. Punjab University, Lahore, University of Karachi, QA University, Islamabad). It is a 4-year degree program sharing its first 2 years with mining engineering. The first graduates are expected by 2005.

Similarly, graduate programs in Water Resources Engineering (Department of Civil Engineering) and Hydrogeology (Department of Earth Sciences) have produced the first batch of graduates at Sultan Qaboos University, Muscat (Oman). The program has already been established at the other regional universities, namely King Fahad in Daharan and King Abdul Aziz at Jeddah, Saudi Arabia. Kuwait University has added graduate program in Environmental Geology to cater to the growing demand of Environmental Geologists. All of these universities have substantial equivalent ABET programs in engineering disciplines and the new one to join the ranks is the Middle East Technical University in Ankara, Turkey. The university received ABET certification in Geological and Environmental Engineering in 2002. Another activity worth mentioning is the opening up of the Petroleum Institute in Abu Dhabi. In collaboration with the Colorado School of Mines, Golden (CO) and the Abu Dhabi National Oil (ADNOC), the Institute has started classes in Petroleum Geosciences and Engineering and has plans to have its own independent campus in the near future (not according to geological time scale).

6.3. *Restructuring of Japan's national universities*

There are 98 national (Federally sponsored) universities in Japan. A national restructuring policy was

implemented in 2002. Changes will be forced by focusing of national funding. Inherent to the new policy will be a sweeping program of integration and economization of major courses of instruction, done to achieve efficiency and to discourage duplication. The result will be a sharp cut in the number of national universities, which are those selected to receive Federal funding.

An “Independent Administrative Agency” will apply management methods proposed by experts from private companies. Two of the tools likely to be used to screen the universities favored for continued national funding will be

- The appointment of specialists outside universities to assume university managerial positions.
- The introduction of a new personnel system, which will evaluate faculty ability and promote on achievement.

We hope that true and relevant research will not be confused with grantsmanship (faculty forced to perform as salesmen for raising money).

Selection of “Top 30” universities in Japan will be encouraged, through competition, to be to be the best level in the world. A third party evaluation team will be named. The “Top 30” concept also was renamed the “Center of Excellence (COE) in the 21st Century.”

- The introduction of an evaluation system conducted by the third party will include participators by specialists and private citizens.
- Public offering of the evaluation results to members of the professions, including societies, students, industry and special-interest promotion groups.
- Selective distribution of Federal funds according to the evaluation results.

The Japanese national plan is to shift the national universities away from national administration to governance by an independent agency. An implementing bill will be submitted to an ordinary session of the Diet in fiscal 2003. All national universities will shift to the “Independent Administrative Agency,” to function as separate campuses of one university in fiscal 2004, at the earliest. Approximately 1,200,000 faculty staff will become “nongovernment employees.”

Financing of the agency and its COE campuses will come from a block grant from the government, but the government will not direct the agency on how to use the budget. Each university will retain the right and the burden of internal decision-making, but the third party review will determine its successes, its campus support budget and will adjust requirements to remain in favored status.

Each of the national COE universities or competing candidates will maintain 6-year plans, including a midterm plan that includes such substantial matters such as numerical achievement values as targets for competition. The degree of the achievement of the midterm plan and the level of the research results will be evaluated by the “Evaluation Committee of the National University” (tentative name). The government will use the evaluation results to select the budget distribution of the Agency (University).

Clearly, the western educational management traditions are not meeting the financial exigencies of today. We hope that Japan, which has forever changed the nature of automobile manufacture, will be able to demonstrate ways essential to saving the public research universities.

6.3.1. Education for geological engineers in Japan

Two programs are selected for the Japanese Accreditation Board for Engineering Education’s (JABEE) trial examination, by taking into consideration the strength of its desire for acceptance and its degree of preparation.

These are the Department of Geosciences, Faculty of Science, Osaka City University, and the Department of Geography, Faculty of Science, Tokyo Metropolitan University.

6.4. External resources for educators

Most university faculty have been trained by their administrators that the words “research” and “resources” are dually defined as bringing in off-campus money for the glorification of the management. For those faculty who still are honored for the quality of their teaching, the National Groundwater Association has added “Educator Resource” pages to its web site (www.ngwa.org). Though there is no glory (money) attached, faculty can pick up much of relevance for

their primary calling, teaching our professional replacements.

6.5. Open courseware initiative

In our 7th Annual Report (2002, p. 61), we spoke of this new development at MIT. We are now pleased to have further insight into the initiative, as prepared by Professor Herbert Einstein of the MIT Civil Engineering faculty.

‘As with most universities, MIT is faced with the great potential and equally great challenges problems created by Information Technology. Many faculty members, including this writer, have been making use of IT to provide broad and current homework assignments, reading assignments. Another promising IT application of IT is student-teams can jointly solve practice-related problems. Clearly, distance learning is another aspect of this information and communication revolution. These advantages are opposed by the dangers involved in easy and uncritical access to information. Nevertheless, it is a fact that this computer-based information is available. MIT believes that it meets the IT challenges by spurring its faculty to move toward providing not only course notes but the best accessory materials and then release the individual faculty member to overseas and stimulate the learning process. We will make the whole thing available to everybody worldwide! This is OCW.

Although voluntary, there will certainly be implied pressure to participate which in turn, and as mentioned in the 7th Annual Report, will make it impossible to use the same teaching for decades. The sharing of new teaching and learning technologies or methods with colleagues will be another very positive consequence. This pressure and opportunity to innovate will also make it unlikely that faculty will be replaced by machines. On the other hand, simply becoming passive users of material developed elsewhere rather than being actively involved in the teaching and learning process is a dangerous possibility. MIT recognizes these challenges and will take the responsibility of providing an exemplary approach to the proliferation of IT.’

6.6. Distance learning

Successful practitioners still must face the option of a master’s degree for full access to career opportunities.

It had to happen sooner or later... an MS in civil engineering is now available at the North Carolina State University via the internet. An additional pseudo-enhancement for the program is that “eligible” students can patch together individual study plans from eight selections of available courses, probably without any other interaction with the faculty (www.ce.ncsu.edu/distance). No doubt the administrators will be handed salary increases for this... .

As in the past, the University of Wisconsin’s Solid and Hazardous Waste Education Center aggressively reaches out to practitioners across the country. This program is called “Landfill Independent Learning Correspondence Course” at the bargain cost of \$149 (oleary@engr.wisc.edu).

In our judgment, the finest value, worldwide, in distance education are the 1- and 2-day weekend topical technical sessions offered by The Geological Society at London and also within its regional sub-units.

7. The environment

There is no denying that our practice has been forever changed by the opportunities before us in the reality of environmental protection. In fact, this arena is just a grand showcase for our traditional *site characterization* methodologies, to which, of course, we must add an additional term, making *site and waste characterization*.

7.1. A wearied USEPA

Eager to show that the Bush administration had not “pulled the plug” on environmental remediation, USEPA Region VIII released its 10-year \$100 million-dollar cleanup plan for heavy-metal copper mining-waste sediment along the nation’s longest (nearly 200 km; Butte down to Missoula) SUPERFUND NPL site, along the Clark Fork River. Responsible Party ARCO (formerly Atlantic Richfield) eager to exploit

the Bush Administration as friendly to industry was being less than cooperative as the acquirer of the original mining companies at Butte and Anaconda. Lead environmental intervenor, the Clark Fork Coalition essentially was pleased with the plans, which calls for removal and secure high-ground land-burial of 167 acres of shoreline. Not yet addressed is the fate of more than 6 million m³ of heavy metal-sediment trapped in the ca. 1908 Milltown Reservoir, just upstream of Missoula. This plan was due to be released at year-end.

7.2. States and provinces

By year-end in North America, the terrorism-affected economy remained sluggish and non-Federal tax incomes of the States or Provinces was off target and causing recessions in environmental programs. This, of course, represents a goal achievement by the terrorists.

Driven by the negative incentive of reduced taxation income, the State of New Jersey was offering early retirement incentives to its already stretched Department of Environmental Protection (DEP) staff. As with other States, these departures remove the most seasoned remedial project managers as well as funds for State-Lead site and waste characterization.

7.3. Solid waste

“Ash and trash” (solid waste) landfilling remains an area of intense activity but difficult to draw sweeping conclusions over trends and magnitude. As in the past, most North American landfilling comes by expansion of existing facilities, in an effort to escape *Not in My Backyard* (NIMBY) protests over new landfill sites. Northeastern States continue to send their solid waste west and south.

Receiving landfills continue to expand in size (local opposition prevents new landfills) and also to open as reclamation measures in the abandoned strip mines of Ohio, Pennsylvania and West Virginia. In Virginia, which takes much of New York City’s trash, landfill expansion is being allowed to be constructed below the static groundwater surface and employs double composite liner systems. When starting from below the ground surface, the operator gains tremendous benefits in expanded airspace, at huge tipping

fees. With trash in place, a favorable equilibrium comes into play and, in some cases excess hydraulic pressure outside the liner is seen to defeat occurrences of leakage and outflow of leachate, especially under the free-draining conditions of the double liner.

Solid waste management, dealing with garbage and other nonhazardous residues of society, remains an excellent career employment for engineering geologists who wish to practice at the BS level. Simply stated, this waste management problem is not going to go away.

By early 2002, a million tonnes of steel had been cobbled from the wreckage of the Al Quaida terrorist attack on New York’s World Trade Center. Cleanup may come in early and considerably under the estimated \$7 billion cost. The steel is considered tainted by the 3000 deaths and has been sent to China and India for recycling. New York City is withholding enough of the scrap to create a memorial to those murdered by terrorists on September 11th.

In 2002, the former number two American waste giant, BFI Industries, disappeared from corporate view, leaving its landfills and familiar dark blue trash containers in sight. We understand that BFI is embedded within the new Waste Management of Houston, TX, not to be confused with the original Waste Management of Chicago. Just as the original WMI royal purple color and fletched arrow logo has been replaced with the orange-yellow and green motif, so has BFI vanished. Most regrettably, the truly admirable corporate geological and environmental engineering staffs of both companies, known by their personal names throughout the profession, were fired in 2000 and either have not been replaced or their stand-ins now are either noninvolved in professional circles or otherwise unrecognizable as professional entities.

As a result of the consolidation, Allied Waste Industries (Scottsdale, AZ) and Republic Services (Fort Lauderdale, FL) now occupy positions two and three, also without national visibility and recognition of their appropriate geological and environmental engineering staffs.

7.3.1. Fresh kills remains only in memory

Fresh Kills, once the Guinness World Record landfill (since held by Seoul, Korea), on Staten Island, NY, was closed in 2001, to receive only the residual demolition wastes from the World Trade Center.

New York City Mayor Michael Bloomberg, in 2002, unveiled his alternative to transport 10,000–13,000 tonnes per day of trash through reactivation of the City's eight derelict marine transfer stations in the four boroughs. Sealed metal containers, 6.5 m in length, will be used to move the garbage to trucking ports and haulage to Virginia and other receiving States.

7.3.2. *Ohio considers new landfill*

Amid protests from environmental groups, the Ohio Environmental Protection Agency (EPA) has issued preliminary approval for the 140-ha greenfield Ridge Landfill in northern Tuscarawa County that would handle up to 3000 tonnes per day, or a total of nearly 74.3 million m³ of trash. Typically, environmental groups are seeking to block this outstanding and refreshingly responsive move for a State to accommodate its own refuse rather than to ship such out of State. Ohio's largest scrap tire dump, in Deerfield Township, has been cleaned up after 559,376 tires recently were hauled off for shredding and recycling for their organic chemical content.

7.3.3. *European waste management in the US*

On the heels of its successful entry into the American water supply market, Vivendi (France), through its Montenay Power (US), has taken over four American waste-to-energy facilities on the east coast. Vivendi now operates 10 such American facilities and makes good use of the thoroughly European ISO quality assurance program, which were not otherwise to be lagging in the States.

7.4. *RCRA enforcement*

The Federal Resource Conservation and Recovery Act (RCRA of 1976) remains the worldwide standard for managing all manner of wastes, solid, special and hazardous. Disposal sites require completion of a comprehensive site characterization and must adhere closely to the conditions written into their legal "permit" to operate. For the hazardous waste component, EPA has issued a new reference manual (USEPA, 2002) complete with CD-ROM, an essential reference for many of us in practice.

Wastes from the anthrax terrorist contamination of late 2001 in the eastern US was largely incinerated in January, by American Waste Industries at Norfolk,

VA, in an agreement allowed by the Virginia Department of Environmental Quality.

7.5. *"Brownfields"*

"Brownfields" is an environmental term gone international. Virtually all nations make use of the term to distinguish blighted urban industrial areas from single uncontrolled hazardous waste sites (UHWS). The term is American, as explained in our 3rd Annual Report (1997, published in 1998). Politicians love the premise of Brownfields as applied in the US, for a paltry grant of \$200,000 is awarded to competitive cities for the purpose of stirring up a storm of grassroots clamor for the remainder of the cleanup funds to come from the Statehouse (Davis, 2002).

In January 2002, President George W. Bush went to the Congress with a request to double the Brownfields budget for application in 2003. Bush seeks \$102 million more than the \$98 million Congress appropriated for 2002. This law was signed 11 January.

In December (2001), Congress also approved an additional 5-year program of \$250 million per year to state and local governments and Indian tribes. The cleanup goal here is to work on the remaining estimated 450,000 polluted industrial sites in America. We are doubtful that this program will go anywhere beyond raising toxic dust. Twenty percent (\$50 million annually) is allocated for administrative costs, which means again that the Congress is engaged in its usual "pork barreling."

A new bill, signed by President Bush, provides Federal liability relief to prospective purchasers of Brownfield properties. The Brownfields Revitalization and Environmental Restoration Act of 2001 (BRERA) modifies CERCLA to encourage Brownfields development by providing Federal liability relief to prospective developers and follow-up purchasers of Brownfield properties (note: when capitalized, Brownfield refers to a UHWS receiving some sort of Federal funding toward redevelopment).

7.6. *Leaking underground storage tanks (LUST)*

USEPA lifted 40 pilot projects out of the LUST category and awarded up to \$100,000 each to foster Brownfield cooperative remediation where the leakage was deemed corrective outside of the SUPERFUND

program, which excludes such expenditures. This action shows that the executive branch of government is bucking the Congress in an attempt to make progress where local funds might be contributed.

7.7. “Tiered” risk assessments

The State of Illinois was first, back in 1996 to develop a cook-book approach to cleanup of petroleum hydrocarbon spills, as Tiered Approach to Corrective Action (TACO). Shortly after this, ASTM got into the act and promulgated a standard for its application to all manners of hazardous waste sites. This was a fundamental and grievous injustice to public health and safety, for beyond the petroleum hydrocarbons, most other high-threat toxic waste groups are naturally non-attenuative.

In 2002, Illinois EPA made some changes to TACO and Indiana introduced its version as RISC.

7.8. SUPERFUND

With the Bush administration in its second full year of the American White House, environmental advocacy groups and liberal politicians were roundly accusing the Republicans of being soft on enforcement of environmental laws. Justice Department Assistant Attorney General Thomas Sansonetti responded (May) that “There’s been no backing off. The Bush-Cheney Administration is committed to strong enforcement.”

SUPERFUND cost-recovery enforcement did make an outstanding achievement in January, with the \$340,000,00 Federal settlement with 177 responsible parties to return payment toward the \$600 million dollars paid out from 1986 to 2001 for remediation of the Operating Industries (OII) landfill operated at Monterey Park, CA, from 1948 to 1984. The senior author remembers that 3.3-m (diameter) augers were once used to drill into existing waste in pre-RCRA days as vessels for dumping of liquid hazardous wastes. Later, greedy land developers subdivided the fringe of the landfill and down-dipping Miocene weak rock strata delivered the toxics to the residents. This dumpsite lies but 16 km east of downtown Los Angeles.

Within this context, SUPERFUND has done without its chemical manufacturing tax-base trust fund

infusions since 1995. Since that time, the Congress has doled out money from the general fund to answer its own prerogatives. Generally, in this time frame, USEPA has received \$1.3 to \$1.6 billions per year to supplement the funds recovered by cost-recovery litigation managed by the Department of Justice (US DOJ). While the usual number of National Priority List (NPL) sites hover around 1080 (with 56 proposed and 248 non-Federal sites up for deletion on completion), more than 800 have been remediated and removed from the list, which continues to grow from biennial nominations. Remediation is underway on nearly 400 NPL sites.

7.8.1. EPA rewards SUPERFUND site

EPA has approved efforts to reduce pollution being released from the waste in the Palmerton, PA, SUPERFUND zinc smelter-waste site. The 34 million-tonne pile has been affected by decades of zinc smelting and considerable amounts of municipal garbage. The cleanup efforts will prevent successor-owner New York-based Horsehead Industries from having to comply with a 1988 EPA decision to cover the pile and heavy-metal denuded hill slopes with a 45-cm blanket of clay-rich soil and Philadelphia urban wastewater treatment sludge, as inducement to the growth of replacement revegetation.

7.8.2. Numbers down on SUPERFUND cleanups

EPA has reported remediation closure of 42 SUPERFUND sites for the year, out of 1238 sites on the National Priority List. The number is down from 47 last year and also is lower than the average 76 completed per year during the Clinton Administration. Environmentalists and Democrats in Congress are heaping criticism on the Bush Administration, but EPA officials say this year’s decline is based on “complexity.” This is a numbers game and more detailed cleanups, such as those with large groundwater pollution, have been saved for last.

7.9. US Forest Service cuts timber again

After 8 years of the Clinton administration embargo on timber harvesting on National Forest Lands, the Forest Service, long in the hands of “tree huggers,” has been ordered to cut trees for the national economy. Most of the action is on a slow-start basis in the fire-

ravaged (1999) lands of the upper Rocky Mountains, where soon the wood will become beetle fodder. We hope that the concomitant return to sensible timber harvesting will result in an early ramp-up for positions for engineering geologists involved in planning the haul roads for minimal hydraulic damage. Currently, most Forest roads confront the visitor with unannounced roadblocks at points designated for “return to nature.” Meanwhile the Canadians gleefully export forest products for the world’s residential construction industry.

7.10. *Forest Service opens mineral lands in Montana after 14 years*

Another early 2002 declaration from USFS is approval of plans to mine silver and copper from vein deposits of the Cabinet Mountains of western Montana. Held up by environmental interests for the past 14 years, the operation will involve only underground access, via shafts and adits. Spokane-based Sterling Mining bought the claims from ASARCO in 1999, after the latter accepted defeat by environmental obstructionists. Mine plant will cover a maximum of 193 ha on Forest lands, with access to the deposit, below Wilderness lands, via the underground workings. An 8-km pipeline will carry slurried tailings to an impoundment of a half kilometer from the banks of the regional Clark Fork River, tributary to the Columbia River. High-technology effluent treatment and tight oversight will be required to protect groundwater and surface water.

7.11. *Former manufactured gas plants*

The year was rife with widespread North American remedial actions at FMGPs. For yet another year, USEPA sat quietly on the sidelines, but was helping out through its continued financial grants to those State agencies leading the cause of recognized carcinogenicity of gas works residuals. Hatheway’s comprehensive site and waste investigation *protocol* for FMGPs appeared in this journal in July 2002 as the first George A. Kiersch Memorial Paper on *Principles of Engineering Geology* (Hatheway, 2002).

An 1894 Rew-Process FMGP was in its third year of exhumation at Oak Park, IL (home of author Hemingway), where a cancer cluster has been

observed and the depth of excavation has gone to more than 13 m, as plagued with DNAPL tar transport into lodgment till joints. Costs have risen from approximately \$20 million to a projected \$100 million. At Plattsburgh, NY, the responsible utility company (NYSEG) has undertaken its own exhumation cleanup under Consent Order and direct supervision of the State of New York (American City and County, 2001). So far, Iowa leads the States with meaningful remedial actions completed, but Wisconsin and New York have moved forward in activity. Sadly, Iowa’s sitting Governor has reversed many of established Orders on Consent calling for invasive cleanup, and is determined to NIFRAP (“No Further Remedial Action Planned”) many of the 200-plus FMGPs in the State. A stout citizens’ resistance group has been formed.

EPA has (2002) placed the abandoned gas works at Ashland, WI, on the National Priority List of the SUPERFUND; first such FMGP site in some 14 years.

Kingston, Ontario, has “erupted” with a cancer cluster located in the Provincial Health agency, found to sit astride a PAH plume in groundwater emanating from the whole-block-sized downtown FMGP, as disclosed by the *Whig-Standard*, Canada’s oldest daily newspaper. At Austin, TX, the prized natural and historic Barton Springs bathing ground has been found, ad year-end, by investigative reporters of the *Austin American-Statesman*, to be highly impacted by coal tar PAHs. A gas works, coal tar origin is suspected.

The Taylorville, IL, FMGP cancer-link jury verdict was upheld in 2002, both by the State Court of Appeals and Illinois Supreme Court. In its decision, the latter found that responsible party, Central Illinois Public Service (CIPS), breached its duty starting in 1938 when it abandoned its underground gas holder tanks and tar wells. CIPS also was found derelict for failing to monitor the former gas works before contaminants migrated off site and were discovered by local authorities and in its failure to warn local authorities or residents after CIPS discovered contamination in 1985. CIPS also was in breach of duty for specific actions or lack of actions during the remediation.

A second issue was whether CIPS was barred from nuisance liability because it conducted itself according to the IEPA. The court held that the company was

liable for nuisance for the release of coal tar constituents into the soil, groundwater and air in violation of the IEPA, contamination of public water supplies in violation of the IEPA and release of airborne carcinogens, clastogens and mutagens before, during and after Immediate Removal Action. The court said “we do not find that liability in this case will frustrate future remedial efforts or deter cooperation. To the contrary, it may encourage cooperation with government agencies, and heighten care and concern for public safety during remedial actions.”

In other parts of the opinion, the court upheld the way expert testimony was admitted and stated that it was not the duty of the plaintiffs to present evidence of the extent of exposure. It only had to be reasonable that there had been an exposure.

7.12. Low-level wastes

America’s congressional solution to the vexing problem of disposal of Low-level wastes LLW was met in 1980 with the dictum that the States must locate and operate such facilities. Now, more than 20 years later, many sound LLW sites have been identified and characterized and all, in turn, have been killed by opposition. The two sites that remain in operation were both operating at the time of the Act of Congress and only the Northwest Interstate Compact, a group of eight States, has a fully operable commercial disposal site. Interestingly, the Compact is chaired and staffed by the Washington State Department of Ecology (<http://www.ecy.wa.gov/nwic/>).

7.13. High-level wastes (HLW) cleanup

Washington State may have discovered and implemented a model approach to safeguarding the public from the bureaucratic excesses of the Federal Department of Energy in its forever-program of make-work on high-level cleanup at the giant Hanford Reservation in SE Washington State. Washington DOE, however, is not making the task of USDOE easy in any way and has declared that the Draft Environmental Impact Statement “. . . does not provide adequate and much-needed information to help us or the public address major issues. . .” The complete document is available on the Washington DOE Nuclear Waste Program web site at <http://www.ecy.wa.gov/programs/nwp/>.

Meanwhile, Beltway contractor Duratek (Columbia, MD) has signed two contracts with Bechtel National (BNI), Denver, for the former to design and construct the \$110.7 million Hanford Waste Treatment Plant. BNI is one of the Department of Energy’s usual primary contractors. The project is to treat and vitrify 53 million gallons of high-level radioactive waste stored in 177 underground tanks.

7.14. High-level waste nuclear repository

This repository concept always has been to place High-level waste (HLW) in a safe situation in a geologic repository so that it satisfies two basic stipulations: (1) that it or its residuals or daughter degradation products will not reach the terrestrial environment for at least 10,000 years and (2) that it will in some way be retrievable for future potential use.

7.14.1. Japan comes to grips with its HLW construction

The Nuclear Waste Management Organization of Japan (NUMO) published September 2001 a “Public appeal system,” which forms the basis for selection of a suitable national site for a final repository. Cities, towns, and villages can propose a suitable site in each provincial region. After publication of this document, NUMO began to examine the geological and social conditions necessary for selecting suitable disposal sites, based on specific requirements of

Absence of significant geological phenomena such as earthquakes, volcanic eruptions, uplift, erosion, etc., in the proposed site;

Relative absence of predicted disturbing natural phenomena in the coming several tens of thousands of years;

Absence of Quaternary unconsolidated sediments in the geological formations for the final repository;

Absence of mineral resources economically valuable for extraction from the geological formation host rock of the final repository.

NUMO has announced these conditions to all of the municipalities in Japan, at end of fiscal 2002. Afterwards, NUMO will seek local-entity submissions of candidates for the repository site.

7.14.2. *Yucca mountain HLW repository in US*

Yucca Mountain, America's only active repository project, remains one of the most important, state-of-the-art (SOTA) rock engineering projects in the world. Deliberations related to its approval, construction and management remain of high importance to all engineering geologists, worldwide. We choose to follow its developments in the Annual Report for many reasons, not the least is the de facto secrecy that the mother agency (USDOE) chooses to shroud its progress. For example, geologists who are employed on the project do not choose (perhaps are not allowed) to speak or write to the profession, thereby maintaining a certain vacuum from technical scrutiny.

Late (Dec. 14) in 2001, DOE Secretary Spencer Abraham, a former Congressman, moved to approve guidelines for final proof of the site and for subsequent construction. Geologically speaking, there are two divided camps. One camp believes that the aridity of the region and the engineered design will prevent entry or generation of vadose-zone waters and thus the deep aquifer system will not see released radionuclides. The other camp, funded by resources provided by DOE and passed on to various consultants, believe that water-solubilized radionuclides will appear at springs in the nearest discharge area, in the Death Valley portion of California, within the 10,000-year radioactive disintegration time. Perhaps foremost of all issues is the fact that nuclear power generation benefits the power Eastern voting bloc of American population, and underpopulated Nevada is to serve as the politician-directed repository site. As of 2002, the project now is at \$8 billion in design and exploratory work, with a remaining largess of \$57.5 billion for construction. As usual, aerospace management methodologies provide the lack of control here.

Nevada's Republican Governor Kenny Guinn vows to take the issue to the highest courts. Meanwhile, now subject to international terrorism, the US continues to store spent reactor fuel rods in water-bath pools at each nuclear power station. Commercial television's popular *West Wing* drama series has already incorporated this issue.

Current temporary storage capacity, at nuclear stations, is insecure from terrorist attack. A terminally frustrated US electric utility industry has gathered its own eight-partner construction consortium to effect

what impotent government cannot provide. The industry has accepted a proposal from the Skull Valley band of the Goshute tribe of native Americans for construction of its own monitorable and retrievable storage site (MRS), at another Basin and Range province location about 130 km SW of Salt Lake City, UT. This theme also was picked up by the new American TV political-drama *Mr. Sterling* at year-end.

Of concern to professional geologists is the troubling adherence of the Congress to unsubstantial "glitz" opposition testimony from Hollywood entertainers who generally testify in total ignorance of the relevant geoscience. *Washington Post* (National Weekly edition, 24–30 June) typifies this as "In the high-stakes fight over the administration proposal to bury nuclear waste in the Nevada desert, President Bush may have the votes, but his opponents have the glitter." Standing apart from the glitz brigade is veteran actor and environmentalist Paul Newman who told the press (20 May) in NY City that he supports the Yucca project because "I found the science very compelling."

The array of functional ignorance is typical of Hollywood and in every way is just another justification for the use of registered professional geologists for expert testimony on environmental issues.

8. Nuclear power

Nuclear power was played out on a low key this year, with greater attentions going to the younger members of the Nuclear Weapons Club and particularly toward the rogue nations of North Korea and Iraq, believed to be in possession (North Korea) or close (Iraq) to fabrication of nuclear weapons.

8.1. *Japan's major nuclear power generator conceals inspection results*

The world looks to Japan as a functioning example of successful nuclear power generation experience. However, Tokyo Electric Power (TEPC), the largest electric-supply company in Japan, has now been found to conceal 29 problems that were found by its own self-inspection personnel at the Fukushima No. 1 and No. 2, and Kashiwazaki-Kariha nuclear power stations (NPS), during the period 1987–1995. These

problems included those known to occur in service, fractures and the abrasion of equipment. Certain of the TEPC staff submitted a false report stating that steam-generator fracturing was noted at three locations within the Fukushima No. 1 NPS, whereas they were actually found at six locations. Mr. M. Minami, president of TEPC, recognized that the staff of TEPC participated in concealing the defects found during that period as well as those found after 1995. As a consequence, all of the past executives of TEPC during that period, as well as the current president, Mr. Minami, resigned from their positions, in order to honorably take the proper responsibility for concealing the extent of these problems.

9. Groundwater

We sometimes lapse in our recognition that most highly populated coastal areas of the world continue to suffer worsening water supply conditions. San Diego, CA, for example, lacking the favorable deep alluvial basins used for wastewater effluent recharge, has moved toward desalination to make up for projected shortfalls in water supplies. Desalination will be moved forward to produce some 45 millions gallons of water per day. For these bottom-line days, the cost goal is \$1000 per acre-foot of water recovered, roughly 2.3 times the cost of non-available water brought from the Colorado River.

10. Engineering seismology

A 2-year project to gather and place accepted strong motion data of Europe and the Middle East has come to fruition at Imperial College of Science and Technology, under the guidance of Professor Nick Ambraseys, his coworkers and colleagues from Iceland, Trieste and Greece. A total of 1974 records from 805 earthquakes recorded at 622 different stations are to be found at www.isesd.cv.ic.ac.uk.

11. Natural hazards

Since the 1970s, progress in the regional characterization of natural hazards has been propelled greatly by

the availability of remote imagery. Until recent years, however, the imagery has not been widely available at an affordable cost to most practitioners and applied researchers in the earth sciences. Now, in America, the Federal Emergency Management Agency (FEMA) has set a new example for the world at large, with its *Multihazard Mapping Initiative* that proclaims to offer and create not only the maps but constantly update such and to keep the coverage available on the internet at www.hazardmaps.govatlas.php.

The coverage is only for the US and is keyed to postal codes, with downloadable tabular historic data.

12. The literature

Jewell of the year for literature was Sir John Knill's keynote address at the IAEG Congress in September, at Durban, South Africa, "Engineering Geology Core Values."

12.1. Trends and changes

The Association of Engineering Geologists has become the first of earth science professional societies to place its entire journal run on the internet for use of the profession at large.

Of the kindred engineering societies, the Earthquake Engineering Research Institute (EERI) has moved to launch a web presence of its professional journal *Earthquake Spectra* (<http://ojps.aip.org/EarthquakeSpectra/>). In addition, EERI provides CrossRef as access to 3.9 million articles from over 5600 journals, in full-text PDF format, color and a personal, virtual filing cabinet.

12.2. A fond farewell to the engineer waterways experiment station

Engineer Lieutenant Herbert Vogle (later Brig. Gen., USA) founded the U.S. Army Engineer waterways experiment station (WES) at Jackson, MS, in 1929. WES was soon removed to its present location at Vicksburg, near the famous battlefield and the Mississippi River. Over the next 7 decades, WES became the Army's think-tank and experimental laboratory for all manners of military applications involving the applied earth sciences. In this role, WES grew

and emerged as one of the world's greatest and most admired earth science and engineering research laboratories, always known for the practical utility of its products. Now we must sadly report that bureaucratic revisionists have robbed its good name and left WES as the Engineering Research and Development Center—Vicksburg.

12.3. UK regional groups

The ultimate realization that the constructed environment is largely controlled by regional geologic conditions has come to pass in the UK where three organizations now hold 1-day seminars. A unique 2002 contribution has been forged by The Geological Society's Engineering Group and Thames Valley Regional Group, along with CIRIA, to survey the "Engineering Geology of the Lambeth (stratigraphic) Group in the Thames Valley. The privatized Transport and Road Research Laboratory, not TRL, is also central to the success of this venture. Other nations need to take heed!

12.4. CIRIA conferences

Another example of contemporary professional conclaves is the annual Contaminated Land Conference hosted in September, at London, by CIRIA. Focus is on practical problems experienced by industrial consultants and contractors when implementing contaminated land strategies. There is no end to the good that can be done when frustrations are aired and discussed.

12.5. U.S. Government Printing Office (GPO) on the net

USGPO is a bottomless pit of useful information, and previously most of us came to discover individual titles in purely fortuitous ways. Now the agency's holdings are instantly accessible at <http://bookstore.gpo.gov>.

12.6. Transportation research board

This outstanding activity of the U.S. National Research Council was created in 1920 and has been a constant source of useful papers in engineering

geology over the years. Now TRB has its Highway Research program reports available on the internet as PDF documents (www4.trb.org/trb/onlinepubs.nsf/web/shrp_publications).

12.7. On-line journals

Last year, the American Chemical Society broke new ground with their posting of the entire 130-year run of ACS journals on the net as downloadable PDF documents. This year, the American Geophysical Union has moved to place their several journals on the Internet and in advance of release of the regular hardcopy versions.

12.8. "Editor's choice;" the AGU concept

American Geophysical Journal, coming in four discipline configurations, has embarked on an on-line assemblage of peer-reviewed journal papers assembled topically for co-relevance. While the journals of our discipline are not as numerous as those of AGU or the American Society of Civil Engineers, the concept of placing topically collected technical papers on society web sites is indeed innovative and worth our consideration.

12.9. Outstanding literature

Clearly, each year we are surprised by a new array of literature that helps to make our careers more effective. Among this new literature are titles that we cannot afford to be unaware of. We therefore try to act as a clearing house so that this useful literature will be in the first stream of our consciousness and not of the color "gray" (Table 1).

13. World environment

On the world level, the environment is perhaps most meaningful to engineering geologists in terms of global climate change. At this point, the authors are willing to subscribe that these influences are indeed real. Perhaps the greatest predictable impact on our profession will be rising sea levels and dropping reservoir and groundwater surfaces in the continental interiors.

Table 1
Outstanding engineering geologic literature noted in 2002

Citation	Details
“Engineering Geology Core Values”, 2002	IAEG keynote address at the Durban Congress, South Africa, by Sir John Knill
The Environmental Legacy of Military Operations, 2001	Reviews in Engineering Geology, v. 14, Geol. Soc. America., edited by J. Ehlen and R. Harmon
Remedial Engineering for Closed Landfill Sites, 2001	CIRIA Report C 557; Construction Industry Research and Information Association, London, UK (McDowell et al., 2001)
Geophysics in Engineering Investigations, 2001	CIRIA Report C 562
Engineering in the Mercia Mudstone, 2001	CIRIA Report C 570
The Map that Changed The World, 2001	by Simon Winchester (2001), Story of Civil Engineer William Smith, of Britain (b, Oxford, 1769), world’s first practicing geologist/engineering geologist
Gondwana to Greenhouse (Australian Environmental Geoscience), 2001	Geological Society of Australia, Spec. Pub. no. 21, edited by V.A. Gostin (2001), 356 pp., 28 separate papers
Comprehensive Seismic Hazard Assessment of Hawaii, 2001	BSSA, Jun (Klein, 2001)
Geophysics in Engineering Investigations, 2001	Engineering Geology Special Publication no. 19
Plate Tectonics; An Insider’s History of the Modern Theory of the Earth, 2001	edited by Naomi Oreskes: Westview Press, Boulder, CO, xxiv plus 424 p. (Oreskes, 2001) (ISBN 0-8133-3981-2, \$35)
Mine Water Hydrogeology and Geochemistry, 2002	Geological Society (London) Spec. Pub. 198, edited by P.L. Younger and N.S. Robbins (2002)
Engineering and Environmental Impacts of Karst, 2002	Special Issue of Engineering Geology, Aug 2002, v. 65 nos. 2–3, B.F. Beck Guest Editor, p 81–232
2002, Recommended Procedures for Implementation of DMG Special Publication 117; Guidelines for Analyzing and Mitigating Landslide Hazards in California, 2002	California Geological Survey (Historically the California Division of Mines and Geology), www.sced.org/resources

Table 1 (continued)

Citation	Details
Engineering Geology Manual (USBR, 1998), Engineering Geology of Northern California, 2002; CGS Bull. 210, AEG Spec. Pub. 12	Edited by Horatio Ferrez Robert Anderson; published by California Geological Survey; Continues the informal AEG series created in 1966 by R. Lung and R.J. Proctor. All west-coast US States have now been published GSA Spec. Paper 359, edited by F.R. Ethensohn, N.R. Rast and C.E. Brett; Defines and describes soft sediment deformation as caused by earthquakes, tsunamis and other dynamic geologic other dynamic forces
Ancient Seismites, 2002	Recommendations of the International Union of Geological Sciences on the Systematics of Igneous Rocks; 2nd ed., edited by R.W. Le Maitre
Igneous Rocks; A Classification and Glossary of Terms; 2nd ed., 2002	by Christopher H. Scholz, Cambridge Univ. Press
The Mechanics of Earthquakes and Faulting; 2nd ed., 2002	by S.A. Schumm, J.F. Dumont and J.M. Holbrook, Cambridge Univ. Press.
Active Tectonics and Alluvial Rivers	(paperback edition)
Coastal Processes with Engineering Applications, 2002	by Robert G. Dean and Robert A. Dalrymple, Robert A., Cambridge Univ. Press, 475 pp.
Evaluation and Remediation of Low Permeability and Dual Porosity Environments, 2002	ASTM STP 1415, (Sara and Everett, 2002) 190 pp.
Unified Soil Classification System Soil and Stratigraphic Analysis USDA Soil Texturing Field Flow Chart	Contained on three durable plastic field reference sheets available from Midwest Geoscience Group (Illinois) at Midwest Geosciences Group; www.midwestgeo.com

Engineering geologists should be aware that global warming, for whatever reason, indeed appears to be real and that the resulting minimal impacts, in our realm, will be seacoast inundation, terrestrial flooding and precipitation-induced mass wastage. Shifting climatic patterns will make this a highly complex issue and new masses of potential unstable weak rock and soil masses become influenced by torrential rains not seen previously in certain areas.

13.1. *Kyoto accord*

The worldwide response to the proclaimed cause of global warming has centered about the coordination offered by the Kyoto Protocol to the United Nations Framework Convention on Climate Change, held in 1990. As of midyear, the 15 members of the EU had joined Japan as a 74-nation block representing about 36% of CO₂ emissions world wide in ratifying the protocol. Another 55 countries, including the US and Canada, representing a total of 55% of calculated 1990 emissions, remain to ratify the pact as a requisite to its becoming binding as a measure of international diplomacy. Later in 2002, President George W. Bush angered many activists by withdrawing US participation from the accord, citing the need to deal first with the energy crisis and its immediate effects.

Potential ratification of the accord created great discussion amongst geoscientists and engineers in Canada. In the summer of 2002, Prime Minister Jean Chrétien announced that prior to his leaving office in 2004, one of his government's priorities was to ratify the accord. There has been and continues to be much debate as to the potential implications of this plan on industry and the actual science that underpins the plan. At this time, the Canadian geoscience community as a whole had yet to wade into the fray and contribute a position on the topic.

14. Public safety activities

Involvement for public safety for the year seemed to emphasize the continuing matter of licensure of individuals whose work product affects that element of society. There always has been some element of strife between the trades (involving skilled labor of one sort or another) and the professions (representing lifelong commitments to learned bodies of knowledge, represented most prominently by medicine, law and engineering). Geology, of course is a calling to high level of scientific knowledge, and hence, a profession.

14.1. *Professional licensure (contributed by Robert E. Tepel)*

Licensure is the hallmark of the professions. Just as professional engineers were first licensed in North

America, in the State of Wyoming, in 1907, the system here is lodged within the governments of the States and the Provinces. The last American State to enact licensure of engineers was Alabama, in 1945, some 38 years after the concept was born. For geologists, the first licensure was in Arizona; in 1921 and as of 2002, the total number of complying States is 23 of 50.

It is the practice of engineering geology (broadly defined) that drives and justifies North American licensure for geologists. In 2002, statutory licensure for geologists continued to grow in the United States and continued to face challenges. Much of what follows in this section is based on or derived from the annual meeting notebook of the National Association of State Boards of Geology (ASBOG, 2002). At the end of 2002, 31 jurisdictions (30 states and the Commonwealth of Puerto Rico) had statutory licensure in effect for geologists. "Practice Acts" prevail. "Title Acts" (or variants on that concept) are found only in Alaska, Tennessee and Virginia. Specialty certification in engineering geology is offered in California, Oregon and Washington. California and Washington also offer specialty certification in hydrogeology.

Licensure became effective in two additional states in 2002, Texas and Utah. An attempt to implement licensure in Colorado did not survive "sunrise" review. Efforts to pass a licensure bill in New York stalled in the legislature.

ASBOG (2002) reports 28,745 active licenses to practice geology issued by 27 jurisdictions (data from Tennessee, Texas, Utah and Washington are not available). California has 1547 active engineering geology certificates, and Oregon has 347.

Several states have instituted marginal forms of supervision over the practice of the profession. Definition statutes exist in Colorado, Oklahoma and Nevada. The states of Connecticut, Iowa, Massachusetts, New Jersey and Nevada do not license geologists, but they require statutory or regulatory registration for environmental professionals, including geologists, who are involved in activities such as hazardous waste and/or fuel leak remediation.

Continuing education requirements are in place for geologists licensed in Alabama, Delaware, Kansas, Minnesota, Mississippi (voluntary), New Hampshire and South Carolina.

14.1.1. ASBOG and licensure examinations

In 2002, 917 candidates sat for the ASBOG Fundamentals examination; the pass rate was 59%. The practice (advanced) examination was taken by 688 candidates; the pass rate was 72% (ASBOG, 2002, and Sam Christiano, personal communication to Tepel, 2003).

ASBOG likely will grow to 27 member boards in 2003, adding Texas and Utah. All ASBOG member boards now use the standard ASBOG Fundamentals of Geology and Practice of Geology examinations. California, Florida and Idaho were the last states to give up their pioneer in-house exams. States that offer certification of specialties still develop and score their own specialty exams. In addition, the states of California, Maine and Oregon have additional, supplemental state-specific examinations as a measure of competency in specific regional geologic conditions.

14.1.2. Trends in academia

Accreditation of undergraduate programs remains intimately intertwined with the licensure process for engineers, but undergraduate program accreditation is lacking in geology. C.D. Elifrits (2002), in Tepel, described potential pathways to accreditation for undergraduate geology programs.

ASBOG examination content correlates closely with typical on-the-job tasks performed early in a career. Therefore, performance of senior baccalaureate students on the ASBOG Fundamentals Exam offers the faculty insights into the match between the department's program and the needs of employers. Currently, five geology departments in four schools in Mississippi use the ASBOG Fundamentals Exam as an exit exam. These are Millsaps College, University of Mississippi, Mississippi State University and University of Southern Mississippi (John W. Williams and Darrel W. Schmitz, personal communications, 2002), and the University of Kentucky (John C. Philley, personal communication, 2003).

14.1.3. Challenges to maintaining licensure

Challenges to the very existence of licensed geologists and geologist licensure boards are a yearly burden. Most issues involve the demanded freedom for geotechnical engineers to perform site characterization work. "Practice overlap" issues exist in Missouri and Wyoming, where resolution has been

achieved via memoranda of understanding between the respective geologist and civil engineer licensure boards. In New York, practice overlap issues arose with the introduction of a bill to license geologists. Resolution required close work bill-language with the New York State Society of Professional Engineers.

The profession faces continuing challenges in "selling" its value to code-writing bodies. Engineering geologic site characterizations provide yield data and recommendations as essential design input for larger-than single residence construction and critical infrastructure. The growth and prevalence of licensure for geologists brought engineering geology prominently into building and grading codes in the 1980s and 1990s. Mathieson (2002) chronicles how engineering geology practice first was ignored, then required, then deleted and then (partially) restored to building and grading codes.

Florida has brought the ASBOG examination to its first legal challenge over validity. A licensure candidate, with multiple examination failures, brought a complaint against the Florida Board of Professional Geologists. ASBOG witnesses testified before an Administrative Law Judge, and the ruling was that ASBOG successfully defended its construction of questions and answers.

The Florida Board of Professional Geologists is continuing to address another challenge from some Florida State agencies because the geologist licensure law does not apply to geologic reports they require because their own regulations do not reference the law. A current member of the Florida Board of Professional Geologists, Gabrielle Enos, notes (personal communication to Tepel, 2002) that "There are still State agencies that do not require documents containing geologic data to be signed and sealed by a licensed geologist. The Board has worked with several agencies over the years to improve the situation. The Department of Environmental Protection, for example, has been on the progressive side of making sure that documents that are submitted to their agency are in compliance with Chapter 492 F.S. Because of the way the State structures their petroleum cleanup program, with County agencies contracted to the State DEP, these requirements are widespread when dealing with petroleum contamination assessment and cleanup. However, there are other agencies that still feel that

because their rules don't reference our Practice Act, they are not required to insure that documents submitted to their agencies are properly signed and sealed. In most cases I can think of, the situation has come about because the agency rules predate our Practice Act. In any case, the Board has been continuing to try to improve communication on this issue with the different agencies."

14.1.4. *Gains in licensure*

Addition of engineering geology specialty certification in the Washington State licensure act strengthens our professional recognition on the West Coast of the United States and makes it more visible throughout the nation.

California has been the scene of a long-lived and vexing situation brought about by bureaucratic self-interest. Certain state government positions were classified as "Engineering Geologist," but through historic usage, some agencies filled the positions with people who had no degree in geology. Continuation of this practice (which defies the state's licensure law) was halted by a classification revision and subsequent action by the California State Personnel Board requiring the Registered Geologist license for all Engineering Geologists above entry level who are supervising staff or projects (Seena N. Hoose, personal communication to [Tepel, 2002](#)).

14.2. *Project management certification and registration*

The U.S. Army Corps of Engineers was subjected to heavy-handed social engineering under the influence of now-departed Lt. Gen. Joe N. Ballard, then Chief of Engineers. Under the command of General Ballard, the way for promotion was cleared for non-engineers and other unregistered individuals with broad governmental experience in any form of program management. This administrative insanity has been corrected now in the term of Ballard's replacement, Lt. Gen. Robert Flowers, PE, graduate of an accredited engineering School (Virginia Military Institute) and a registree by examination. The Corps has reinstated professional licensure as a basis of qualification for professional positions of GS-12 and higher. At these grades, professional registration is mandatory for individuals dealing

with "final approval of engineering products and services, oversight and certification of the technical adequacy and safety of facilities, and authoritative interpretation and administration of construction contracts."

14.3. *Subprofessional licensure*

"Subprofessionals" in engineering and the applied sciences generally are recognized to be some sort of technician, not required to be a graduate of a formal, 4-year (or longer) accredited university curriculum of instruction. The individuals who serve as field exploration (drilling) and construction-inspection technicians, along with testing laboratory personnel, fall into this category. Qualification for the technical subprofessions generally requires intensive hands-on junior college or trade school instruction of less than 6 months duration, or perhaps completion of a 2-year "Associate" degree.

The latest species of subprofessional to appear in our profession is the Certified Hazardous Materials Manager (CHMM). This program leapt into existence at the urging of the USEPA for the purpose of qualifying large numbers of technicians to independently perform services that now may be performed only by PEs, and which require engineering judgment for determination of existing conditions. Many State engineering registration laws require that PEs provide such services. Examples of such sensitive determinations are determination of completion of post-closure care, tank system integrity, structural integrity of hazardous materials tank systems and surface impoundments, and tank system repairs. CHMMs are not required to possess any college education, just a minimum of 11 years of unstructured experience. They are not tested in any aspect of engineering, nor are they required to have any engineering knowledge at all.

Our profession has always maintained that graduate scientists and engineers should provide these services. Quite the opposite in the eyes of the bureaucrats at HQ USEPA who are proposing that the Congress amend the Resource Conservation and Recovery Act (RCRA of 1976) to permit CHMMs to perform certain services that RCRA now specifies to require the efforts of professional engineers. ASFE has protested to EPA that such a program would be

“akin to... allowing phrenologists to perform neurosurgery.” We agree.

14.4. Labor union activity among field technicians

Field technicians were created in southern California in the late 1940s as a means of conducting exploration and for assessing geological conditions exposed during active construction for engineered works. Our professional premise has always been that we apply our expertise, as funded by the owner, to discover, detect and observe conditions that must be addressed by design engineers. The need for such technicians came from the usual shortage of graduate geologists and engineers capable of conducting field work.

Now, ASFE, watchdog of the geoenvironmental consulting industry, has warned geoenvironmental concerns of ongoing attempts of labor unions to organize their field technicians. Broadly speaking, the turf disputes that accompany union representations are viewed as inimical to the operating freedom needed by consulting firms to maintain solvency in the difficult professional service market now plagued by priced competition.

Considerable trade union organization occurred in 2002 in NW Washington State where Local 302 of the International Union of Operating Engineers focused on organizing engineering firms. Other organizing activities have been going on in Illinois, Tennessee, Alabama and California.

15. Standards, liability consciousness and loss prevention

The fruitful association of ASFE (www and the geoenvironmental consulting industry) produced an early response to its own liability protection problem. While ASFE promoted loss prevention through quality of practice and choice of clientele, Terra Insurance (Corte Madera, CA) was formed as an independent, policy-holder company in 1980 and now insures geoenvironmental consultants to more than \$150 million in gross fees. Terra is “highly selective” about the firms it chooses to insure and bases that selection largely on the firm’s adherence to ASFE guidelines for quality of practice.

16. Techniques and technology

The most important facet of change as that affects our profession is change itself. Change is a necessary aspect of society and without change, humankind eventually is visited by revolutions and war.

16.1. Emerging concerns

Just as the profession exists only to serve society, so must we maintain constant awareness of changing societal trends and its laws and regulations. Most of these changes are initially viewed as unwelcome threats to the manner in which we conduct our profession, and mostly this is the case. However, we must be prepared to respond, but better to sense the coming of change proactively.

16.2. “Mold” as a new trial lawyer target

Trial lawyers are the breed of attorneys who bring civil action cases to court to seek damages for their clients. The stakes are high and among the legal profession, these are the Storm Troopers, peopled with very bright and highly aggressive lawyers. We need only to mention the pitched legal battles and crushing corporate defeats and ensuing bankruptcies that came out of the “Asbestos Wars” of the 1990s.

Mold emerged in year 2000 as a source of potential respiratory diseases. It is difficult to see the connection between our type of professional assignments and responsibility for mold existing or developing in renovated or “built” engineered works, but we must expect the worst when it comes to loss prevention and liability consciousness.

16.3. New technologies

Advances in science and engineering, coupled with environmental regulation and changing social mores, draws out various new technologies developed to meet these forms of changes. Most new technologies come to be created by economic imperatives, the profit motive and the capitalist market pressure of price. We track these new technologies on a yearly basis as a means of advising the profession on maintaining relevance and competence to practice.

16.3.1. Hot Dry Rock

While many other nations have lost resolve over developing their geothermal potential, Japan continues to move boldly forward. The New Energy and Industrial Technology Development Organization (NEDO) is closing into the final stages of its 2-year Hot Dry Rock (HDR) production-rate circulation experiment at Hijiori site, Yamagata Prefecture, in northeastern Japan. In this experiment, the temperature of the entrance of the production well was kept at more than 130 °C, and the recovery ratio of the hot water was 60%:2 t/h of steam and 34 t/h of geothermal water. On June 5, 2002, a 3-month generation experiment was begun to test the power generation ability of the HDR system at the final stage of the heat extraction. The average output by the HDR system was approximately 50 kW. A decision was made to close the test site at the end of March 2003.

16.3.2. SVOC behavioral awareness

Semivolatile organic compounds (SVOCs) continued to confound many industrial site cleanup personnel, especially plant-wide conversions to follow-up uses. We noted that many of these sites were discovered to have been the scene of routine pit burning of SVOC sludges and still bottoms. In these cases, considerable ash now remains and the edges of the pit need definition and sampling for contamination levels. It would appear that most of the toxicity was transferred by long-gone air pollutants.

16.3.3. Dredge spoil containment

This concern had to return. Since 1838, in America, the U.S. Army Corps of Engineers has been charged with the maintenance and improvement of harbors and navigable rivers. First and foremost, meeting that commitment since the 20th century has been maintenance dredging. Here is an area of application of emerging technology, for dredge spoil is the contamination sump of urbanized rivers. Maintenance dredging was severely curtailed beginning in the 1970s with the worldwide wave of environmental awareness, but 30 years later, large-river ports and harbors can no longer be neglected for such renovation. Further, the focus of environmental cleanup for an increasing number of industrial sites has shifted to the adjacent intertidal and subtidal areas now that the upland problems are remediated and/or the impacts to

nearby waterways have been identified in bodies and horizons of sediment.

In 2002 emerged a brisk market of competition among specialty geoenvironmental consultants in the location, design and construction of nearshore confined disposal facilities (CDF) to contain contaminated sediments to avoid typically more costly upland disposal while providing the site owner usable land once the CDF is completed. Hand-in-hand comes the associated technology of confined aquatic disposal (CAD) for the contaminated sediments, the latter being completely submerged. The focal type-area for U.S. CAD is Boston Harbor that initially had problems in maintaining CAD-cover integrity, though lessons were learned about cap stability that later improved the project. Among the consultants in this growing field, Hart Crowser (Boston), a New England colonizer from Seattle, has the crowning reputation for this expertise. We are told that the design secrets include complex geotechnical design factors and careful and experienced modeling of groundwater flow and contaminant transport. An equally important and compelling aspect of these projects in the necessity in design to maintain habitat for benthos, fish and other species that could be impacted, as well as ensuring that construction is planned to meet closure restrictions such as seasonal fish migration. Thus, careful attention applicable local, state and Federal regulation is an integral part of these projects.

16.3.4. Turning contamination to charity

Santa Fe, NM, now has a qualified public charity that acts to transfer corporate dumpsites into philanthropic write-offs. Realty Restoration Gift Fund will, for a fee, of course, arrange for a third party consultant to evaluate the Brownfield and then arranges for a “national environmental remediation company” to present a remediation plan. If any profits accrue from the project, such are to be distributed to charitable organizations. This almost sounds too good to be true.

16.3.5. Harmless but embarrassing releases of waste treatment byproducts

In-place cleansing of contaminated building surfaces at the former Hunters Point Naval Shipyard, San Francisco, resulted in the deliberate contractor dis-

charge of some 4500 l of spent sodium permanganate cleaning solution to the ground some 250 m inland of the shore. Quickly, the solution migrated to breakout on incoming tide and turned Bay waters the predictable tones of deep purple. In January of 2002, an embarrassed Naval Facilities Command consulted the Coast Guard and declared the release to be harmless and then signed a remediation agreement with the City of San Francisco, in which the City will be gifted with 32 ha of former U.S. Navy property, fuel for the developers around the space-scarce city.

16.3.6. Video clips in power point

Dr. Gary Robbins, Engineering Geologist and Professor of Hydrogeology, University of Connecticut, has created a CD version of the now-standard *Expedited Site Assessment*, a must-have tool for our profession. The Connecticut Department of Environmental Protection sponsored the development of this instructional aid, which provides technical guidance on using direct push technologies and field analytical methods for conducting contamination investigations. The CD guidance comes in multimedia format with slide presentations, animations, video and simulations, and a computer game-like site investigation training exercise (<http://www.esacd.uconn.edu>).

17. In memoriam

It is with appropriate sadness that we report the deaths of a number of true leaders of the profession. We must celebrate the gifts of their membership in the profession for they have made our calling more meaningful and our works more efficient by their examples and writings.

17.1. David J. Varnes (1915–Feb 2002)

Dave Varnes was unique in many ways, not the least being his having surpassed the decades-long record of Newel H. Darton, pioneer U.S. Geological Survey Geologist, for the longest term of professional employment with the Survey. David's parents brought him out to Los Angeles and he matriculated from CalTech. He never looked back. David concentrated on major works dealing with the logic of geologic mapping and on the various mechanics of mass

wastage. David was among the best known American Engineering Geologists on the worldwide circuit, spending considerable out-of-pocket funds to achieve coordination of the North American Groups and to represent them to IAEG. There is simply no replacement of and for David, either in his gentlemanly conduct or for the depth of his technical knowledge of our spectrum.

17.2. Alice Standish Allen (Nov 1907–Apr 2002)

We have lost she whom we believe to have been the first North American Woman Engineering Geologist. Elected Honorary Member of AEG in 1987, Alice served her entire career as an Engineering Geologist and did so in the Federal Government beginning in 1936, one of the first of a long line that had begun only in 1934 (Garrison, 1987). Alice was a native of Boston, was brought up at Lexington and completed a Bachelor of Geology at Mount Holyoke College, South Hadley, MA. With a Masters degree from Wisconsin and all-but-dissertation at Northwestern, both in geology, Alice took employment with the U.S. Geological Survey in 1936 and served in Washington, DC, until retirement in 1982. During this time, she was one of the first members of the USGS Military Geology Unit (1942), then the Engineering Geology Branch, then Office of Chief of Engineers, U.S. Army, and finally, the resident subsidence-mitigation expert at HQ, U.S. Bureau of Mines. In Alice's own words, "At the end of World War II, all sorts of new engineering activities were being planned. ... My great good fortune was to have been the one to whom such requests were sent, pending the actual start of the newly forming Engineering Geology branch" (AEG *Bulletin*, 1987).

17.3. Charles Shirley Content (Nov 1908–Feb 1902)

"Chuck" Content was one of the last of the "old-time" Engineering Geologists, those who practiced close to the gee-pick and eschewed attending society meetings, publishing and delivering papers. Nonetheless, inside his close circle of construction engineers and big-project designers, Charles was revered for his geologic expertise and was broadly known for the ease with which he made friends, his "quick wit and dry humor." We are told that he could spend weeks and months in remote locations

practicing his profession to the full depth of interpretation of geologic history and its effect on the rock mass at hand. Content he was to take solace from the majesty of towering rock outcrops and he leaves us with his 1977 *Geologist's Sketch Book*, now a rare item for the library of those who wish to extract the most from their field work (Content, 1997).

Charles was a native of New Mexico who sampled Montana and Colorado, graduating from the University of Colorado and joining the Bureau of Reclamation in the early 1930s. In time he became Chief Geologist of the Bechtel Company and operated out of Danville, CA. He had a strong personality and is remembered for having set much of the tone of geology at Bechtel over the decades. We hope that some close associate will come forth with a memorial to share his many capabilities with us.

17.4. Helmut Ehrenspeck (1943–July 2001)

A field geologist known mainly for his tireless editing and publishing of more than 100 manuscript geologic maps by Thomas Wilson Dibblee, Jr., of the California Coast Ranges. Born in the Bavarian foothills of Germany, he emigrated to the US with his parents in 1953 and took degrees in geology at the University of Massachusetts (1963) and California at Santa Barbara (1972). It is said that his interest in geology stemmed from hunting for wildflowers and mushrooms to be used by his gourmet-cooking mother. At UCSB, Helmut became indoctrinated in the famous University of California devotion to field mapping and ever returned to the Coast Ranges from other assignments. From 1984 he became the Editor and Project Director of the Dibblee Geological Foundation and was responsible for conversion of Dibblee's field map manuscripts to published full-color geological maps using his own "painted-cell" technique. UCSB praised Ehrenspeck with status of Elected Fellow of the Department of Geological Sciences (June 2001) in recognition of his professional stewardship, not the least of which was his outreach to "thousands of our students at all levels, as well as local teachers, docents and interested citizens who have been enriched by his efforts." Of Helmut, the amazing and still ambulatory Tom Dibblee (born 1911) has given the highest honor or all, "...the best

field assistant I ever had!" Ehrenspeck died in the field, with his "boots on."

17.5. William Wallace Moore, PE (1912–October 2002)

"Bill" Moore was a legendary and substantial friend of engineering geology and made it the cornerstone of his practice with Trent Dames. Both were BS and MS graduates (1933, 1934) of the small soil mechanics section of CalTech, built by the eminently practical Professor Frederick Converse. Dames and Moore was founded in 1938 and flourished for 62 years before being assimilated into URS. Moore is remembered for his innovations, many of which were Converse concepts that Dames and Moore pushed fully into practice, notably the thick-walled California drive sampler, workhorse of the profession west of the Missouri River. Moore was an accomplished soils engineer, an astute manager and a gentlemen among business executives. We honor him smartly for his staunch support in the early and blossoming years of our profession.

17.6. Ronald C. Hirschfeld, PE (1932–March 2002)

Dr. Hirschfeld was a geotechnical engineer who embraced engineering geology to the fullest extent and who was a constant supporter of our profession for the more than 40 years of his strong dual practice in teaching and consulting. He too died "with his boots on," while teaching on 7 March at Tufts University. As an associate professor of civil engineering, he left the MIT faculty in 1970 to form with three former Harvard University colleagues, Geotechnical Engineers, now GEI Consultants, of Winchester, MA, and major cities. Dr. Hirschfeld was a member of AEG and a Fellow of The Geological Society of America, as well as Fellow, then Honorary Member of ASCE. Ron also was a stalwart promoter of engineering geology through his many years of involvement in the ASCE/GSA/AEG Joint Committee on Engineering Geology, created at the urging of Karl Terzaghi in the 1950s. His teaching efforts in the two traditional engineering geology classes in civil engineering at MIT have been continued by Professor Herbert Einstein of that faculty.

18. Summary and statement of coverage

We are delighted to welcome this year our esteemed coauthor, Professor Tariq Cheema, of Sultan Qaboos University, Oman. Professor Cheema holds the assignment as Middle East author and he promises that his observations will prove that the disciplines of Engineering Geology and its subdisciplines Hydrogeology and Environmental Geology and Engineering Geology are demonstrating not only momentum but new degree programs in the various universities of the greater region of South West Asia. Diane Rydell Hatheway (wife of the senior author) performed a most helpful review for context and continuity.

We also wish to thank the following contributors to this year's report: Dr. J. Hadley Williams, Emeritus State Geologist of Missouri, and especially our Canadian team of Dr. Réjean Couture and his colleagues, Dr. Jim Graham, Corey Froese and Peter Bobrowsky. From MIT, we thank Dr. Herb H. Einstein for his clarifications on the *Open Coursework Initiative*. For the coverage on professional licensure, we asked Robert E. Tepel, of Santa Clara, CA, to draw us a summary of that situation, for 2002 was yet again another important year. We regard Tepel as the foremost North American expert on the subject and thankfully, he has drawn on other front-line workers: Dr. John W. Williams, Seena N. Hoose, Gabrielle M. Enos, John C. Philley and Darrell W. Schmitz for contributing unpublished information from their own knowledge.

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