

It can't happen here—can it?

Planning for a nuclear accident

An invited comment by Dennis Tate

WHILE NUCLEAR POWER IS important to the energy needs of the nation, it also presents a unique set of hazards that planners must be ready for. The problems with the Japanese nuclear plants after the earthquake and tsunami there have emphasized the need for emergency managers around the world to reassess their thinking about how to get ready for a nuclear disaster.

As the Japanese experience has demonstrated, a major nuclear disaster will result in a large displacement of uncertain duration for the population around the plant. Current shelter plans are inadequate to deal with this disruption, and the assumptions on which these plans are based are flawed. Training and exercises have also been inadequate to assess our response to this massive human migration.

There are currently 104 nuclear reactors operating in 31 states in the United States. These plants make important contributions to the nation's overall energy production. For instance, nuclear power provides 72 percent of the power used by Vermonters, 55 percent in New Jersey, and 53 percent in Connecticut. Nationwide, about 20 percent of U.S. electrical generation in 2009 was provided by nuclear power plants, according to the Nuclear Energy Institute.

Three of these power plants—Sequoyah units 1 and 2 and the Watts Bar unit 1, totaling nearly 3,500 megawatts of generating capacity—are located in my home state of Tennessee. They are owned by the Tennessee Valley Authority.

In 1982, the Nuclear Regulatory Com-

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Earthquakes, moonquakes, and building safety design

An invited comment by
T. Matthew Evans

From the dirt
to the moon

WHETHER THEY'RE located on the moon, in Marin County, or in Maracaibo, all buildings have one thing in common—dirt. One of the first steps taken during building design is to assess the strength, stiffness, and hydraulic properties of the soil, along with the risks to which the structure is likely to be subjected, such as earthquakes, floods, or other extreme events.

If you're in Marin County, the sampling of the soil is a fairly straightforward matter: you go out to the site and drill some holes. If you're building on the moon or in a distant, underdeveloped area, however, the problems multiply. Bringing large quantities of soil back from the moon, for instance, is extraordinarily expensive and time consuming. In a developing country that is earthquake or flood prone, the expense is not as large as the moon, but can still add substantially to the design costs.

Our research group at North Carolina State University is developing design methods that require significantly smaller soil samples to provide robust data—maybe as little as a five-gallon bucket. Rather than considering the soil as a continuum material, it is instead considered as an assembly of discrete particles. The interaction of these particles is governed by simple contact laws between particles and structures and by Newton's equations of motion. This approach requires many fewer input parameters and, thus, less testing.

Traditionally, characterization of soil properties consists of a suite of laboratory experiments and in-situ tests. The laboratory tests may require several cubic feet of soil weighing several hundred pound. In-situ tests are typically performed using large drill rigs or other specialized equipment, like cone penetrometers or self-boring pressure meters. For the majority of construction projects, this level of testing is not cumbersome and the cost is small relative to the overall design and construction budget. However, in some cases, acquiring large soil samples for laboratory testing or performing advanced in-situ tests may be too costly.

A prime example of this is construction at a site where there is little or no existing infrastructure to allow for site access, such as in many underdeveloped nations, remote areas of the world, or on extraterrestrial bodies. If a particularly



remote region is also prone to natural disasters—hurricanes, floods, earthquakes, moonquakes—the difficulty associated with measuring soil properties acquires new significance because of the extreme loadings that must be considered in design.

Clearly, new design approaches for lunar exploration and construction are necessary. NASA has outlined an aggressive plan to explore the moon and Mars over the next 15 years, including surface landings, robotic rovers, and even a moon-based laboratory. In NASA's 2008 "Exploration 101" presentation, six key focus areas are highlighted in the NASA exploration strategy. Of these, at least three will involve the interaction of structural components with lunar regolith: accumulating scientific knowledge, expanding human civilization, and expanding economic opportunities. Each of these three key focus areas involves placing some structure—be it landing gear, sampling tools, a building foundation, or resource recovery infrastructure—in contact with extraterrestrial soil.

The work is still in its nascent stages, but using the discrete element method (Cundall and Strack 1979) we have simulated the response of shallow foundations, deep foundations, and rigid retaining walls to quasi-static deformation. Our results show excellent consistency with traditional approaches to design of these geostructures. As a first step, this is quite promising because it indicates that we are able to capture complex soil-structure interaction behaviors using this very simple model. Knowing that it is possible to reproduce large-scale system response using a discrete model is the first step to actually using this approach in design.

In addition, it is possible to observe local behavior with these models that cannot necessarily be captured with laboratory tests or continuum models. For example, we may be able to gain insight into why and how a specific structure may fail as a function of extreme loadings, such as those associated with natural disasters.

While our existing results show promise, it is still necessary to validate our calculations with laboratory studies and field tests for the applicability of this approach to real design problems. These tests will be straightforward in concept, but are expensive and delicate to perform. For instance, we would like to simulate the effects of dynamic loading on geosstructures and also consider more complex structures, such as foundations for offshore wind farms. We believe that we have proven the concept to be valid, but we still have a ways to go before we are able to implement our results in practice.

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More news of the apocalypse

America versus global warming versus climate change

warming is a problem.

A University of Michigan study published in *Public Opinion Quarterly* found the way the issue is identified creates a difference in support, especially among Republicans (poq.oxfordjournals.org/cgi/reprint/nfq073?ijkey=YcGpwzhzykOYkl7&k eytype=ref). While scientists prefer to let facts speak for themselves, presentation apparently has an impact on the public. "Wording matters," says lead author Jonathon Schuldt.

Sixty percent of Republicans told surveyors they thought climate change was real. But only 44 percent believed in the reality of global warming. This anomaly may be the result of the way the issue is presented by liberal and conservative think tanks. The authors surveyed the Web sites of 12 conservative think tanks and 14 liberal ones. They found that the conservative groups were more likely to refer to "global warming" while the liberals preferred "climate change."

"Given the politicization of global climate change in America this pattern may reflect the selective use of these terms for political advantage, consistent with 'global warming' being easier to discredit than 'climate change,'" the authors wrote.

THE AMERICAN PUBLIC is nothing if not flexible. Seventy-four percent think that climate change is a real problem, while only 68 percent think that global

On another front in the culture wars, the Public Religion Research Institute reported "less than 4-in-10 (38%) believe earthquakes, floods and other natural disasters are a sign from God; and even fewer (29%) believe that God sometimes punishes nations for the sins of some of its citizens" (www.religionnews.com/index.php?/polls/americans_divided_on_whe- he_).

"The poll found that a majority (56%) of Americans believe God is in control of the earth, but the idea of God employing Mother Nature to dispense judgment (38%) or God punishing entire nations for the sins of a few (29%) has less support," according to an assessment by the Religion News Service in a story about the report.



They Said It ...

"With planetary defense there's a complex interaction of science, psychology, politics and money—and everything falls into a gap between disciplines. The science guys say, 'NEOs [near-earth objects] are not scientifically interesting, and saving the planet is not our job,' and the military guys say, 'We'll blow them up, but we don't have anything to do with telescopes of space missions.' The issue's an orphan."—Robert Arentz, head of the NEO team at Ball Aerospace and Technologies Corp, quoted by Tad Friend in *The New Yorker*.

"Investing in children and building the resilience of countries and communities living on the edge not only shortens their road to recovery, but also helps them to manage anticipated risks before a crisis strikes and to mitigate loss when it does."—UNICEF's Deputy Executive Director Hilde Johnson, in a UNICEF release announcing a \$1.4 billion annual appeal to donors.

"What was scariest was to look up at the skyscrapers all around. They were swaying like trees in the breeze."—William M. Tsutsui of Southern Methodist University, in Tokyo when the earthquake hit on March 11, quoted in *The New York Times*.

"Geologically speaking, it's nothing special. Seismic activity is not increasing, and the tectonic plates driving all the seismicity are not accelerating—not by any geophysical measure we have at our disposal. Truly huge earthquakes seem to have become more frequent over recent years, partly because their impact on society has risen as vulnerable cities have mushroomed and become more fragile, and partly because of the rarity of gigantic earthquakes and their tendency to cluster for statistical reasons and nothing more. It's a matter of perception and coincidence."—Lamont-Doherty Earth Observatory geophysicist Colin Stark in a commentary about the Japanese earthquake on CNN.

Getting closer to an answer

Was that climate change—or just weather?

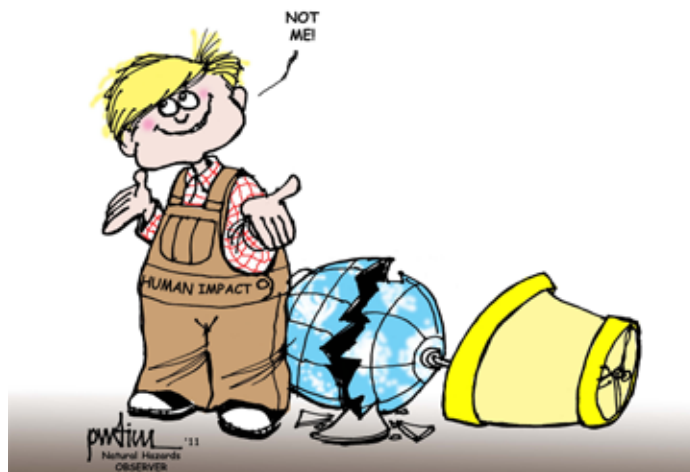
UK floods show fingerprints of global warming

A HOLY GRAIL OF CLIMATE research is the ability to make regional and local predictions about the effects of climate change. To date, climate models have not had a fine enough scale to allow objective observers to attribute an event, say the 2010 Russian heat wave, to warming. While lay people will often make the leap—witness the surge in U.S. interest in climate change in the United States following Hurricane Katrina—scientists have been very reluctant to attribute any individual phenomenon to global warming.

But a couple of recent papers in the journal *Nature* have come very close to attributing flooding in the United Kingdom in 2000 to the changing climate. Their results have important and immediate implications for the occurrence of natural disasters.

A paper in the February 17, 2011, issue of *Nature* by Seung-Ki Min of Environment Canada and colleagues found "human-induced increases in greenhouse gases have contributed to the observed intensification of heavy precipitation events found over approximately two-thirds of data-covered parts of Northern Hemisphere land areas."

In a commentary on the paper, Richard Allan of the University of Reading wrote, "A tentative but intriguing finding by these authors is that climate models may underestimate



the effects of anthropogenic global warming on rainfall intensification, a possibility that has implications for projections of future climate."

The authors say that extreme precipitation events may strengthen more quickly in the future. The water-holding capacity of the atmosphere is expected to increase exponentially with temperature. This expectation is in fact happening in accord with that theory.

In the same issue of *Nature*, Pardeep Pall of the University of Oxford and colleagues get even more specific in their attribution of an event to climate change. The group generated several thousand seasonal climate model simulations of autumn 2000 weather, both with and without global carbon emissions. They say the extreme autumn 2000 floods in England and Wales were very likely the result of climate change.

"The precise magnitude of the anthropogenic contribution remains uncertain," they write, "but in nine out of ten cases our model results indicate that twentieth century anthropogenic greenhouse gas emissions increased the risk of floods occurring in England and Wales in autumn 2000 by more than 20 percent, and in two out of three cases by more than 90 percent."

Swiss Re, in *Natural Catastrophes and Man-Made Disaster in 2010*, said, "2010 was a year of extreme weather events, such as floods of unprecedented scale—in terms of the territory and damage suffered." Floods in Australia triggered \$2 billion in insurance claims. Five hundred people died in floods in Brazil

and Colombia.

"China and Pakistan experienced extraordinary rainfall during the summer," the report says, "resulting in unprecedented floods affecting the entire length of the country in Pakistan and several large regions in China," the report states. "More than 6,000 people died as a result ... For Pakistan, this was the worst natural disaster in its history. In China, an es-

timated 230 million people were affected, 15 million of whom became homeless."

If the fingerprints of climate change can be found on these events, extreme flooding may be the new normal.

Obama issues national preparedness directive

Only the eighth directive of his presidency

THE OBAMA ADMINISTRATION has issued a presidential directive on national preparedness intended to "strengthen the security and resilience of the United States through systematic preparation for the threats that pose the greatest risk to the security of the nation, including acts of terrorism, cyber attacks, pandemics, and catastrophic natural disasters."

"It is noteworthy that the new presidential policy directive is only the eighth one to be issued by the Obama administration," says *Secrecy News* (www.fas.org/blog/secrecy/). Presidential directives are fundamental instruments of national policy, setting long-term policy goals on important national issues.

"At this point in the third year of the George W. Bush administration, around 25 presidential directives had been issued. And in the Clinton administration, there had been around 35 directives," the Web site says. "So this administration is using directives much more sparingly, for reasons that are hard to discern from a distance."

The document itself directs the Secretary of Homeland Security to develop national preparedness goals within six



months—by October 1, 2011.

The directive embraces an all-hazards approach "covering prevention, protection, mitigation, response, and recovery ... coordinated under a unified system with a common terminology and approach."

The policy is expected to provide a planning and execution framework for all levels of government. The homeland security secretary is expected to produce a report to the president based on the new national preparedness goals with a year.

Don't get buried in the snow in Canada

Swiss skiers caught in avalanches have better survival than Canadians

BACKCOUNTRY SKIERS and snowmobilers trapped in avalanches in Canada have less chance of survival than those buried in Swit-

zerland, according to a new study. This is true even though length of burial in Canadian snow slides was shorter.

Despite the fact that avalanche victims in Canada are buried for an average of 18 minutes while Swiss victims average 35 minutes under the snow, the Canadian cohort has lower survival rates. The study, published in the *Canadian Medical Association Journal*, finds, "While trauma reduced survival

primarily within the first 10 minutes of burial, the study also revealed that avalanches in areas with denser snow conditions—such as British Columbia's Coast Mountains—were associated with an earlier onset of asphyxia."

The lower survival rate emphasizes the need for education in prevention and avalanche avoidance, the paper says.

The results also suggest new guidelines for rescue.

"Prompt extrication by companions is paramount for survival," the authors say. "While the window for a successful companion rescue has been previously described as the first 18 minutes, this study shows that in Canada the window is smaller and 10 minutes might be a more appropriate guideline."

Resilience

SELECTIONS FROM THE JAPANESE Twitter stream after the 9.0 Mw earthquake on Friday March 11, 2011.

The translations were done by Jun Shiomatsu, an MBA student at the University of Cambridge, voicesfrom-japan.blogspot.com/

ディズニーランドでは、ショップのお菓子なども配給された。ちょっと派手目な女子高生たちが必要以上にたくさんもらって「何だ？」って一瞬思ったけど、その後その子たちが、避難所の子供たちにお菓子を配っていたところ見て感動。子供連れは動けない状況だったから、本当にありがたい心配りだった。

Tokyo Disneyland was handing out its shops' food and drinks for free to the stranded people nearby. I saw a bunch of snobby looking high school girls walking away with large portions of it and initially thought "What the ..." But later I found out they were taking them to the families with little children at emergency evacuation areas. Very perceptive of them, and a very kind thing to do indeed.

話でびっくりしたのが、とっさに「入口の確保」と揺れてるにも関わらず、あの状況で歩いて入口を開けた人が居たのが凄いと思った。正直、シャンデリアも証明も何時落ちるか分からないのに、凄く勇敢な人が居た事に感動した。

During the earthquake we've all been trained to immediately open the doors and establish an escape route when there is an earthquake. In the middle of the quake while the building was shaking crazily and things falling everywhere, a man made his way to the entrance and held it open. Honestly, the chandelier could have crashed down any minute ... that was a brave man!

バスが全然来ない中、@saiso が、バス停の前にある薬局でカイロを買ってきて、並んで待ってる みんなに配った！

Bus stop mini episode: It was freezing and bus was taking ages to arrive. @saiso left the queue to run to a nearby pharmacy. He bought heating pads and gave one to everyone in the queue!

この地震が、きっかけになって、失いかけていた日本人本来の良さが戒問見れた気がする。犯罪はする 様子はなく、助け合い、律儀、紳士的。普段日本人は冷たい人が多い…。って個人的に 感じてるんだけど、多くの人が今回で「絆」を取り戻しつつあるように見えて、それがなんか感動して、泣けてくる。

Today I see no crime or looting: I am reminded once again of the good Japanese spirit of helping one another, of propriety, and of gentleness. I had recently begun to regard my modern countrymen as cold people ... but this earthquake has revived and given back to all of us the spirit of "kizuna"



(bond, trust, sharing, the human connection). I am very touched. I am brought to tears.

ホームで待ちくたびれていたら、ホームレスの人達が寒いから敷けて段ボールをくれた。いつも私達は横目で流してるのに。あたたかいです。

Cardboard boxes, thank you! It was cold and I was getting very weary waiting forever for the train to come. Some homeless people saw me, gave me some of their own cardboard boxes and saying "you'll be warmer if you

sit on these!" I have always walked by homeless people pretending I didn't see them, and yet here they were offering me warmth. Such warm people.

階に 下りて中部電力から関東に送電が始まってる話をしたら、普段はTVも暖房も明かりもつけっぱなしの父親が何も言わずに率先してコンセントを抜きに行った。少し感動した。

We live in an area that was not directly hit. When my father came downstairs and heard the news saying that our area had begun allocating electricity to the hard-hit areas, he quietly led by example, turning off the power around the house and pulling the plugs out of their sockets. I was touched. He usually NEVER turns off the lights or the AC or the TV or anything!

ドイツ人の友達が地震が起きた時に渋谷に居て、パニックになっていた所を日本人に助けてもらったらしく、その時の毅然とした日本人の態度や足並み乱さずに店の外に出てやるべきことを淡々とこなす姿にひどく感動し、まるでアーミーのようだったと言っている。

A German friend of mine was in Shibuya (downtown Tokyo shopping district) when the earthquake hit. He was panicking when a Japanese passerby saved him, taking him into a building. My friend was blown away at how calm and disciplined this Japanese man was. He went out of the building with firm, unfaltering steps, did everything he was trained to do and came back. My German friend was deeply impressed by the Japanese people's actions during the earthquake, saying they looked like a trained army.

今日、募金箱に金髪にピアスの若い兄ちゃんが万札数枚入れていた。そしてその友人に「ゲームなんていつでも買えるからな」と言っていたのが聞こえて私を含め周りの人達も募金していた。人は見た目じゃないことを実感した。そんなお昼でした。この話感動しました。

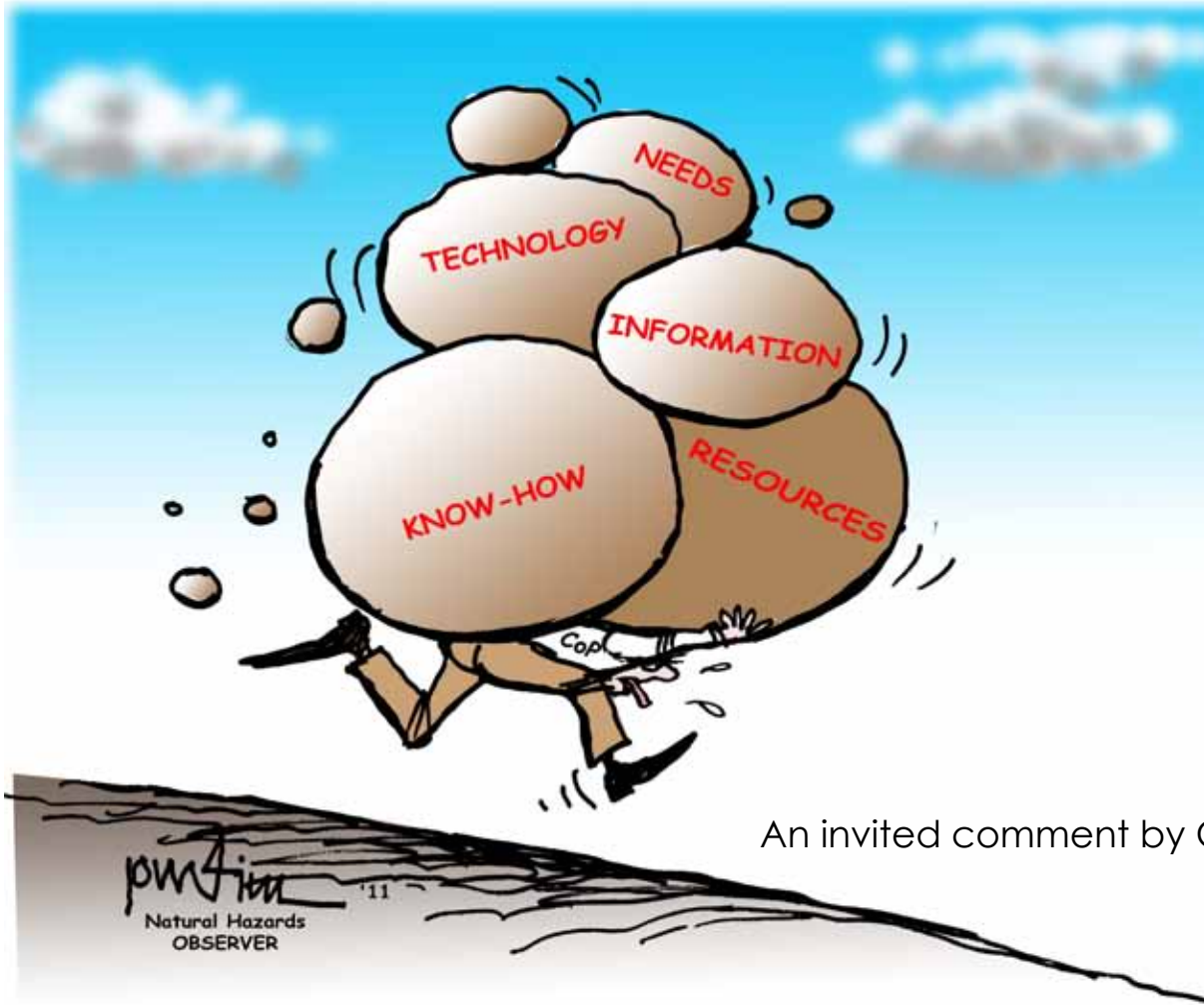
A Goth youth with white hair and body piercings walked into my store and shoved several hundred dollars (several tens of thousands of yen) into the disaster relief fund donation

box. As he walked out, I and people around me heard him saying to his buddies, "I mean, we can buy those games anytime!" At that, we all opened our wallets and put our money

into the donation box. Really, you cannot judge people by their appearances.

Social media and emergency management

Building a Better Mousetrap



An invited comment by Connie White

SOCIAL MEDIA NETWORKS HAVE SEIZED the world's attention, especially as organizing and information tools in response to crises. In North Africa, they've been credited with toppling dictators. Since the Haiti earthquake, they've been used to effectively share information to distribute relief supplies and provide medical services. Twitter was an important component of communication during the 2009 Iran election protests. Pictures and information flowed rapidly across Twitter and Facebook when U.S. Airways flight 1549 made an unexpected landing in the Hudson River in January 2009. In India, much of the information about the 2008 Mumbai terror attacks reached the outside world through Twitter and Flickr.

And so on. You can probably fill in your own examples from Albania to Zanzibar.

The emergency management field is not immune to the enthusiasm and potential generated by social media. Social media networks promise to provide instantaneous information on hazards and disasters, helping both local communities

and responders to deal with them more effectively.

But while the responses in many of the examples above came about spontaneously, the emergency management community can't rely on chance to incorporate this type of communication. It must be integrated into the communities of practice that already exist, and doing so means emergency managers need to be creative.

Cultivating social media

COMMUNITIES OF PRACTICE (CoPs) ARE POPPING UP all over the Internet. Some explicitly call themselves CoPs; some are implicit, organized along lines of mutual interest. Etienne Wenger, a leader in social learning theory and visiting professor at the universities of Manchester and Aalborg, defines communities of practice as "groups of people who share a concern, a set of problems, or a passion about a topic, and who can deepen their knowledge and expertise in this area by interacting on an ongoing basis." (Wenger, McDermott, and

Snyder 2002)

So CoPs are social networks, people linked together by choice or, sometimes, by default. They exist both online and offline. They can be extended families, clubs and volunteer organizations, stamp collectors, book clubs, or just about any group you can think of that shares a common interest.

The groups and their interests may exist whether there is an online community or not. Book clubs, for instance, often meet in person. But people may also be linked together by technology. Groups can be organized through social networking sites through Web applications supporting a variety of communication needs. CoPs can exist totally online or totally offline or somewhere in between.

But what is social media and how does it support social networks? Social media are forms of electronic communication like Web sites for social networking (Facebook, MySpace, and their kin) and blogging, through which users create online communities to share information, videos, ideas, personal messages, and so on. These forms of electronic communication provide avenues by which professionals can discover others with common interests. Online groups help seed CoPs (White, Hiltz, and Turoff 2008). Existing relationships are strengthened and new relationships are created. One advantage is that geographical proximity—unlike the Sunday brunch book club—isn't essential to share information and interests (White 2011).

Communities of practice are not only people who share a common interest, they are often serious working groups driven to better their interests by interacting. Wenger (2002) further describes CoPs as communities which:

- Share information, insight, and advice;
- Help each other solve problems;
- Discuss situations, aspirations, and needs;
- Ponder common issues;
- Explore ideas and act as sounding boards;
- Create tools, standards, generic designs, manuals, and other documents;
- Are bound by values in learning together;
- Develop, over time, a unique perspective on their topic as well as a body of common knowledge, practices, and approaches;
- Develop personal relationships;
- Exist as a group with both core members and occasional participants.

Whether a CoP is online or offline, this list of characteristics demonstrates the complexity of designing systems that match and fulfill all of the needs of the group.

Emergency management CoPs already exist and use online platforms for support. Emergency management online social networks are defined as “links from people to other

people, groups or information objects. Such objects may be messages, photos, videos, wall postings, notifications, current activities, events, widgets, etc.” (White et al. 2009)

Communities use blogs, Facebook, Foursquare, Twitter, and mapping applications as knowledge exchange centers. Smaller networked teams link to other practitioners, creating a larger network of experts. An important strength of social



media is that these smaller groups of specialists can easily connect with other groups. Together, these groups can learn from one another and better fulfill the needs of the individual groups. The challenge lies in determining how to best identify the existing CoPs and then, for those areas with holes of expertise, how to “cultivate a community of practice.”

Old dog, new trick—a bit of theory

THE TECHNOLOGY ACCEPTANCE MODEL is an information systems theory used to understand why some systems are accepted and others rejected by users (Venkatesh 2000). Important acceptance factors are ease of use and perception of usefulness. The enormous user population of social media sites such as Facebook and Twitter can't be taken for granted. It's not easy to build a system that people will want to use. Re-creating something of that magnitude is unlikely, so it's best to leverage the existing technology rather than trying to create a new site encompassing all of the features of established social sites.

For example, research on how social media could be best used by emergency management showed human resources to be a recurring theme (White, et al. 2009). Practitioners wanted features such as job postings and a place where people can post resumes. They also wanted lists of people who could be deployed at a moment's notice. Many people are qualified in a variety of ways, but a closed site might eliminate valuable

people. LinkedIn, a popular career-driven social site, however, allows for the flexibility and agility required to meet the demands of dynamic events (Harrald 2009) and has more than 90 million registered users.

Social media is easy to use—another component of the TAM. There is a huge user population which already knows how to use these sites. This is especially important when the public and community are part of response and recovery efforts. If community members are to support resilience, then their knowledge must be more integrated into emergency management efforts.

Social media is vital for emergency information specialists as they make the online information transition for their crisis communications. By using already popular forms, more information can be sent to the right people at the right time. If we create closed, isolated sites, the flow of information could be compromised.

It's also true, though, that not everyone knows how to use social media sites. But books are coming out, workshops are being conducted, and conference speakers are spreading the word. If all else fails, you can ask your children or grandchildren to help you out.

Motivating participation

SITES CREATED ESPECIALLY TO SUPPORT A CoP must be valuable enough that people engage them. If a CoP site duplicates existing applications that already meet users' needs, then there is no incentive to spend more time on the CoP site.

Community of practice sites often have trouble maintaining members' interest. But to be effective, active participation is necessary. Designing sites to support the information needs of emergency management is no trivial task. Several studies have outlined the design requirements for emergency management information systems (Turoff et al. 2004):

General design principles and specifications:

- System directory;
- Information sources and timeliness;
- Open, multi-source communication;
- Content as address;
- Dynamic updating and expectations of updating provided users;
- Relevant links;
- Authority, responsibility, and accountability; and,
- Psychological and social functions (user group design that promotes quick trust and collaboration).

Information must be updated in real time. In some cases the user has to know when new information about the situation is expected in order to make decisions in real time. Inevitably, many decisions must be made based on incomplete information.

People working in stressful situations must be mutually supportive. They have to be able to trust each other and their information. Communications facilities must enhance his trust. People responding to disasters will often be working with others they haven't met before. In a 24/7 operation, people must know that those who take over for them are competent. Parties need to be able to access each others decisions and information.

Supporting design considerations and specifications:

- Resource database and community collaboration;

- Collective memory;
- Online community of experts.

The variety of demands made on a site mean a multi-application approach is probably a good approach. Successful sites such as Facebook, Twitter, YouTube, and uStream, have additional features that contribute to their success. For example, Facebook has a gaming component that adds a recreational incentive. Gaming interactions can build strong relationships that might even increase work-related exchanges (Tapscott and Williams 2006). Existing popular social sites have many characteristics required for emergency response systems (Turoff et al. 2004).

There are three major considerations for creating a successful CoP environment. First, you must decide on the target audience—who are the group's members? Second, should group be open, closed, or secret? Finally, to what extent is information private or shared with the public.

"The traditional information management model for disaster response is centralization," write Dave Yates and Scott Paquette in the *International Journal of Information Management*. "In the past, responders have relied on information systems that manage knowledge in silos, with the rationale that consolidating unique disaster circumstances, reconciling it with existing organizational knowledge, and presenting a useful summary for decision makers required specific expertise."

But using social media to improve decision making requires a more open, flowing, silo-free method of communicating. A large group creating a closed site would be counterproductive. Valuable information should be open to all. If a fire department evaluates a situation, it's best for the information to be shared with others in a more open environment.

Another counterproductive aspect of a closed site is that it limits participation. The membership activity will be less dynamic given the initial restrictiveness. A less restricted environment opens the door to more people, hence more information. Just because someone is not officially a practitioner or emergency management official doesn't mean they can't provide useful information to the practitioner community.

Studies show disaster theories such as social convergence occur on Web-based systems (Hughes et al. 2008). The community uses existing systems to support emergency efforts (Palen and Hiltz 2007).

The public should be encouraged to be part of emergency management communities of practice. Citizen input creates greater situational awareness more quickly. Citizen journalism applications, such as uReport, iReport, and iWitness, encourage public involvement and lend to a richer picture that informs decision making. If there were an emergency management version of YouTube, for example, people could upload videos they made since they may be the first people on the scene. Perhaps citizens might be given guest privileges to upload and tag files, which practitioners could search, retrieve, and view.

Size matters

THE U.S. EMERGENCY MANAGEMENT REALM IS VAST. It represents many groups, including federal, state, local, and tribal officials; specialists; ad hoc groups and permanent organizations; and many others. A dynamic network of networks will provide the flexibility required.

Smaller groups that don't want to share or integrate information (i.e., a closed group) will be more successfully sup-

ported by a single site. This might be a good choice for group needs initially. However, as membership increases, so does complexity. More structure will be needed to keep information organized. Extreme events requiring large numbers of people for response and recovery require a host of applications (Turoff, White, and Plotnick 2010). The more complex the system, the more difficult it becomes to use and the less likely users will be to accept it.

Social media can support scalability, which will be useful for large, looming catastrophic events, such as a New Madrid or California earthquake. "Collective intelligence" and the "wisdom of the crowds" are concepts that can benefit from larger populations (Hiltz and Turoff 1978). CoPs need the flexibility to grow and contract and be modified as an event unfolds. Collaborative efforts will mature as partially distributed emergency management teams move communications to Web-based platforms, transforming the way groups interact and work together (Turoff, White, and Plotnick 2010).

Conclusion

I HAVE OBSERVED INCONSISTENCIES IN TECHNOLOGY from state to state and even from one neighboring county to the next. This creates a dangerous lack of interoperability where one group has the ability to effectively manage a disaster while the next is technologically stranded and unable to work as a unified team. Providing practitioners and officials with the technology and know-how to effectively use existing social technologies and Web applications could prove a more efficient approach to supporting the needs of emergency practitioners.

Social media is an evolving solution to support the communication and response needs of emergency management communities of practice. It has demonstrated its usefulness in crisis communications and decision making—before, during, and after an event. It doesn't provide every answer. Challenges remain in aggregating beneficial information. But using existing social media sites that have a grip on their respective parts may be a good place to start. Given the user population, popularity, robustness, cost, ease of use, and applicability—social media just may prove to be the better mousetrap.

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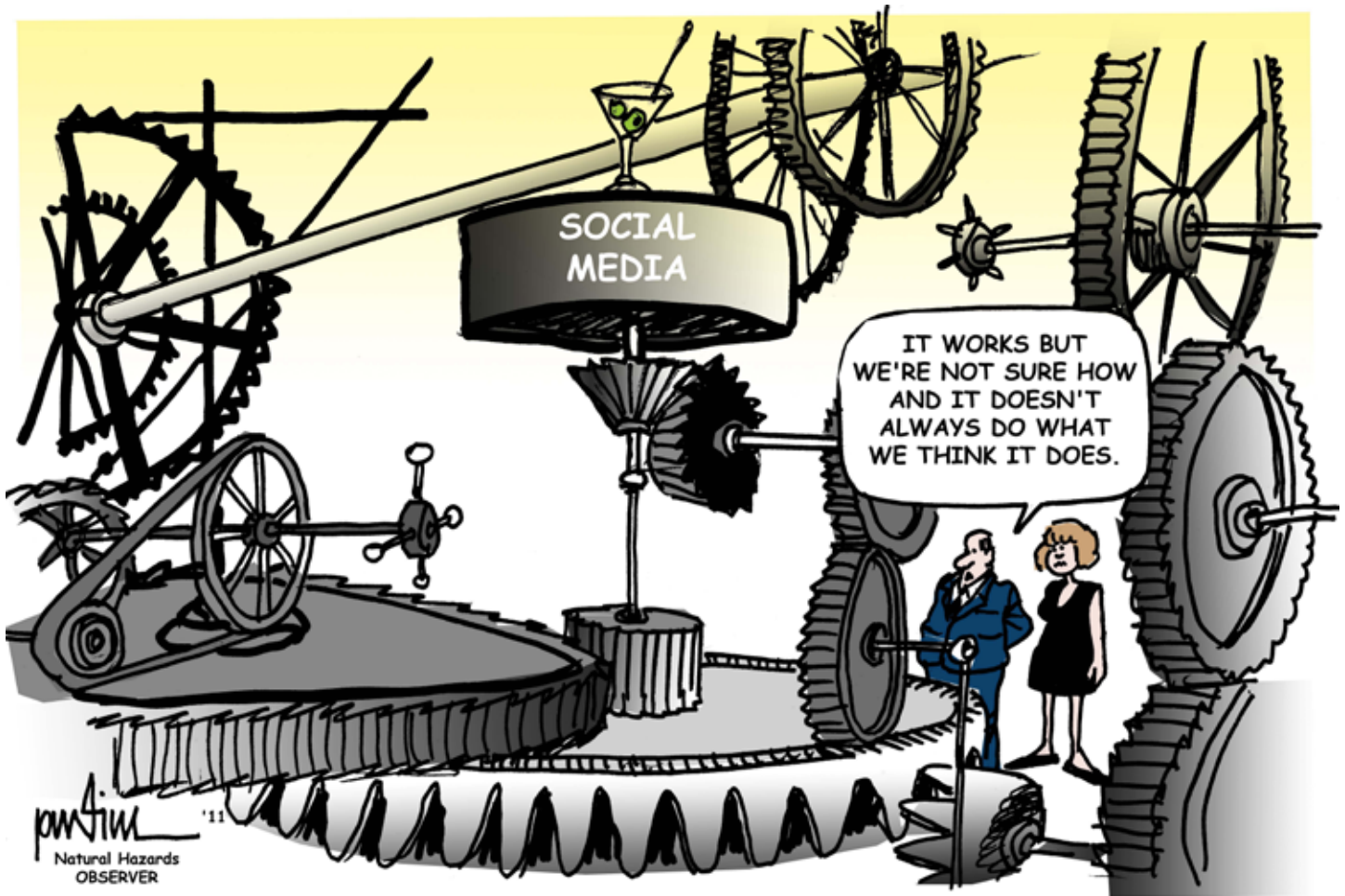
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Social media

From dictators to damage control

By Dan Whipple

SOcial media is the hot new new thing. There are several examples in which crowdsourcing of information via the Internet has proven effective, ranging from dancing “flash mobs” to overthrowing dictators.

But social media enthusiasts can be a little too quick to point out the successes, and too slow to acknowledge the failures. The Internet can serve the needs of the dictators as well as the populace. Its practical use in effective emergency management is promising, but still has issues.

New York University professor and social media advocate Clay Shirky cites several instances of successful social media-based organizations in the January/February 2011 *Foreign Affairs*. In the Philippines in 2001, mass text messaging resulted in a protest of more than a million people against President Joseph Estrada and his eventual downfall. In Egypt recently, social media enthusiasts, especially in the West, have credited social media with toppling President Hosni Mubarak. Social media played a role in the protests in Libya, which is now in the midst of a civil war.

But Shirky, who is generally enthusiastic about the future of social media, also cautions, “The use of social media—text messaging, email, photo sharing, social networking, and the

like—does not have a single preordained outcome ... Empirical work on the subject is hard to come by, in part because these tools are so new and in part because relevant examples are so rare.”

New Yorker writer Malcolm Gladwell is less enthusiastic about social media’s revolutionary potential, however. In an article in the October 4, 2010, issue of the magazine, Gladwell contrasted social media activism with the type of activism that began the U.S. civil rights movement and the first sit-ins at North Carolina lunch counters in 1960.

“Some seventy thousand students eventually took part,” he writes. “Thousands were arrested and untold thousands more radicalized. These events in the early sixties became a civil-rights war that engulfed the South for the rest of the decade—and it happened without email, texting, Facebook, or Twitter.”

Social media promotes a kind of armchair activism, he implies, “built around weak ties.” To be successful, he says, the civil rights movement had to organize in a hierarchical structure. Social networks are not hierarchical—they are unmediated networks.

When the unrest in Egypt broke out in January of this year, a lot of Western commentators were quick to draw the conclusion that it was a “social media revolution.” But Bren-

dan O'Neill, in a story in *Spiked Online* (www.spiked-online.com/index.php/site/article/10169/) says this conclusion "reveals more about the West's feverishly fearful outlook—and its narcissism, where an Egyptian uprising comes to be less about Egyptians and more about us—than it does about real life and politics in the modern Arab world."

While social media tools may have helped in some organizational aspects of the Egypt uprising, the deep politics of the situation better answered the questions of "why here?" and "why now?" than did an appeal to modern technology.

Most advocates assume that the open Internet will lead to greater freedom and democracy. Indeed, it is official U. S. policy to encourage "Internet freedom." Shirky writes, "In January 2010, U.S. Secretary of State Hillary Clinton outlined how the United States would promote Internet freedom abroad. She emphasized several kinds of freedom, including the freedom to access information (such as the ability to use Wikipedia and Google inside Iran), the freedom of ordinary citizens to produce their own public media (such as the rights of Burmese activists to blog), and the freedom of citizens to converse with one another (such as the Chinese public's capacity to use instant messaging without interference)."

But in Egypt, the regime shut down the Internet in an attempt to quell demonstrations. This effort failed which, in one way of looking at it, may demonstrate that the underlying political reasons for the revolt were indeed more important than the tools used to promote it, as O'Neill argues.

In the United States, Congress is currently considering a bill to allow the president to "turn off the Internet" if a significant cyber threat develops. The bill—which is known colloquially as the Internet "kill switch"—would not give the U.S. president the same far-reaching powers as exercised by former Egyptian President Hosni Mubarak, according to sponsor Sen. Susan Collins, R-Me.

Emergency management

Many emergency managers have been reluctant to embrace social media as a management tool, not because they can't see its potential, but because the demands they have to meet can have pretty specific requirements. Crowdsourcing is a distributed network, while dealing with an emergency often requires a hierarchical system—to put relief supplies and equipment in place, for instance.

Many groups are making progress toward turning the raw input from crowdsourcing into actionable intelligence, said Rick Tobin, head of TAO Emergency Management Consulting.

"There is information—a conglomeration of proven data compiled but not necessarily to relevancy, but which can cause paralysis by analysis," he says. "Then, we hope, there is intelligence. This occurs when information is correlated to factors of specific interest and relevance and weighted for value, then synthesized into condensed details related to the actions at hand.

"The Ushahidi folks have been trying to build a pathway from information to intelligence, but that road is fraught with difficulties because of the need to sift and verify. Right now, in large events, what is provided is a massive pile of messages that may, indeed, have some data that is important information that could provide critical intelligence, but the conversion is still too costly in labor and risky without intense screening

of the sources. I've seen the work being done to resolve this, and it is, indeed, promising—but not quite ready, yet."

Ushahidi (www.ushahidi.com) is a Kenyan open source project that allows users to crowdsource crisis information via mobile phone. It was used very successfully during Kenya's post-election violence in 2007-2008. It has since been used in Haiti and other crisis locations.

Steven Longmire, a tech expert who advises state and local governments, is working on a software solution to this information-to-intelligence issue. "The negative side," he says, "are messages that somebody sends out as a joke—'Come here, the building's collapsed. Come here, they need rescued.'"

But, he says, "The positive far outweighs the negative. You've got the amazing capability of having more eyes to help the responder get to where the need is." After the Christchurch quake, people would send messages to a pre-published number to indicate where help was needed. "Very few, if any, bad messages came through," Longmire says.

Social media platforms can have many uses in disaster relief. One New Zealand effort demonstrated how efficiently it can distribute volunteers to maximize available resources.

When Christchurch was struck by a 7.1 magnitude earthquake on September 4, 2010, a company called GeoOp provided its tracking software to nearly 15,000 members of the Volunteer Student Army based at Canterbury University for free, according to the company Web site (www.geoop.com/volunteer-army-case-study).

"Now they could enter all their jobs into the GeoOp system, dispatch them via SMS and using iPhone 4s donated by

"These deliberate rumors ranged from humanitarian aid being poisoned to cross border attacks carried out by a particular ethnic group. But many civil society groups were able to verify these rumors in near real-time using Skype."

—Patrick Meier of Ushahidi



Apple and data cards donated by Vodafone, 2Degrees and Telecom, they could update jobs, add notes and take photos in the field. Central command could then track progress of the team who were disbursed throughout the region, and send them to their next task, relative to their location."

Another promising use of social media is for rumor control. In his blog, *iRevolution*, Ushahidi Director of Crisis Mapping Patrick Meier describes how social media was able to control potentially damaging rumors during unrest in Kyrgyzstan (irevolution.net/2011/03/26/technology-to-counter-rumors/).

"These deliberate rumors ranged from humanitarian aid being poisoned to cross border attacks carried out by a particular ethnic group," Meier writes. "But many civil society groups were able to verify these rumors in near real-time using Skype."

The aid workers assembled a group of about 2,000 people—the maximum crowd allowed by Skype's software—who used their personal contacts to verify or dispel rumors. "This

method proved incredibly effective. Why? Because members of this Skype group constituted a relevant, trusted and geographically distributed network," he says.

But these groups worked using a combination of distributed and hierarchical organization. In the Kyrgyzstan effort, for instance, the only people allowed into the network were those who were trusted by others. The "inputs"—rumors—would come from anywhere, but the decision making in response to the rumors was done by a hierarchical arrangement, albeit a loose one. The same is true of the GeoOp/New Zealand case, as volunteers were assigned from the top down, while the data used for resource allocation was from the bottom up.

The decision about where to allocate resources in an emergency—from plowing the roads in a snowstorm to rescuing people from collapsed buildings after an earthquake—is the critical issue for emergency managers. While the wisdom of the crowd shows enormous potential for data gathering, managers still need to have what Tobin calls actionable intelligence so that scarce resources can be distributed efficiently.

Nukes ...

(Continued from page one)

mission commissioned a report on the Calculation of Reactor Accident Consequences (CRAC-2). Sandia Labs, the contractor who completed the report, found that an accident at the two Sequoyah units could result in 29,000 immediate fatalities and 61,000 injuries. The plants were completed in 1980 and 1981. A newer plant, Watts Bar, was finished in 1996.

The Fukushima nuclear plant in Japan—damaged in the March 11, 2011, earthquake and tsunami there—is older than our Tennessee plants. It was finished in 1971, making it one of the earliest nuclear plants commissioned. It is a boiling water reactor, a different technology from the pressurized water reactor at the Sequoyah and Watts Bar units.

However, the Brown's Ferry reactor, also a nearby TVA facility in northeast Alabama, is a GE Mark III plant, just like Fukushima, with above-ground spent fuel storage tanks. Fukushima has a total of 1,744 tons of spent fuel, 647 in pools, 1,097 in aboveground storage, according to the *Mainichi Daily News*. The three area plants—Sequoyah, Watts Bar, and Brown's Ferry—store a total 3,262 metric tons. Brown's Ferry has 1,771 metric tons; Sequoyah, 1,174 tons; and Watts Bar, 317 tons, according to TVA spokesman Ray Golden, quoted in the *Tennessean*.

The population within 50 miles of Sequoyah is about 1.1 million people, according to the 2010 U.S. Census. Chattanooga is 14 miles from the plant.

Nuclear issues for emergency managers

BACK IN 1990, I PARTICIPATED IN MY FIRST Tennessee Multi-Jurisdictional Radiological Emergency Plan Full-Scale Exercise under the direction of Patricia Davis, then the emergency services director for the Chattanooga chapter of the American Red Cross. We held our debriefing at the old emergency operations center in the "pit" at the old county jail.

Many agencies participated. After the exercise, we were evaluated by Federal Emergency Management Agency staff—with a universally good report. John Vinsant, at that time the chief of emergency management for Hamilton County, asked, in his cheery, booming voice, "Is there anybody here who doesn't believe that we could fully implement this plan in the event that we had to, and protect our community fully from the potential threat of radiation?"

One person raised his hand. When Vinsant pointed and asked "Why is that?" I realized that the person with his hand

up was me! I was much younger then. I suppose in my youth and inexperience I thought he really was asking for conversation. "Rhetorical" wasn't even a word that occurred to me at the time. I offered a brief thought or two and we all moved on quickly. Nothing to see here, folks.

In the years since that exercise, I've had time to refine my answer to Vinsant's rhetorical question. While the United States and Japan operate in different ways and with different resources, the disasters there that have affected the nuclear plants cannot fail to raise issues that must be addressed by emergency planners around the United States. Many of the long-term issues we are seeing develop in Japan are not being adequately addressed here, either.

Let's start with shelters. The American Red Cross is the lead agency for mass care for evacuated populations in Tennessee. Experience shows that in most types of disasters in the United States—floods, earthquakes, storms, and so on—only a small percentage of affected families seek shelter. But in a nuclear disaster, shelters will look better to people. They'll be scared. They'll want to know whether they should be decontaminated. Many won't have the resources to escape the sometimes long distances required, or they may be prevented from leaving by traffic gridlock.

The current nuclear emergency plans call for a relatively small number of high density shelters. In these plans—in Tennessee, at least—the number of persons to be sheltered at each individual location is unrealistically large, in my opinion. A greater number of less densely occupied facilities, while perhaps missing a few benefits of scale, would provide much less stress and conflict for residents and staff alike.

Furthermore, the trained staff available to respond in the immediate area is inadequate for effective response.

At present, the 10-mile radius, four-county emergency planning zone around the Sequoyah plants has about 63,000 residents. If there were a major accident at the plant, virtually all these people would have to be put into shelters. Sheltering this number of people would require between 8,000 and 10,000 staff for 24-hour operation. Staffing counts must be included in the facility capacity, since many of the staff would have to live at the site.

There are currently seven designated shelters in Hamilton County. There were originally 10, but one facility was logistically impossible, one ceased operation as a school, and then the percent of the population presumed to be seeking shelter was reduced in planning assumptions. The relocation center plans call for housing 30 percent of the population in the evacuation zone.

There are also three shelters in nearby Bradley County, two in Meigs County, and five in Rhea County. I'd suggest that at least twice this number of shelters ought to be identified to deal with a nuclear emergency.

In Hamilton County alone, there are an estimated 38,100 people in the 10-mile emergency planning zone. Sheltering that many people would require 5,000 staff. Even looking at the five-mile EPZ, you're still talking about 25,000 evacuees and 3,300 staff. We've never done a complete roster for our local plan in terms of identifying specific sources for a specific number of needed staff, with names and contact info. But if everyone comes who is presently trained by the local Red Cross and other agencies, you are only talking about a few hundred people—at most.

Calculating shelter capacity should be performed based on total square footage in common areas, not including classrooms and other such spaces. Manageability, security, and staffing can quickly become difficult. Ensuring that groups of strangers under extreme stress conduct themselves appropriately requires continuous contact and supervision. It will soon become chaotic if we plan to use all these spaces without adequate staffing and communications.

Staffing should be developed specific to each planned shelter facility, so that key staff can learn to work together. They must develop standard operating procedures for management challenges, including communications and developing trusting relationships.

Even in common areas, practical issues of equipment and infrastructure create challenges. In our shelter for Katrina evacuees at South Chattanooga Recreation Center—a brand new, state-of-the-art building at the time—lighting in the dormitory area was a major issue. We used the gymnasium as a dorm area, with cots. The only choices we had for lighting that area were brighter than the surface of the sun, suitable for television broadcast, or darker than God's pocket. Most people can't sleep in the kind of bright light that was available.

But when the lights were out, individuals and couples were doing things that were also hard to live with. We had incidents of sexual relations, tripping and falling, and urination on a resident. This kind of management challenge is exacerbated the more geographically dispersed and the lower the staff-to-resident ratio at the facility.

It's also possible that a lot of people won't show up. Not everyone will be comfortable working in this kind of environment. They may find a higher priority is taking care of their own families.

A radiological emergency is qualitatively different from other natural disasters. The volunteer response could be different, including national recruitment success. When hurricanes and tornadoes are over, they're over. Radiation, on the other hand, is the gift that keeps on giving. In addition, people often do not trust leaders who say everything is safe. Staffing preparedness should be examined carefully and designated civilian cadres developed who are technically, logistically, and mentally prepared for deployment to this kind of event.

Calling in help

THE ALERT AND NOTIFICATION PROCESS for getting even such trained staff as does exist into place is inadequate for timely deployment to emergency assignments. Public Switched Telephone Network failure in our community occurs when fewer than 30 percent of handsets are lifted, or when callers attempt to initiate calls. This is the familiar (and annoying) recorded



On second thought ...

Public opinion reconsiders nukes

The American public has lowered its opinion of nuclear power substantially in the wake of the Japanese nuclear emergency. Only 39 percent of Americans now favor the use of nuclear power, while 52 percent oppose it, according to a March 21, 2011, poll by the Pew Research Center for the People and the Press.

The numbers match the previous low on the pop charts for nukes, achieved in September 2005, when 39 percent favored an increase in the use of nuclear power and 53 percent opposed it.

With our exquisite timing in these matters, the March 2011 issue of the *Natural Hazards Observer* caught nukes at the high point of their popularity, just before the earthquake and tsunami hit Japan. In that article, the *Observer* reported that an April 2010 survey had found 60 percent of Americans favored increasing the use of nuclear power.

The nearly carbon emission-free electricity supplied by nuclear power plants is an often-mentioned option for reducing the threat from global warming.

In the same poll, Pew found that while the debate about the physical recovery of the Gulf of Mexico from the Deepwater Horizon oil spill is still raging, public opinion seems to have recovered completely. High gasoline prices have apparently influenced 57 percent of Americans to favor more oil and gas drilling in American offshore waters.

During the spill, support for offshore drilling declined to 44 percent in favor and 52 percent opposed. The numbers have now nearly recovered to pre-Gulf spill popularity, in which about two-thirds favored increased drilling, with one-third opposed.

message, “We’re sorry, all lines are busy, please try your call again later,” we get during severe weather, widespread emergencies and so on.

Within a short time of the onset of an emergency, family members, emergency services workers, and others will create a cascade of calls, flooding the network, bringing land-line telephone communication, at least, to a halt. Internet and wireless failures are also possible. These should be examined carefully.

One way our Red Cross chapter attempted to address communication issues was via the Government Emergency Telecommunications System (GETS). This system prioritizes national security-related calls through overloaded switching networks. At the time of my more active involvement and establishment of our local GETS participation, scarcely any Red Cross chapters in the nation had secured access to this service, and it is not clear what its operational capacity or success might be in practice.

Further, our Red Cross chapter has not had a functional, let alone robust, radio communications system for some time. This situation varies across the nation and should be evaluated, especially for chapters serving communities with civilian nuclear facilities. While amateur radio is something of a backup, and certainly can have its uses, most professional services have professional systems, and the best performing services have redundant communications resources. If you don’t have communications, you don’t have anything. Coordinating staffing and logistics instantly goes from difficult to impossible, let alone learning about and adjusting to changing conditions.

In the event of radiation emergency, it is unreasonable to expect staff to come to shelters unless they have assigned duty stations and responsibilities, initiated by reliable communications. Volunteers aren’t going to spontaneously show up at the proper facilities with the proper distribution of skill sets for each one. It’s not even certain that all trained radiological shelter responders would attempt to proceed to those locations, even if they could do so.

Public response

IN ADDITION TO TRAINING AND DEPLOYING RESPONDERS, the public has to be educated about the hazards. Radiological emergency evacuation planning for the public consists essentially of two pieces. First, each year residents within the 10-mile emergency planning zone receive professionally crafted communications about emergency planning and their response requirements in the form of a calendar. Included in this calendar is a postage-paid postcard requesting that residents notify emergency responders, by mailing it, of any mobility, health, or communications impairments to evacuation. This information is then forwarded to the local fire department or other emergency services unit as appropriate.

Past years’ calendar postcards, included a box to check reading, “I am blind.” Never mind how the blind will complete and return the form to begin with. Hopefully their family members help. But adequate family participation is far from assured. Self-reporting may not be a sufficiently reliable way to identify those who would need help, especially for those who might need the most help. They are the most likely to be so overwhelmed already. Planning for any disaster, let alone a nuclear Armageddon in their neighborhood, just isn’t on the list with pet food, medicine, and the cost of daily living.

The second piece of evacuation preparedness consists of road signs marking evacuation routes. These are inspected

annually and replaced as needed. But even if a few signs are damaged or missing, evacuees may miss critical information. Shelter information points are designated to help people get directions. They are staffed and evaluated as a part of each biannual exercise. Transportation infrastructure planning has proceeded beyond this point, but I’m not aware of these elements being integrated into planning or exercises. Evacuation behavior research must be conducted and results integrated specifically for radiological emergencies.

In Tennessee, we have conducted a number of long-range transportation planning studies, but I doubt that any of it has dealt with an evacuation from the vicinity of our nuclear facilities. “Smart” technology might be available or easily developed to improve our ability to manage this critical avenue.

Each county hosting a civilian nuclear power plant has a fixed nuclear facility planner. These are the resident experts training first responders and organizations about their duties in the event of an emergency. It is questionable whether a single FNF planner for one county is sufficient given the magnitude of duties and responsibilities. The benefits from additional FNF staffing benefits would be high compared to the potential costs measured in radiation exposure and physical infrastructure damage.

There are many details that should be included in shelter plans. Since shelters are often in schools, a plan’s operational activities should include adequate distances between shelter resident and school child pickup and drop-off areas. This will avoid the buildup of tensions. Someone—the Red Cross, the health department, or some other designated agency—must be responsible for providing towels and alternative clothing for decontaminated residents whose contaminated clothing is bagged.

Hamilton County, Tennessee, has nine designated shelters for an event at Sequoyah Nuclear Plant. In each exercise cycle, we have normally evaluated no more than three shelters. In my experience, many of those years we have had at least some of the same staff stationed at multiple shelters, which are typically evaluated in series—not simultaneously. So we have never even attempted to open all nine shelters in any given year.

We have always practiced with a skeleton crew, never attempting to present sufficient staff for any specific population of evacuees, only demonstrating that the organizations have the knowledge to carry out their assigned functions at a leadership level. It is important to demonstrate the adequacy of staffing for some specific level of occupation of the facility. Certain resources have always been in short supply, with 48 to 72 hours promises of materials like cots and blankets. A grid evacuation scenario doesn’t lend certainty that supplies will arrive in a timely way.

In the military and law enforcement, as well as emergency management functions, professionals say you “perform like you train, and you should train like you need to perform.” Planning and preparedness lead to operations that often turn out like you planned and prepared for. We may be preparing to fail at large-scale operations in response to civilian nuclear plant emergencies.

Worst case scenarios

IN JAPAN, THE FUKUSHIMA NUCLEAR PLANT WAS BROUGHT LOW by a powerful but unlikely series of events—one of the largest earthquakes ever, followed by a devastating tsunami. Every emergency planner has been forced to consider low probability events that have large impacts. These kinds of multiple di-

sasters and failures—though by definition unlikely—can be all too easily envisioned in many areas of the United States.

Along the Tennessee River, we have several hydroelectric dams built in the 1930s for flood control and economic development. These dams are old. The locks at our local Chickamauga Dam are widely known to be subject to failure. U.S. Sen. Lamar Alexander, R-Tenn., a long-time supporter of nuclear power, is well aware of this hazard and has worked hard to secure repair funds.

According to Lt. Gen. Robert L. Van Antwerp, commanding general of the U.S. Army Corps of Engineers, the spontaneous failure risk of the locks is low to moderate. This is spontaneous failure—never mind an attack or the occurrence of nearby seismic events. In the event of a failure of Chickamauga Dam, Hamilton County Hazards Analysis has stated we could expect 17 feet of water on Market Street in Chattanooga in 24 hours. Similar to the cascading failures of Fukushima, one wonders if the nuclear plant cooling water intake lines would still extend to water if the locks or dam were to fail, and whether the needed volume would be available.

More generally, eastern and central U. S. earthquake preparedness needs thoughtful examination and serious action. With increased understanding of a higher hazard level in the East Tennessee Seismic Zone should come increased resources devoted to identifying and reducing risks.

The Memphis area is also at risk. A smaller event than the Japan quake could cause greater devastation in the central or eastern United States from the lack of physical seismic mitigation, unprepared populations, and dramatically increased seismic shock transmission. Some estimates indicate that we could suffer 30 to 50 percent casualties in unreinforced masonry construction schools in the Memphis area should a large event occur during school hours. Hundreds of thousands of meals and shelter spaces would be required without

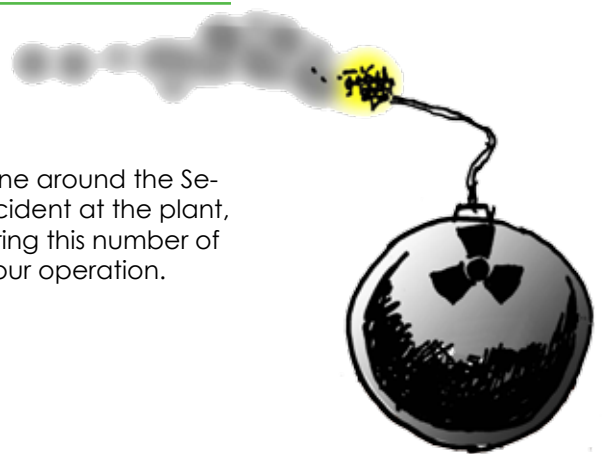
a moment's notice. Poor people and people of color would likely be disproportionately affected. The disabled and infirm would die first and in the greatest numbers. Suffering would be unimaginable, much as it must be today near Honshu.

While all-hazards emergency management is a powerful tool for a wide variety of disasters, some events require specific mitigation and response strategies to be effective. Nuclear and seismic disasters are these kind of events. Budgets are tight at every level of government and in the private sector. But we spend billions on building, operating, and securing the reactors that power our communities. Only a little more is necessary to build community capacity to respond to the unique threats these facilities pose.

Civilian nuclear power is an enormous asset to our power portfolio. Improved nuclear emergency preparedness can be a catalyst to enormously improve our all-hazards response capacities, educate and involve our citizenry, and build the resilience, common purpose, and connectedness that unites Americans.

Dennis Tate has served in numerous emergency management positions in Tennessee, including disaster specialist for the Chattanooga-Hamilton County chapter of the Tennessee Red Cross. He can be reached at indisaster@gmail.com.

At present, the 10-mile radius, four-county emergency planning zone around the Sequoyah plants has about 63,000 residents. If there were a major accident at the plant, virtually all these people would have to be put into shelters. Sheltering this number of people would require between 8,000 and 10,000 staff for 24-hour operation.





Resources

Below are brief descriptions of some of the resources on hazards and disasters that have recently come to the attention of the Natural Hazards Center. Web links are provided for items that are available free online. Other materials can be purchased through the publisher or local and online booksellers.

All of the material listed here is available at the Natural Hazards Center Library. For more information contact librarian Wanda Headley at wanda.headley@colorado.edu

ALL HAZARDS

Disaster Law. Daniel A. Farber and Michael G. Faure, eds. 2010. ISBN: 978-1-84844-431-7. 704 pp. \$306 (hardcover). Edward Elgar Publishing. www.e-elgar.com.

This book reprints critical review articles on the law of natural hazards and disasters. The articles cover the legal problems in disaster prevention and mitigation, response, insurance, and government provided compensation. "Disaster law" has not been much of a unified discipline, an oversight which this book attempts to rectify by drawing a coherent legal context for the entire spectrum of disaster preparation and response.

Managing Children in Disasters: Planning for their Unique Needs. By Jane A. Bullock, George Haddow, and Damon P. Coppola. 2011. ISBN: 978-1-4398-3766-5. 394 pp. \$79.95 (hardcover). CRC Press. www.crcpress.com.

Since we published a long treatise on caring for children in disasters last issue (*Natural Hazards Observer*, March 2010), we've kept a weather eye on material to flesh out those recommendations for emergency managers. And—what do you know?—here comes one across the desk. *Managing Children in Disasters* provides the detailed steps necessary to implement many of the recommendations made by the bipartisan National Commission on Children and Disasters.

Managing Children is a comprehensive compendium about dealing with children in disasters. It also explores how the management of children's needs impacts short- and long-term recovery. The authors cite, for instance, how important child care is in getting the economy running again: "After the hurricane, I understood how little I knew about how interconnected everything was, how everything could disappear overnight," they quote Steve Refroe of Chevron as saying. "A disaster of the magnitude of Katrina has the power to stop the economy, but how do you restart it? We used portable electric generators to generate the fuel we needed to restart the refineries. Child care is like that generator. It enables parents to go back to work—a key factor in getting the rest of the economy back up and running."

Over 12 million children under the age of six attend child care each week, which makes emergency planning crucial to ensuring a secure environment for children during and after disasters. But only 14 states currently have laws or regulations requiring child care providers to develop written disaster plans for addressing general evacuation processes, reunification efforts, and accommodation of children with special needs.

Managing Children in Disasters does not, however, go into the potentially useful step recommended by the children's commission for using existing computer and paper methods for keeping track of children to make it easier to reunite them

with their families. The National Mass Evacuation Tracking System is a manual and computer-based system states may use to in track "transportation-assisted evacuees, household pets, luggage, [and] medical equipment." It can be adapted to keep tabs on separated children as well.

But the book otherwise provides useful insights into this complex and important issue in emergency management.

Public Response to Alerts and Warnings on Mobile Devices: Summary of a Workshop on Current Knowledge and Research Gaps. By the Committee on Public Response to Alerts and Warnings on Mobile Devices. 2011. ISBN: 978-0-309-18513-4. 102 pp. \$25.20 (softcover). National Academies Press. Free download at www.nap.edu/catalog.php?record_id=13076.

The Department of Homeland Security has the ambitious goal of providing electronic alerts and warnings to 80 percent of the Americans who own cell phones and pagers. *Public Response to Alerts and Warnings on Mobile Devices* explores the alternatives about how this might be achieved, and how the public will react if it is.

There are 290 million Americans with wireless services, or about 90 percent of the population. Such wide penetration of the market offers a potentially broad and fertile field for letting people know when hazards are afoot in their neighborhoods. But how would Americans react to these alerts? One report assessed in this document says that providing URLs at which to seek additional information about an alert could overload the cellular network. On the other hand, it is a natural reaction to try to find more information about an alert before acting on it. This seems rational, since most of us have grown wary of unsolicited advice from our mobile devices.

While it provides few conclusions on these topics, *Public Response* offers a comprehensive overview of warning systems from experts in the field. It also includes recommendations for further study that may make DHS's ambitious goal a reality.

The World in 2050: Four Forces Shaping Civilization's Northern Future. By Laurence C. Smith. 2010. ISBN: 978-0-525-95181-0. 336 pp. \$26.95 (hardcover), 12.99 (softcover). Dutton. www.penguin.com.

Laurence Smith is bullish on the North. Sort of. The UCLA geography professor spent a year and a quarter traveling along the "northern rim" of North America, Europe, and Asia to assess how this region's environment and influence on the world will be changed over the next 40 years. The northern reaches of the globe are the ones that will be most affected by climate change.

One chapter relevant to hazards work is his insight on world water issues. Smith runs through some fairly well-known consequences of recent developments in water distri-

bution. Rainfall in the tropics is expected to increase. Past history is no longer a reliable guide to future water availability, volume, or rainfall frequency—known among the congenicenti as “stationarity.” The risk of wars over water in overallocated parts of globe may increase. (Or not. Experts differ about this, as they sometimes will. Even traditional enemies have compromised rather than fought over water.) The American Southwest gets drier. And so on.

“The areas where human populations will be most water-stressed are the same areas where they are water-stressed now, but worse,” he writes. “From this model and others, we see that by midcentury the Mediterranean, southwestern North America, north and south Africa, the Middle East, central Asia and India, northern China, Australia, Chile, and eastern Brazil will be facing even tougher water-supply challenges than they do today. One model even projects the eventual disappearance of the Jordan River and the Fertile Crescent—the slow, convulsing death of agriculture in the very cradle of its birth.”

The real battle over water, he says will be cities versus farms. In California, for instance, the coastal cities are economic dynamos that will eventually win any fight with agricultural interests over water.

“I’m glad humanity has a decent track record with things like settling water disputes with courts rather than missiles, and exporting food from the places that have water to the places that don’t: If any of these model forecasts are correct, we’re going to need it,” he writes. “Humans currently withdraw about 3.8 trillion cubic meters of water annually, and are projected to require more than six trillion in the next fifty years. To serve India’s expected 2050 population of 1.6 billion, even with improved water efficiency, will require a near-tripling of its water supply. Farmers, energy utilities, and municipalities are all in competition for water. Put it all together and the numbers don’t add up. Something will have to give.”

WEATHER

Hailstorms Across the Nation: An Atlas About Hail and Its Damages. By Stanley A. Changnon, David Changnon, and Steven Hilberg. 2009. 101 pp. Illinois State Water Survey. Free download at www.isws.illinois.edu/pubs/pubdetail.asp?CallNumber=ISWS+CR+2009-12.

As weather phenomena go, there is nothing quite as thrilling as a hailstorm. They often appear out of nowhere in an otherwise unobjectionable day. You can go to the window and anticipate the weathercaster’s description: Golf ball-sized? Quarters? Mothballs? Softballs? Hailstorms are interactive.

As promised in the title of this interesting work, this is a geographic exploration of hail in all its aesthetic and destructive glory. This atlas contains the interesting factoids that hail has caused only eight deaths in the United States in the past 70 years. More than 50 people were injured in Denver in 1990. In 1995, 200 people were hurt in Ft. Worth, Texas. While its killing power is negligible, hail’s economic toll is substantial, primarily in agriculture, where annual crop losses from hail damage have occasionally reached \$580 million.

Nationally, the East Coast and desert Southwest have the lowest frequency of hail—one day a year, on average—while the Rockies, especially Colorado and Wyoming, average five days a year when all hail breaks loose.

Considering its sober and scientific approach, *Hailstorms Across the Nation* makes wonderful reading for the amateur hail enthusiast. “The largest hailstones measured in the U.S.

have been 6.5 inches in diameter. A 1928 hailstorm in southwestern Nebraska produced a 6-inch hailstone weighing 1.5 pounds. A 1970 storm in southwestern Kansas produced 6.5-inch hailstones, as did a 2003 storm in western Nebraska ... Other reports of exceptionally large hailstones have come from widely separate locales. For example, 5-inch hailstones fell in Chicago in 1938, and 4-inch diameter hailstones fell in Washington, D.C., in 1953.”

Just so you know, a golf ball has a diameter about 1.7 inches, a softball has a diameter of about 4.5 inches. At 6.5-inch hailstones, we’re talking cantaloupes. Ouch.

CLIMATE CHANGE

Describing Socioeconomic Futures for Climate Change Research and Assessment: Report of a Workshop Panel on Socio-Economic Scenarios for Climate Change Research and Assessment. By three committees of the National Research Council of the National Academy of Sciences. 2010. ISBN: 978-0-309-16144-2. 76 pp. \$18.90 (softcover). National Academies Press. Free download at www.nap.edu/catalog.php?record_id=13007.

Climate change is not just about meteorological change, but also about how the prospective socioeconomic future changes with it. This document summarizes a workshop which took place in early February of 2010 to “examine how well scenarios used in climate change research reflect fundamental understanding of socioeconomic processes and change.”

Prediction is hard, especially when it’s about the future, said physicist Niels Bohr. When talking about possible socioeconomic futures and climate change, prediction is further confused by the fact that climate change isn’t the only factor that has to be considered. Christopher Field, the leader of Working Group 2 for the *Fifth Assessment of the Intergovernmental Panel on Climate Change*, told the workshop, “What is important ... is to provide better treatment of extremes and disasters. Thus, the most important change in direction is probably to present issues in a way that provides a good foundation for decisions about risk, especially about low-probability, high-consequence events.”

The group came out with several ideas for moving forward on the issue of socioeconomic research in the face of climate change, including getting scenarios under way so that results can be included in the upcoming fifth IPCC assessment.

DISEASE

What You Need to Know About Infectious Disease. By Madeline Drexler with the Institute of Medicine and the National Academies Office of Communication. 2010. ISBN: 0-309-16140-1. 44 pp. National Academies Press. Free download at www.nap.edu/catalog.php?record_id=13006.

This brief publication explores the fundamentals of a “more ecological view of the microbial world around us.” New infectious diseases are emerging, and some old ones are invading new places around the globe.

With the expanding world population and its concentration into crowded cities, an understanding of the hazard posed by infectious disease is important across the globe. There are four chapters here: How Infection Works; Disease Threats; Global Challenges, and; Prevention and Treatment.

The conclusion says, in part, “Pathogens—old and new—are endlessly resourceful in adapting to and breaching our

defenses. In addition, factors related to society, the environment, and our increasing global interconnectedness enhance the likelihood of disease emergence and spread."

TERRORISM

Is America Safe? By Robert T. Jordan and Don Philpott. 2010. ISBN: 978-1-60590-650-8. 334 pp. \$30 (softcover). The Scarecrow Press. www.govinstpress.com.

The authors don't really answer their title question, though they present a lot of useful information about preparations necessary to take care of yourself in an emergency. Like many good books on the topic of disaster preparation, this one has quite a few lists of things that you'll need to keep yourself going until help arrives. They make the strong and necessary case for self-reliance and resilience.

"During our travels around the globe," they write, "one human characteristic stands out: *resiliency*. Whether innocent victims of war in Vietnam, terror in Beirut or Iraq and Afghanistan, or tsunamis in Southeast Asia, the human instinct to survive is amazing" (emphasis in original).

The authors do add another threat to the arsenal that isn't usually seen in books about hazards. They rail against "wasteful spending ... On a moral and humanitarian level, misuse of these funds restricts our capability and capacity to respond to both man-made and natural disasters, such as terrorist sabotage or attacks and hurricanes, tornadoes, flooding, and earthquakes." Unfortunately, it's often the case that one person's pork is another's vital program. When does the high cost of emergency preparedness become wasteful? Most economic assessments of environmental and hazard threats—like climate change, for instance—focus on the costs of the effort, but say little about the benefits. How much is it worth to keep America safe?

VOLCANOES

Living Under the Shadow: Cultural Impacts of Volcanic Eruptions. John Grattan and Robin Torrence, eds. 2007. ISBN: 978-1-59874-269-5. 320 pp. \$34.95 (softcover). Left Coast Press. www.lcoastpress.com/book.php?id=95.

Living Under the Shadow concentrates on volcanoes to provide broad lessons on natural hazard risk and recovery. "By limiting the focus of this book to volcanoes—a single, although admittedly variable, type of environmental hazard—the chapters achieve a focused comparative framework," the editors write. "Volcanic disasters are, however, rather special, and it is worth noting the particular features that set them apart from other types."

While looking at the destructive power of volcanoes and their unpredictability, the volume provides a more optimistic perspective by looking at the creativity and resilience that people demonstrate while recovering from a volcanic disaster. "What has not been widely appreciated are the positive effects that volcanic events can have on the environment and on cultural process," the editors write. "Despite the seemingly devastating nature of many events, volcanic hazards as a class should not be viewed in a purely negative light. As many of the chapters show, destruction of life and environment can also provide new opportunities for alternative lifeways and/or form the platform for new forms of life and cultural innovations."

Contracts and Grants

Below are descriptions of some recently awarded contracts and grants related to hazards and disasters.

Characterizing fault zones at Kilauea and Mauna Loa volcanoes by large-scale mapping of earthquake stress drops and high precision locations. National Science Foundation grants #1045035 and #1045042. www.nsf.gov/award-search/showAward.do?AwardNumber=1045035. Three years. Two grants. \$249,393 to principal investigator Peter Shearer, University of California-San Diego Scripps Institute of Oceanography, pshearer@ucsd.edu, and \$69,151 to principal investigator Cecily Wolfe, University of Hawaii, cecily@soest.hawaii.edu.

Hawaii is one of the most active volcanic regions in the world, with the long-lived Pu'u O'o-Kupaianaha eruption of Kilauea continuing since 1983. The magmatic activity is accompanied by high rates of earthquake activity. The seismic network operated by the U.S. Geological Survey Hawaii Volcano Observatory records thousands of events every year. Since 1986 a substantial database of earthquake waveforms has accumulated. This project will analyze these data to improve earthquake location accuracy and to resolve more details of earthquake source processes, such as the amount of stress that is relieved during faulting. We will adopt a number

of new methods used successfully in the analysis of Southern California seismicity. The results from this study are expected to yield a sharper view of fault zone characteristics as well as generate a public database of information suitable for other researchers in their work at Hawaii.

These methods promise to greatly improve event location accuracy and to provide robust estimates of the patterns of earthquake stress drops, results that will help characterize fault-zone structures at Hawaii and help resolve the relationships between seismicity, volcanic activity, and strain transients. Our results will address the following questions: (1) re-located microearthquakes in Hawaii will likely align along resolvable fault and/or conduit structures: what do these structures reveal about the tectonic and volcanic processes? (2) Are there repeating earthquakes with nearly identical waveforms, and can they be used to resolve temporal variations in seismic velocity associated with tectonic and volcanic activity? (3) How do the stress drops of Hawaiian earthquakes compare to other regions? Are there variations in earthquake stress drops that can be used to characterize stress field heterogeneity and identify regions of stress concentration? (4) Are earthquakes at

Hawaii self-similar, such that average stress drop is constant with event size and large earthquakes are simply scaled up versions of smaller earthquakes? (5) What is the space/time evolution of seismicity at Hawaii? Are there consistent temporal variations in seismicity and earthquake properties related to ongoing volcanic activity and strain transients? How much of the observed clustering in the earthquake catalog can be explained by mainshock/aftershock triggering models and how much reflects possible physical triggers such as fluid migration or slow slip?

Field data on levee breaches. National Science Foundation grant #1068116. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1068116. One year. \$76,149. Principal investigator M. Chaudhry, University of South Carolina Research Foundation, chaudhry@sc.edu.

Well-designed and properly-constructed levees are generally effective against floods of short recurrence intervals. In recent years, though, there has been a spike of historic floods worldwide which may be linked to the phenomenon of global warming. Most levees are not designed to withstand floods of large magnitude and may breach. Levee failure often leads to casualties and damage to property and infrastructure. Understanding and formulating the breach process is necessary for emergency repair and breach closure in a timely manner.

Laboratory-based research has contributed to some basic understandings of the breach process, and led to the development of a number of breach prediction models. However, small-scale laboratory experiments are influenced by the scale of the experiment, and models based on these data may not be reliable. In order to develop reliable breach models, it is necessary to understand the scale effects on physical model experiments. We are currently conducting experiments at larger scales to understand the scale effect on observed breach processes. However, it is also essential to collect data at the field scale, when the opportunity arises.

The ongoing flood in Pakistan has led to numerous levee breaches, both natural and engineered. This project will allow us to collect valuable breach and flood data at the field level. These data will be useful for developing breach prediction models, for gaining clear insight into the breach evolution process, and understanding the effectiveness of engineered breaches for flood mitigation.

Technocratic expertise and the government of catastrophic risk in the United States, 1950-2010. National Science Foundation grants #1059025 and #1058882. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1059025. Two years. Two grants. \$95,848 to principal investigator Andrew Lakoff, University of Southern California, andrewlakoff@gmail.com, and \$108,686 to principal investigator Stephen Collier, New School University, colliers@newschool.edu.

In the last two decades a series of events in the United States has focused public attention on the government's role in anticipating and managing catastrophic events. In the wake of terrorist attacks, major natural disasters, pandemic influenza, and financial crises, planners and policy makers have been criticized for their failure to prepare for potential catastrophes. This project approaches the government of catastrophic risk from the vantage of science and technology studies. It asks how the category of catastrophic risk is constituted as an object of knowledge and intervention at the interface of potentially disruptive events, on the one hand, and the agencies

and experts charged with managing them, on the other.

The project investigates the historical emergence of distinctive "styles of reasoning" about catastrophic risk, and associated knowledge practices such as catastrophe modeling, vulnerability assessment, and simulation exercises. Many of these practices were initially developed in the context of the Cold War military confrontation, and then migrated to other areas, including natural disaster response, public health, and terrorism preparedness. The project traces critical moments when experts developed tools to manage events whose catastrophic potential outstripped the capacities of government agencies charged with protecting wellbeing.

Resilience and vulnerability to climate change: A collaboration between NABO and LTVTP. National Science Foundation grant #1104372. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1104372. One year. \$49,954. Principal investigator Margaret Nelson, Arizona State University, mnelson@asu.edu.

Vulnerability to climate change is a pressing policy issue at local, state, national, and global scales. Public and private organizations, policy makers, and resource managers are concerned with how communities at these scales can adjust to climate change and an increasingly uncertain future. Archaeology has a strong contribution to make to climate change policy because it investigates long sequences of social and climate change at multiple scales.

This proposal funds a research collaboration involving two research teams—the North Atlantic Biocultural Organization (NABO) in the circumpolar North Atlantic region and the Long-Term Vulnerability and Transformation Project (LTVTP) in the arid and semi-arid deserts of the southwestern United States and northern Mexico. Each team investigates the relationship between climate change and social change in extremely different settings and over many centuries. This proposed work will address: (1) how rigidity of social systems influences adjustments to climate change; and (2) whether infrequent climate changes (outside of human memory) are more impactful than frequent changes.

This research will address the impacts of social responses to climate change, an issue central to contemporary policy and relevant to public and private organizations, policy makers, and resource managers interested in promoting resilience to climate change.

Merging monsoon, snowmelt and post-flood ground information for a multivariate estimation and prediction of flood risk for the Indus River, Pakistan. National Science Foundation grant #1063717. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1063717. One year. \$45,323. Principal investigator Amilcare Porporato, Duke University, amilcare.porporato@duke.edu.

The Indus River system is fed by the melting of snow and glaciers and by monsoon rainfall. Both have the potential to produce catastrophic flooding. The intensity of the present flood clearly exceeded previous probabilistic estimates. River bank protections and dam spillway were designed to withstand smaller discharges. This project will combine statistical analysis of rainfall, streamflow, temperature, and meteorological maps with projections of global circulation models of climate to provide a reliable estimate of the typical average recurrence time of such types of events for the Indus River basin at different locations.

There is especial urgency with regard to gathering information on the flooded areas to verify the flood water levels and volumes, as well as to define (or redefine) flood risk areas. From a scientific point of view it is important to understand whether these events may become more likely with climate change.

The Indus River, one of the world's largest irrigation networks, faces both serious scarcity of water in one season and disastrous floods in another. In late July and early August 2010, the worst floods in Pakistan's history killed more than 1,600 people and directly affected more than 20 million more. The destruction to the farming industry and concurrent epidemics resulted in an incommensurable socioeconomic crisis for the country.

Assessing biomarkers of oil-spill weathering in the air and water at impacted Louisiana shorelines. National Science Foundation grant #1118254. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1118254. One year. \$199,989. Principal investigator Bernard Singleton, Dillard University, bsingleton@dillard.edu.

Following the Deepwater Horizon oil spill into the Gulf of Mexico in 2010, we will sample and do biomarker analysis of air, water, and sediments from oil-impacted shoreline and from pristine shorelines under various meteorological conditions. Sampling will be conducted to assess the effects of weathering as well as seasonal changes in surface temperature. Samples will be collected and analyzed on bioaerosol culturing assays, by quantitative microscopy, by testing of the genotoxic effect of the particulate matter. Airborne particulate matter will be analyzed for its total carbon content and its total biological load (carbohydrate, protein, phospholipid, and DNA). The project will assess the effect that weathering hydrocarbons and dispersants from the oil spill have on increasing the numbers of particles which can penetrate the human respiratory system and the toxicity potential that those particles will carry over aerosols generated in their pristine counterparts.

Disaster Roundtable. National Science Foundation grant #1060460. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1060460. One year. \$40,000. Principal investigator Lauren Augustine, National Academy of Sciences, LEAlexander@nas.edu.

This grant provides funding to the Disasters Roundtable, which facilitates and enhances communication and the exchange of ideas among scientists, practitioners, and policy makers. The goal is to identify emerging issues related to natural, technological, and other types of disasters. The Roundtable convenes public workshops to discuss issues related to the understanding and mitigation of disasters.

In the post-9-11, post-Hurricane Katrina era, the roles and responsibilities related to research, practice, and capacity of disaster and emergency management continually change. The Disasters Roundtable of the National Academy of Sciences provides a neutral forum into which representatives from various disciplines are invited to share perspectives, increase understanding, or confirm common interests to work towards solutions to disaster-related issues.

The Disasters Roundtable membership is comprised of recognized experts across the research, practice, public, and private sectors, and about half of the members provide the financial support for the Roundtable as ex-officio members.

The Disasters Roundtable and workshop formats include carefully structured presentations, small break-out and working groups, and other types of discussions that illuminate disciplinary areas of overlap and integration. The Disasters Roundtable was established in 2000 and has held more than 30 workshops, meetings, and activities on disasters-related issues since then.

Understanding changing seasonality, variability and extremes in the northeast U.S. climate. National Science Foundation grant #1056216. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1056216. One year. \$137,064. Principal investigator Anji Seth, University of Connecticut, anji.seth@uconn.edu.

This project will establish an integrated research, education and outreach program to understand changing climate in the Northeast (NE) United States.

The research will emphasize high resolution global multi-model ensembles being prepared for the Coupled Model Inter-comparison Project. Analysis will include verification of models using both global and regional observations (temperature, precipitation, winds, and moisture) and evaluation of projections for variables and timescales of importance to the region. Uncertainties will be examined using multi-model statistics. The objectives of this research are to evaluate and understand the drivers of 21st century probabilistic changes in: (1) the phase and amplitude of the mean annual cycle of climate variables; (2) the relationship between NE cold season precipitation and temperature variability associated with both tropical and mid-latitude sources; (3) the variability of warm season moisture transport into the Northeast and the relationship of soil moisture to temperature and precipitation variability; and (4) indices of extremes, the frequency and intensity of cold season cyclones, the intensity and duration of extreme heat, and their modulation by decadal variations.

Detecting local earthquakes in a noisy continental margin environment. National Science Foundation grant #1049682. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1049682. One year. \$103,966. Principal investigator Anne Trehu, Oregon State University, trehu@coas.oregonstate.edu.

Assessing earthquake risk due to seismicity along the Cascadia margin from northern California to southern British Columbia is a matter of great public interest. Studies of regional seismicity recorded by arrays of seismographs are a primary tool for this purpose, but to date studies have been largely limited to onshore arrays. In the upcoming Cascadia project, onshore instrumentation will be complemented by deployments of 60 or more Ocean Bottom Seismographs off the Cascadia coast for several years. A modest deployment of OBSs off the Oregon coast in 2007-2009 has demonstrated the great difficulty of separating relevant seismic events in OBS data from impulsive signals of probable biological origin. This project will develop computer automated methods for separating seismic signals from extraneous signals in the OBS data, particularly for instruments located in shallow water near the coast. The project has very high societal relevance for developing these techniques for studies of seismicity and seismic hazards in general, and for the Cascadia project.

The role of sediments in rupture dynamics of tsunami earthquakes and tsunami generation. National Science Foundation

ation grant #1045369. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1045369. One year. \$116,797. Principal investigator Shuo Ma, San Diego State University Foundation, sma@geology.sdsu.edu.

Continuous flux of sediments carried by the oceanic plate into subduction zone is one of the distinct features of the convergent plate boundary, giving rise to probably the most pronounced low-velocity fault zones, a factor that has largely been overlooked by the earthquake modeling community. The dominance of sediments in the subduction zone contributes to complexities in subduction zone earthquakes that are not seen in crustal earthquakes.

This research focuses on a special class of subduction zone earthquakes: tsunami earthquakes. Numerous observations indicate that tsunami earthquakes occur at shallow depths close to the trench. They are associated with the unusually long rupture duration, low rupture velocity, and/or small stress drop. These rupture characteristics have been attributed to sediments in subduction zone. Sediments in the forearc basin have also been found to affect the location of large slip asperities on the plate interface and correlate with large tsunami generation.

Why is the rupture velocity slow for tsunami earthquakes? Why do the earthquakes have long rupture duration and small stress drops, which are different from regular earthquakes? Are these features related to the anomalous tsunami generation? How significant is the role of sediments?

Understanding the physical mechanism for controlling tsunami earthquakes and tsunami generation has obvious value for reducing tsunami hazards to society. This research

will use dynamic rupture models to investigate the role of sediments in rupture dynamics of tsunami earthquakes and to better understand the physical mechanism for anomalous tsunami generation. It will include the following activities: (1) investigate the dynamic stress evolution on faults during tsunami earthquakes induced by both sediments and free surface, and its relations with rupture velocity and slip; (2) explore the effect of off-fault yielding of sediments on the rupture characteristics and seafloor deformation; and (3) simulate the effect of the forearc basin on seismic wave propagation, seafloor deformation and fault slip distribution.

Frictional behavior of oceanic transform faults and influence on earthquake characteristics. National Science Foundation grant #1061203. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1061203. Two years. \$258,077. Principal investigator Yajing Liu, Woods Hole Oceanographic Institution, yliu@whoi.edu.

Predicting earthquakes and mitigating earthquake hazards requires understanding how faults work. Most of the slip on continental strike-slip faults such as the San Andreas occurs during earthquakes, while most of the slip on mid-ocean ridge transform faults (RTFs) is accomplished by aseismic creep not related to earthquakes. The largest events on RTFs are comparatively small—magnitude 6 to 7. This study will model the behavior of oceanic transform faults using laboratory-derived rate and state friction laws that have been successfully applied to continental faults. Models will be constrained by seismicity on the faults recorded by ocean bottom seismographs.

Conferences and Training

May 8-11, 2011

Eighth International Conference on Information Systems for Crisis Response and Management
International Association for the Study of Information Systems for Crisis Response and Management

Lisbon, Portugal

Cost and Registration: \$550

This year's theme at ISCRAM is "the integration of preparedness and warning activities for crisis management." Sessions will examine how emerging technology and information systems support those activities. Panels include early warning and alert systems, geographic information science and crisis management, social media, emergency impacts on the healthcare system, risk perception, analysis, and management.

iscram2011.lnec.pt

May 9-12, 2011

National Hydrologic Warning Council Training Conference and Exposition
National Hydrologic Warning Council

San Diego, California

Cost and Registration: \$500 members, \$550 non-members

Designed especially for hydrologists, field personnel and emergency managers, this conference addresses the improvement of warnings for all types of hydrologic hazards

with special focus on changing environments and technology. Session topics include the future of flood hazards in California, Washington, and Oregon, a nationwide comprehensive water management system, and prediction of flash floods and debris flows in fire burn areas. Workshops and training, along with listening sessions, are also offered.

www.hydrologicwarning.org/content.aspx?page_id=22&club_id=617218&module_id=64114

May 10-11, 2011

International Crisis and Risk Communication Conference

University of Central Florida

Orlando, Florida

Cost and Registration: Between \$345 and \$745, depending upon category

ICRC will bring together people from government, industry, and the academy to understand how to better communicate risk. The program will focus on communicating risk and crisis information in an age offering a wealth of communication technologies. Session topics will include the social media impact on crisis communication, communications during the Gulf Oil Spill and H1N1 outbreak, social media's role in disaster scandals, and federal crisis communications.

www.icrccommunication.com/index.html

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Copies of the *Observer* and the Natural Hazard Center's electronic newsletter, *DR-Disaster Research News You Can Use*, can be downloaded free from the Center's Web site:

www.colorado.edu/hazards/

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May 11-13, 2011
Second International Conference on Disaster Management and Human Health
Wessex Institute of Technology
Orlando, Florida

Cost and Registration: \$1450

This conference will address global risk, strategies to prepare for disruptive events, and methods of prevention in disaster management and public health. Conference topics include risk mitigation; surveillance and early warning systems; pandemic and biological threats; service sustainability; and public health preparedness.

www.wessex.ac.uk/11-conferences/disastermanagement-2011.html

May 15-20, 2011
ASFPM 35th Annual Conference
Association of State Floodplain Managers
Louisville, Kentucky

Cost and Registration: \$555 to \$760, depending upon category; registration closes May 11

This is the world's largest floodplain management conference. It will cover flood mitigation, watershed management, and community flood safety, while using Kentucky's flood and water issues as a learning tool. National Flood Insurance Program compliance, green infrastructure and stormwater management, levee safety, and dam assessment are among the topics to be covered. Grant writing workshops, training sessions, and a chance to check out ASFPM's new FloodManager interactive scenario will also be offered.

www.floods.org/index.asp?menuid=663

May 15-20, 2011
Governor's Hurricane Conference
Florida Governor's Office
Fort Lauderdale, Florida

Cost and Registration: \$85 to \$195, depending upon category

2011 is the 25th anniversary of the Governor's Hurricane Conference, which focuses on preparing Florida to better respond to hurricanes. The conference focuses on

the lessons learned from the complex management challenges posed by the tropical events in whose path the state often lies. The agenda is heavy on training sessions for practical response.

www.fghc.org/

May 16-18, 2011
Effective Risk Communication
Harvard School of Public Health
Boston, Massachusetts

Cost and Registration: \$1,595

Directed primarily at health professionals, this workshop addresses underlying cognitive and emotional processes in risk perception, recognizing common biases and errors in decisions involving risk or uncertainty, communicating risk to various audiences, and strategies to improve understanding and trust. Conference topics include mental models, effects of emotion on risk perception, and risk perception and communication.

ccpe.sph.harvard.edu/programs.cfm?CSID=RCC0511&pg=cluster&CLID=1

May 25-26, 2011
Growing Old in a Changing Climate: Exploring the Interface Between Population Aging and Global Warming
Simon Fraser University Gerontology Research Centre
Vancouver, Canada

Cost and Registration: \$350

Population aging and global warming are two of the biggest challenges facing humanity this century. They are inextricably linked because older adults are among the most vulnerable to the direct and indirect health effects of climate change. Currently, gaps exist in research, planning, policy, and practice. This conference will review what is currently known; provide a forum where researchers, knowledge users, and policy makers can discuss strategies for adaptation and risk reduction; and generate new cross-cutting research and practice ideas and collaborations.

www.sfu.ca/fc2011/



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Observer cartoons are drawn by Rob Pudim.

Send items of interest to the Natural Hazards Center, University of Colorado at Boulder, 483 UCB, Boulder, CO 80309-0483; (303) 492-6818, (303) 492-2151 (fax); hazctr@colorado.edu. The deadline for the next *Observer* is **May 30, 2011**.