Maximizing Public Engagement in Radiological Monitoring as a Means of Furthering Public Understanding of Ionizing Radiation.

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Abstract

The recent accident at the Fukushima Daiichi nuclear power plant resulting from the massive earthquake and subsequent tsunami helped to highlight the persistence of public fears about ionizing radiation, as well as the need to develop and implement better communications strategies both prior to and in the wake of such accidents. The Community Environmental Monitoring Program (CEMP), established in 1981, meets nearly all of the principles for stakeholder engagement identified by the International Radiation Protection Association. The CEMP goes beyond the traditional model of public involvement often defined by town hall meetings, community advisory groups, and opportunities for written feedback, by providing a hands-on role for members of the public in the operation and communication of monitoring results collected from a network of 29 radiation monitoring stations installed at communities and ranches surrounding the Nevada National Security Site (NNSS), the area where the United States conducted the majority of its continental nuclear tests in the past. The CEMP stations are located across southern Nevada, southwestern Utah, and southeastern California, and help provide assurance to the public that no radioactive releases of health concern are occurring from the NNSS to off-site communities.

Members of the public who are residents of towns where the stations are located, many of whom are teachers at local public schools and colleges, are tasked with collecting samples and also are trained to become knowledgeable points-of-contact in their communities on issues concerning the NNSS and on ionizing radiation in general. Developing a role for members of the public in the monitoring process can provide for the creation of a network of informal communicators and knowledgeable lay-experts whose involvement can help defuse distrust of the monitoring results by the public at large, while helping to address some of the fear and misconceptions associated with ionizing radiation.

Key words: radiological monitoring, public communication, citizen scientist, Fukushima

1. Introduction

The recent accident at the Fukushima Daiichi nuclear power plant resulting from the massive earthquake and subsequent tsunami helped to highlight the persistent nature of public fears about ionizing radiation, as well as the need to develop and implement better communications strategies both prior to and in the wake of such accidents. While no direct deaths from radioactivity released by the accident have been reported, numerous indirect deaths caused by the evacuation of critically ill patients from hospital in the affected region around Fukushima have been documented and subsequently reported in the media (e.g., Talmadge and Yamaguchi 2012). Additionally, within six days of the accident, poison control centers in the United States were already starting to receive reports of adverse reactions in individuals who had taken potassium iodide pills, ostensibly to protect themselves from radiation sickness, including serious symptoms such as vomiting, racing heart, and dizziness or vertigo (Aleccia 2011).

The differences between technical and perceived risk, particularly as related to issues concerning radiation, management of radioactive waste, and nuclear weapons and power, can be significant (e.g., Slovic 1993; Whitfield *et al* 2009). Oftentimes, perceptions of nuclear risks are more influenced by trust than other technologies and sources of risk, even in nations that rely to a great extent on commercial nuclear power (Tanaka 2004; Viklund 2003). While Japanese authorities likely averted significant radiation doses to the general public by proactively evacuating the region around Fukushima, on the one year anniversary of the accident the persistence of fear and distrust among the Japanese public of both the government and nuclear industry is still marked, with many expressing uncertainty about the future of their health. In one particularly poignant example of this sentiment, a woman who lives about 40 miles (60 kilometers) from the Fukushima Daiichi power plant describes how she now keeps her windows shut, never hangs laundry outdoors and, fearful of birth defects, advises her daughters to never have children (Kageyama 2012).

While some scientists may scoff at the above reactions and sentiments, for those who have them they are very real indeed, and it is a mistake to view them as irrational. In fact, these responses, when framed within the context of the personal experiences of the individual (cf., family history and upbringing, education, exposure to popular culture, media reports, etc.) and reinforced by the phenomenon of confirmation bias that affects us all as human beings, are likely very rational reactions. The short and long-term psychological effects of the accident, which have the potential to be multi-generational in scope, will likely have long-lasting implications not only for the health of the individuals experiencing them, but for national policies on nuclear power worldwide, as indeed they already have.

In order to better address public concerns and actions such as those detailed above, it behooves the scientific community, as well as government and industry, to continue to improve their efforts in the realm of public communication in this area, in both pre- and post-event scenarios. The Community Environmental Monitoring Program, a radiological monitoring program that provides a hands-on role for public stakeholders, is proposed as a model to assist with the accomplishment of this endeavor.

2. Public Stakeholders as "Citizen Scientists"

There is a growing recognition amongst scientists and those in environmental communication that the establishment of meaningful partnerships with public stakeholders that include significant participatory roles for those who are willing to take them on can help facilitate the communication that occurs between interested, concerned citizens and corporations or agencies and the scientists who perform research or monitoring tasks for them (Groffman *et al* 2010; Shneider and Snieder 2011; Hartwell and Shafer 2011). This is especially true in cases where potential contaminants being monitored are anthropogenic in origin and have the potential, either real or perceived, to inflict harm upon human communities and their associated ecosystems. The direct participation of these "citizen scientists" can lead to increased public trust in both the process of collecting and reporting data, and has the added benefits of creating a network of informal communicators within communities, as well the potential to decrease programmatic costs.

3. Community Environmental Monitoring Program

The Community Environmental Monitoring Program (CEMP) is a network of 29 fixed monitoring stations covering a 160,000 km^2 area of Nevada, Utah, and California in the south-western United States (Fig. 1). The stations are located in communities (n=23) and on ranches (n=6) surrounding and downwind of the Nevada National Security Site (NNSS), formerly known as the Nevada Test Site, the principal continental location where the United States conducted hundreds of tests of atomic weapons from 1951-1992. The stations are sited to be very publicly visible, and collect a wide variety of radiological and meteorological data (Fig. 2). The CEMP is funded by the U.S. Department of Energy's (DOE) National Nuclear Security Administration, and is administered by the Desert research Institute, a non-profit environmental research arm of the Nevada System of Higher Education.

The CEMP has been in operation since 1981, and is modelled in part after an independent monitoring network that was created around the Three Mile Island nuclear power plant in the United States following the accident there in 1979 (Gricar and Baratta 1983). Its mission is to provide maximum transparency for and accessibility to monitoring data. It does this by making monitoring data available in near real-time through a public web site at http://cemp.dri.edu, but more importantly by providing a hands-on role for

public stakeholders in the monitoring process. The CEMP meets all of the IRPA Guiding Principles for Stakeholder Engagement, with the exception of implementing the process as early as possible. Significant public participation was not implemented until after a general loss of public trust had already occurred.

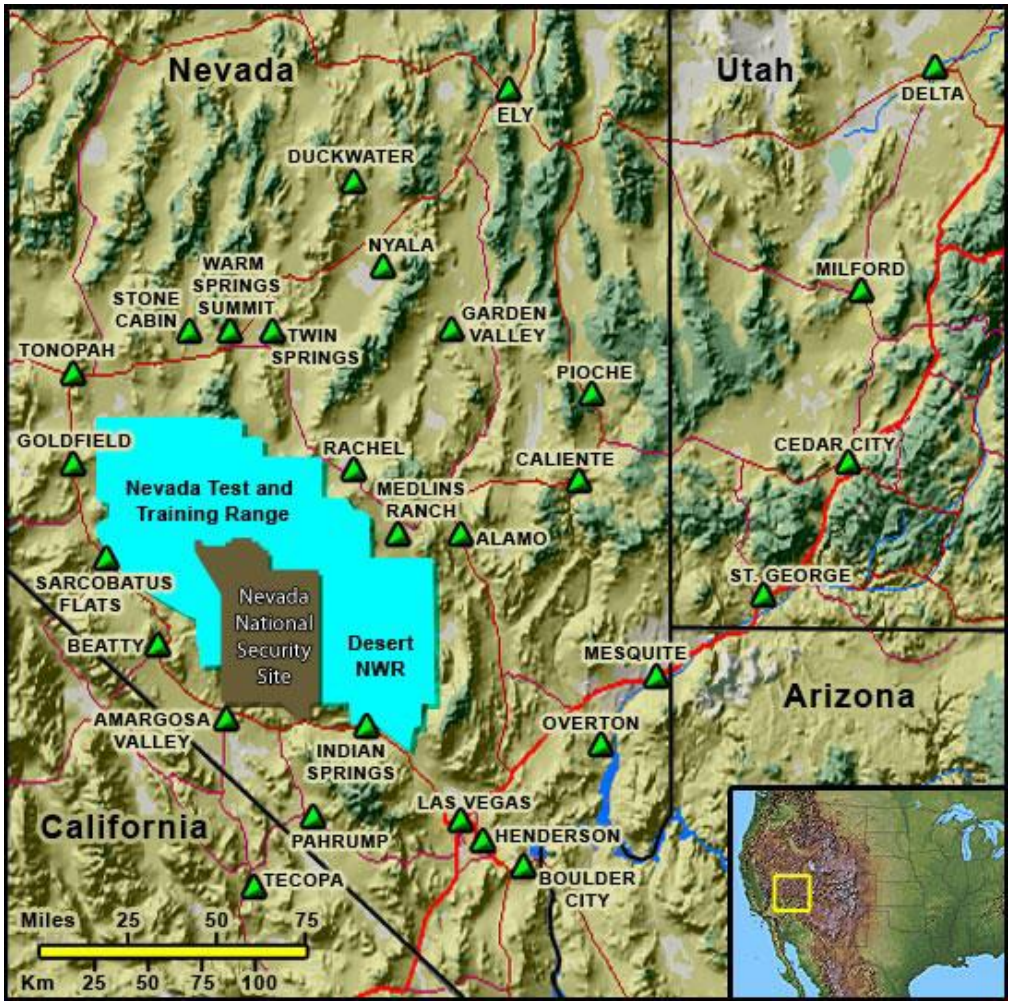

Figure 1. A map from the CEMP public web page located at http://cemp.dri.edu. The monitoring stations that make up the CEMP are located in communities and ranch sites scattered across a 160,000 km^2 area of southern Nevada, south-eastern California, and south-western Utah in the United States.

Historically, many residents of the area have viewed the DOE with distrust, as the agency responsible for contamination of downwind areas, especially during the era of atmospheric testing of nuclear weapons. While the administration of the CEMP monitoring program by a state agency associated with the higher education system helps to improve public confidence in the reported monitoring results, it is the direct participation of local residents who live in the affected communities that provides the most significant benefit for the program with regards to public trust and communication.

Figure 2. The CEMP monitoring station located at Delta, Utah in the United States. The monitoring stations are placed in public places, and most consist of a full suite of meteorological sensors, a pressurized ion chamber, a continuously running low-volume air sampler, and an interpretive display with real-time sensor displays. Data are collected every three seconds, and upload to a publicly-accessible web site located at http://cemp.dri.edu every ten minutes.

3.1 Public Participants

There are two public representatives for each of the 23 monitoring stations located in communities (Fig. 3). Their duties include collection of bi-weekly air filters, reporting any station equipment issues and, most importantly, serving as points of contact in their communities for any neighbours that may have questions or concerns about past nuclear weapons testing or current activities at the NNSS. Most of the public representatives are schoolteachers with a general background in science, which has the advantage of information gained from the program being transferred to students in the classroom. The remainder, however, are from highly varied backgrounds, including clergy, postmasters, volunteer fire fighters, and retirees. The only real requirements to serve on the program are that they be willing to take on the

responsibilities and training required, and that they be generally respected members of their communities who have a significant amount of contact with other community residents.

Formal training includes the proper procedures for collecting and delivering filter samples and for completing chain-of-custody forms. An annual workshop provides participants with a basic working knowledge of atomic structure, a "history" of ionizing radiation, what is known and not known about its potential health effects, etc. In addition, they have the opportunity to hear directly from scientists about their current research in such areas as nuclear power, low-dose effects, medical applications, etc. The program equips them with the general knowledge to be able to answer most general questions that their neighbours may ask, and provides them with a direct line-of-contact to researchers who can answer questions of a technical nature or which they don't feel comfortable answering. While there may be occasional pitfalls associated with the degree of public transparency (e.g., Hartwell *et al* 2008), the benefits outweigh the potential risks in terms of public confidence in the data and information reported by the program.

Figure 3. Residents of 23 communities in Nevada, Utah, and California in the southwestern United States are given a hands-on role in the collection of radiological monitoring data in areas surrounding the Nevada National Security Site. They participate in regular workshops where they are trained to become effective communicators with their neighbors on issues of concern related to ionizing radiation. Most are schoolteachers who are encouraged to take what they learn through their participation in the CEMP to their students in the classroom.

3.2 The CEMP in the context of communicating information about Fukushima

Although the CEMP was designed to address public concern about past nuclear weapons testing in Nevada, the first public inquiry to the program concerning Fukushima occurred within 3 days of the

accident, and an informational web page was created shortly thereafter. The page provided a brief summary of what was known of the accident at that time, including speculation that the CEMP network might detect radionuclides associated with the accident through analysis of air filter samples collected from the monitoring stations. Links were provided to professional organizations and societies as well as government agencies reporting on the event. It is worth noting that the CEMP was the only DOE program in the United States that was allowed to report information associated with Fukushima independent of DOE headquarters in Washington, DC. It was recognized that years of public trust-building could potentially be compromised were the CEMP to detect radionuclides associated with the accident and not report them in a timely manner.

Radionuclides associated were Fukushima were first detected in Nevada by the University of Nevada Las Vegas in samples collected on March 17, 2011, but not immediately reported publicly. The CEMP reported detection of I-131, Cs-137, Cs-134, Te-132, and Xe-133 on its web page several days later as analytical results became available. Following a brief interview with Associated Press (Griffith 2011), the information quickly went global, and was reported in hundreds of publications online and in print in many different languages over the next couple days. As a result, the author was deluged with dozens of media requests and hundreds of public inquiries over the next several weeks, each of which was answered personally, via email or phone, with the assistance of both environmental health faculty on staff at the Desert Research Institute as well as the health physicist serving as the DOE program manager for the CEMP. Web site hits increased a hundredfold, from a modest 40-50 per day to 5,000 per day at the peak. After approximately 6 weeks, web site hits leveled off to 400-500 per day, still ten times the previous normal rate. It is likely that the fact that detection had occurred in Las Vegas, a globally-recognized tourist destination, was a significant driver in the interest shown regarding this particular detection. Questions and concerns received ran the gamut from fear-based questions ("Do I need to cancel my vacation to Las Vegas?") to informational ("How do the millisieverts I hear mentioned on the news relate to the micro-Roentgens and pico-curies per liter I see reported on your site?") to questions about the source of the detected material ("How do you know the radionuclides originated at Fukushima rather than at the Nevada National Security Site?").

An important aspect of reporting the detection of Fukushima radionuclides was that by disseminating data results to the public representatives on the program as they became available, the CEMP was able to keep its network of community citizen scientists (Fig. 3) informed not only of the detection of radioactivity from this incident, but also that levels being measured in Nevada, and in the United States, were not a public health threat, which helped them reinforce important public messages (e.g., "There is no need to

take potassium iodide pills or any other medication to protect yourself and, in fact, it could be very dangerous to do so."). As recognized points-of-contact in their communities, they were able to provide an invaluable service by mitigating much of the concern being expressed by their neighbors over the event, and had access to relevant monitoring information *prior* to its being reported in the media so that they were prepared to address the results before they became common public knowledge.

4. Conclusions

Public involvement in environmental monitoring or other scientific endeavours that may be of a controversial nature have traditionally stopped short of a direct role for public involvement, instead relying only on practices such as holding public meetings, providing opportunities for written feedback in the form of response to proposals or studies, or the formation of advisory groups to provide input into the decision-making process. All of these are important avenues for public discourse, but they are oftentimes regulatory-driven, with little effort or impetus on the part of the agencies or corporations involved to provide additional opportunities for public engagement. Providing public stakeholders with a hands-on role can convey several potential benefits, both to public stakeholders as well as the entities responsible for conducting studies or activities that are viewed with distrust by the public. Direct participation by public stakeholders can impart a sense of ownership to those involved as well as to the general community.

Selecting individuals in positions of public trust who are representative of a broad cross-section of the members of affected communities can contribute towards increasing public confidence in monitoring results, or other activities that are conducted by groups with low public trust. A role for direct involvement for the public from the outset (rather than waiting until after public trust has been lost) can be seen as a gesture of both good faith and public transparency in the process. A larger role for public stakeholders also helps to engender increased accountability on the part of those conducting the monitoring activities.

Finally, the process of educating and training public stakeholders can create a network of informal communicators who live and work within the communities whose residents have concerns about past, ongoing, or future activities conducted by organizations or agencies that have reduced public trust can provide benefits for conveying information that may otherwise be viewed with scepticism. There may even be unanticipated benefits---for example, the ability to reinforce important public messaging on Fukushima that was made possible by the CEMP's existing communications network of community participants. These "citizen scientists" can be equipped with the knowledge to become lay-experts on

related issues of community concern, and can serve both as liaisons between their communities and industry or government, and as points-of-contact for their neighbours, which can help to identify and defuse rumours or public tensions before they reach unmanageable proportions.

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