IN THIS NUCLEAR WORLD, WHAT IS THE MEANING OF 'SAFE'?

By Barbara Rose Johnston | 18 March 2011

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Article Highlights

- How today's governments and nuclear industry educate the public on the health effects related to radiation exposure is not dissimilar from the approaches used during the Cold War.
- Japan's nuclear disaster illustrates how a nation prioritizes security interests over the fundamental rights of people and their environment.
- In a nuclear world, nations must learn how to respond, adjust, and adapt to the associated hazards and health risks.

In a nuclear crisis, life becomes a nightmare for those people trying to make sense of the uncertainties. Imaginably, the questions are endless.

Radiation is invisible, how do you know when you are in danger? How long will this danger persist? How can you reduce the hazard to yourself and family? What level of exposure is safe? How do you get access to vital information in time to prevent or minimize exposure? What are the potential risks of acute and chronic exposures? What are the related consequential damages of exposure? Whose information do you trust? How do you rebuild a healthy way of life in the aftermath of nuclear disaster?

And the list of unknowns goes on.

These questions are difficult to answer in the chaos and context of an ongoing disaster, and they become even more complicated by the fact that governments and the nuclear industry maintain tight control of information, operations, scientific research, and the biomedical lessons that shape public-health response.

This regulation of information has been the case since the nuclear age began, and understanding this helps to illuminate why there is no clear consensus on what Japan's nuclear disaster means in terms of local and global human health.

Nuclear secrecy in context. In the initial hours after the earthquake and tsunami, the Japanese government and Tokyo Electrical Power Company issued statements reporting minor damage at the Fukushima nuclear power plant. In the days that followed, government and industry officials reported the "venting of hydrogen gas", but that there was "no threat to health." This reassurance of health safety was echoed when hydrogen gas explosions occurred at the power plant.

In fact, the hydrogen released is tritium water vapor, a low-level emitter that can be absorbed in a human body through simply breathing, or by drinking contaminated water. Tritium decays by beta emission and has a radioactive half-life of about 12.3 years. As it undergoes radioactive decay, this isotope emits a very low-energy beta particle and transforms to stable, nonradioactive helium. Once tritium enters the body, it disperses quickly, is uniformly distributed, and is excreted through urine

within a month or so after ingestion. It produces a low-level exposure and may result in toxic effects to the kidney. As with all ionizing radiation, exposure to tritium increases the risk of developing cancer.

So, then, why no mention of tritium in the government or industry statements? Relatively speaking, the health effects of a low-level emitter like tritium are minor when compared to the other radiogenic and toxic hazards in this nuclear catastrophe. Such omission is a standard industry practice, designed to reassure the public that the normal operating procedures of a nuclear power plant represent no significant threat to human health.

The assertion that low-level exposure to radiation represents no human threat is an artifact of Cold War-era science that was shaped to meet government and industry needs.

During the Cold War, scientific findings on health effects to nuclear fallout that contradicted the official narrative were typically censored. **Scientists were not only punished for their work**, they were also blacklisted -- one example of this was American anthropologist **Earle Reynolds** whose work for the Atomic Bomb Casualty Commission was censored in 1953 by the US government. His research showed (http://sarweb.org/index.php?sar_press_half_lives_and_half_truths) that Japanese children who were exposed to fallout were not only smaller than their counterparts, but had less resistance to disease in general and were more susceptible to cancer, especially leukemia. The consequences of this censored history was examined in 1994 (http://www.hss.energy.gov/HealthSafety/ohre/roadmap/achre/index.html) by the US Advisory Commission on Human Radiation Experimentation, which concluded that the radiation health literature of the Cold War years was a heavily sanitized and scripted version meant to reassure and pacify public protests while achieving military and economic agendas.

Decades of such control reinforced, again and again, the core message: Humans have evolved in a world where background radiation is present and is natural and beneficial at some level; any adverse heath effect of radiation exposure is the occasional and accidental result of high levels of exposure.

Cold War classification and the close nature of government, military, and industry agendas made it difficult to challenge the assumptions that underlie the "trust us" narrative. For example, the assumption that radiogenic health effects must be demonstrated through direct causality (one isotope, one outcome) meant science on cumulative and synergistic effects was not pursued. Discounting or ignoring the toxic nature of varied radioisotopes meant health risks were assessed and regulations promulgated on the basis of acute exposures and outcomes (radiation poisoning and deadly cancer).

There are other sources of conclusive data that allow a very different interpretation of the health hazards posed by a nuclear disaster. Several of these sources document radiogenic health outcomes that sharply contrast mainstream reports: Declassified records of US human radiation experiments and similar Soviet records; Atomic Bomb Casualty Commission records; new research conducted by Japanese scientists; long-term research on Chernobyl survivors; and research done for the Marshall Islands Nuclear Claims Tribunal proceedings.

But what does this mean? From this record of studied and lived experience, there are a few things that we know. For example, fallout and the movement of radionuclides through marine and terrestrial environments ultimately get into the food chain and the human body. The toxicity of contaminants and radioactivity in fallout represent significant health risks. Acute exposures are further complicated when followed by chronic exposure, as such assaults have a cumulative and synergistic effect on health and well-being. Chronic exposure to fallout does more than increase the risk of developing cancers, it threatens the immune system, can exacerbate pre-existing conditions, affects fertility, increases rates of

birth defects, and can retard physical and mental development, among other things. And we know the effects of such exposures can last for generations.

Japan's nuclear disaster demonstrates in powerful and poignant terms the degree to which the state prioritizes security interests over the fundamental rights of people and their environment. Japan's response to its nuclear disaster -- similar to other government responses to catastrophic events like Katrina and Chernobyl -- has struggled to control the content and flow of information to prevent wide panic (and the related loss of trust in government), reduce liability, and protect nuclear and other industry agendas.

There are many lessons to be learned here, not the least of which is how to respond, adjust, and adapt to the hazards and health risks associated with life in this nuclear world. These responses will most assuredly include a demand for transparency and accountability -- that is, governance that truly secures the fundamental rights of its citizens to life and livelihood.

As the world's nations reassess nuclear power operations and refine energy development plans, now -- more than ever -- we need to aggressively tackle this question: How do we define the word "safe"?