Improving Public Understanding: Risk Assessments, Perceptions, and Communication

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ABSTRACT

This paper explores why many people oppose radioactive waste management facilities for their states and suggests strategies to reduce opposition. Technical advances beyond the methodology of traditional probabilistic risk assessment suggest new methodologies that will help mangers address salient public concerns. In addition, new insights beyond psychometrics into the origins of risk perceptions may help risk managers tailor their messages to improve public understanding of radioactive waste management issues and opportunities.

INTRODUCTION

Although the managers of radioactive waste in America have a remarkable record of successfully protecting the health and safety of the American people, there is significant opposition to proposed repositories and monitored retrievable storage facilities. This paper summarizes the reasons for this opposition and suggests how managers might both improve public understanding and reduce the intensity of opposition to radioactive waste management facilities.

SOURCES OF PERCEPTIONS

The Psychometric Paradigm

People do not necessarily want to minimize all risks in their lives. Some people willingly choose to engage in risky behavior (e.g., skiing, driving fast) and to live in areas (e.g., hillsides susceptible to landslides and forest fires) for many reasons and with full knowledge that there are safer alternatives. The benefits of such risky locations or behavior presumably outweigh the associated risks. Most people, however, view some threats as so unacceptably risky that they are rejected without consideration of any putative compensating benefits.

To differentiate acceptable risks from unacceptable ones, social scientists generally invoke the psychometric paradigm. Using qualitative cognitive methods such as focus groups as well as systematic surveys, scholars have identified aspects of threats that lead people to perceive potential threats as more or less dangerous and acceptable. These factors include:

- Catastrophic potential
- Imaginable
- Level of personal control
- Origin (human or otherwise)
- Victim status (risk imposed by others or self-selected)
- Level of societal benefit

People will generally be more concerned about deaths from a catastrophic event (e.g., a nuclear explosion) than from chronic situations (e.g., diabetes from obesity). Disasters that can be easily and vividly envisioned (e.g., a plane flying into a high-rise building) are scarier than threats that are difficult to see (e.g., radon). People are much more concerned when they perceive a lack of personal control (e.g., an accident at a radioactive waste management facility) than when they perceive themselves as in able to avoid or mitigate an accident (e.g., driving a car). People get much angrier when humans have caused the problem (e.g., explosion at a chemical plant) than if nature is responsible (e.g., a volcanic eruption or radon). People are much more likely to be outraged when the victims have the risk imposed on them (e.g., a chemical plant constructed near a neighborhood) than if they choose to accept the risk (e.g., coal miners, Everest climbers). Finally, if people perceive a technology to produce significant benefits for society, they are likely to downplay the risks of that technology and find it acceptable. For example, people who hold the opinion that America's nuclear arsenal is a necessary deterrent to foreign aggression see nuclear facilities are much less dangerous than do people who are not sure that the nuclear arsenal is needed.

Radioactive waste facilities fall on the unpleasant side of all of these factors that tend to define risk acceptance. Studies show that most people can easily envision an accident at a radioactive waste facility. That image is the terrifying mushroom cloud. People see radioactive waste facilities as closed places over which they have little influence. The origin of any accident at a radioactive waste facility would be human and the victims (outside of those working at the facility) would be innocent of any complicity in their injuries or demise. Finally, Americans are deeply ambivalent and conflicted in their views of nuclear power, the preponderant source of radioactive waste. Environmentalists, whom one would expect to be most supportive of nuclear power because of their desire to reduce greenhouse gas emissions and purify the air, generally have a dim view of nuclear power. Most Americans have little awareness of the benefits we all currently enjoy from nuclear power, so most Americans feel little emotional obligation to feel favorably about radioactive waste facilities because of their benefits to society.

We are not arguing that radioactive waste facilities really can explode to produce a mushroom cloud or that nuclear energy has not been a bargain for the country. Our point

is instead that radioactive waste facilities by their nature are likely to be so scary that they are unwanted.

Other Sources of Perceptions

Outside of the psychometric factors, four factors specific to radioactive waste facilities have made the task of siting facilities difficult. These are issues of spatial fairness, concerns over management competence and trust, the legacy of the "dump-and-leave" plan, and the question of the appropriateness of traditional probabilistic risk assessment for projects expected to survive hundreds of thousands of years. Some of these factors have little or nothing to do with whether people perceive radioactive waste facilities as risky.

First, and perhaps most important, is the fairness issue. The default heuristic for waste management is that whoever benefits from the activity that makes the waste has to clean it up. Parents teach their children that they need to clean up after themselves. Even for simple solid waste, ethicists and others suggest that there is something that does not sit well when wealthy states ship their garbage elsewhere. So, the states whose citizens benefit most from nuclear power should also have waste management facilities including repositories within their borders. If there is initially to be only one repository for high-level radioactive waste and spent fuel, the candidates should be states that benefit from nuclear power. Nevada, which also has provided a service to the entire nation through the Nevada Test Site, would seem to have deserved to be ruled out on simple grounds of fairness. If, as the US Department of Energy's Office of Civilian Radioactive Waste Management (DOE, OCRWM) has argued frequently, constructing and operating a safe repository is a trivial technical problem and that there are many suitable sites across the nation, there seems to be no legitimate reason to select a state that uses only a negligible quantity of electricity generated through nuclear power.

The law to establish repositories for low-level radioactive waste addressed the spatial fairness issue through creating regional compacts intended to ensure that these facilities would be spread out among the states. By amending the Nuclear Waste Policy Act of 1982 (NWPA) to postpone the search for a second repository and to select Nevada as the site (pending technical analysis), Congress ensured that many Nevadans would feel, to state their views gently, that the federal government is treating them unfairly.

Second, the question of managerial competence and trust has also created difficulties for managers of radioactive waste facilities. DOE and its predecessor agencies have a history of questionable waste management practices that go back to the squash court at the University of Chicago in 1942. We may agree that this sort of thing is ancient history, that we all know so much more now about how to manage radioactive waste and spent fuel, and that DOE is currently performing at the highest level in managing wastes. Still, memories of bad judgments count more than success stories in influencing trust.

Trust specifically in radioactive waste management also is a function of how citizens view the competence of the federal government in general. The federal responses to Hurricane Katrina and to events in Iraq have brought many Americans to question the general competence of the federal government. "You know you can trust me; I'm from Washington" is a comedic gag line that assumes that anyone who trusts the government is probably a fool.

Third, the "dump-and-leave" plan envisioned in the NWPA increased opposition to the repository for high-level radioactive waste and spent fuel. Doe's intention was to construct a geologic repository, deposit large number of canisters holding high-level radioactive waste or spent fuel in the repository, backfill the passages, and leave (after placing a sign discouraging anyone from digging on that spot). The imagery of the federal government bringing large quantities of high-level radioactive waste to a site and then leaving is not comforting to people who live in the vicinity. Although OCRWM now states its intention to monitor any repository for the foreseeable future, the legacy of the earlier plan left an impression of the federal government not taking responsibility for the consequences of its actions.

Fourth, traditional probabilistic risk assessment (PRA) has been the methodology used to assess the ability of the repository to isolate the waste from the biosphere. The problem is that as models extend to hundreds of thousands of years, the predictive capability of the models becomes problematic. To traditional economists, this is not a problem because even the most conservative temporal discount rates produce a conclusion that spending money to increase safety for a world 500,000 years from now is irrational. Many citizens, however, question this view and care about future conditions far into the future. They want to insure that conditions for future generations are at least as good as the present.

BETTER COMMUNICATIONS, WISER IMPLEMENTATION POLICIES, AND IMPROVED UNDERSTANDING: TOWARD AN END TO IMPASSE

In light of public perceptions and political realities, there is no silver-bullet message that will make states want radioactive waste repositories — low-level, high-level, or transuranic — in their borders. Based upon the description above of the nature and origins of perceptions toward radioactive waste facilities, there are steps that would contribute to successful policy implementation.

We put these suggestions forward in our belief that, for high-level radioactive waste, the policy question is whether radioactive should go into permanent repositories, monitored retrievable storage facilities, or stay on site at nuclear reactors. We see the "stay on site" option as the most dangerous and least in the national interest. Too often the debate over repository safety seems posed as a choice between an option of bringing high-level waste to a repository or having the waste disappear. Alas, the waste will not disappear if we ignore it, and its half-life is essentially forever. We have a number of suggestions.

First, DOE can emphasize that it has no intention of ever leaving the site of a repository with its dangerous contents. Monitoring will be continuous so that engineers will learn of

potential problems while those problems can be addressed with little danger. Engineers may argue that such a promise is silly because there will never be any problems and that monitoring has its own practical problems (e.g., what and where to monitor). The idea of sticking high-level radioactive waste deep in the ground and backfilling so that nobody can ever retrieve the waste is appealing because it would solve the waste problem forever ("shoot it into outer space" has the same appeal). A problem is that DOE by its own actions has suggested that the waste cannot be made permanently unretrievable. If the waste were not retrievable, why did DOE at one time hire a linguist to work on language to warn future generations not to dig on the site? Regardless of the technical feasibility of different levels of ease of retrievability (with full recognition that quick retrievability would facilitate access from unwanted intruders), DOE needs to eliminate the "dump-and-leave" perception.

Second, DOE should monitor the facility in conjunction with local and state officials and other stakeholders. The point is to reduce the degree to which DOE is asking others to trust the government.

Third, DOE and the US Environmental Protection Agency should reject the assumption that specific probabilities can be assigned to very rare events and that optimal decisions can be made today for projects whose consequences will occur in the distant future. Scholars have proposed Bayesian and related statistical methods for modeling the facility over different time frames. These models would be periodically updated as new information becomes available. All decisions have to be viewed as reversible, at least in principle, and contingent upon the best available information over time. Such an approach would ensure that the repository will be continuously evaluated, and not unrealistically left alone for the next 500,000 years. Presumably such updating would provide adequate warning so that managers can take appropriate protective actions.

Fourth, we urge nuclear power advocates to consider increasing efforts to educate the public regarding the benefits from nuclear power. From the psychometric perspective, on most dimensions there is little one can do to make radioactive waste facilities more popular because the facilities are inherently perceived as open to vividly imaged catastrophes that are caused by humans and threaten innocent victims. Telling people that, if a plane flew into a radioactive waste processing facility, the facility would not explode has the effect of frightening people into thinking about a plane flying into a facility that would explode with disastrous consequences to whoever happens to be within miles of the facility. The one psychometric factor that is amenable to change is the perception of benefits from the technology. Radioactive waste is a byproduct of nuclear power that has reduced our dependence on foreign oil, mitigated climate change, and saved lives through improving air quality. Radioactive waste is a small price to pay for the benefits from nuclear power, the environmental energy alternative.