Paper

AN ANALYSIS OF PUBLIC-INTEREST GROUP POSITIONS ON RADIATION PROTECTION

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Abstract—**The history of radiation risk management is replete with contentious public debate between public interest groups and the technical community of radiation protection professionals. To promote a deeper understanding of this phenomenon, this paper describes the rationales and values underlying public-interest group positions in one radiation risk domain (low-level waste) and contrasts them with those of the technical community. Public interest group objections to recycling of radioactivity-contaminated materials and to discarding of other low-level wastes are made on fairness, risk assessment, and energy-policy grounds. Concerns about procedural fairness stem from the continuing use of top-down expert-driven, rather than deliberative, systems for low-level waste policy-making. Concerns about distributional fairness arise because the benefits and risks of alterative low-level waste policies accrue to different stakeholders. Risk assessment is faulted for failure to acknowledge hidden subjective assumptions (e.g., on screening vigilance in materials recycling, on integrity of disposal facilities in the far future). Skepticism of technological risk management arises from a history peppered with unexpected untoward events that lay outside the design bases of protection systems. Finally, public interest groups view low-level waste issues as part of a larger debate on wise and legitimate energy policy, and are reluctant to support measures that provide relief to a nuclear industry that, in their view, established itself outside the democratic process. Health Phys. 91(5):508–513; 2006**

Key words: National Council on Radiation Protection and Measurements; radiation risk; public information; waste, low-level

INTRODUCTION

ONGOING DEBATES over the disposition of radioactively-contaminated materials from decommissioned nuclear facilities, the siting of low-level waste (LLW) disposal facilities, and other radiation risk issues have pitted a largely top-down expert-driven quantitative framing adopted by regulators and the radiation-using community against a more democratic, holistic, and qualitative framing advanced by a variety of public interest groups. The result has commonly been stalemate. In the United States in recent years, no process has been approved for recycling of radioactive materials from nuclear facilities, nor have any new LLW disposal facilities been opened. Despite decades of contention between technical risk managers and public interest groups over radiation protection issues, the parties seem no closer to understanding each other, let alone finding areas of agreement or compromise. In December 2004, for instance, representatives of 50 public interest groups protested sharply against proposed government standards for cleanup of property contaminated by acts of radiological terrorism (Hirsch and D'Arrigo 2004). These proposed standards were developed without public interest group involvement. Is this state of affairs immutable, or are there ways that radiation protection professionals can facilitate more consensual policy decision-making?

This paper draws on statements and writings of various stakeholder groups, as well as on existing social science literature on risk management, to identify key differences in perspective that are most responsible for disagreements over radiation protection. The purpose of this analysis is to promote a meta-perspective that might lead to more edifying deliberation in this particularly challenging area of public policy. The article focuses on management of low-level radioactive waste to provide a specific context for analysis, but the discussion is applicable to other areas of radiation protection as well.

TECHNICAL AND DEMOCRATIC CULTURES

The public discourse over management alternatives for low-level radioactive waste provides a fascinating and instructive example of the interplay between the technical and democratic perspectives on risk (Table 1) (Plough and Krimsky 1987; Fiorino 1989). The vast majority of radiation protection and regulatory professionals who work on LLW issues are trained in the natural sciences or engineering. They inhabit a technical

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Table 1. Contrasting caricatures of judgment and decision making in technical and democratic cultures (Plough and Krimsky 1987; Fiorino 1989).

Technical culture	Democratic culture
Decisions are framed in technical (risk) terms, with a focus on natural science and engineering.	Technical aspects are part of a larger ethical, social, economic, and historical milieu.
The most important attribute of a decision process is its technical rigor.	The most important attribute of a decision process is its ethical rigor (fairness).
Meritocracy. In disputes, defer to the most technically credentialed.	Pluralism. In disputes, trust collective wisdom.
Trust technical models of proposed systems to provide the best predictions of performance for those systems.	Trust the historical record for technological enterprises in general to provide the best performance predictions for proposed systems.
Utilitarian ethics. It's ok to expose people to small risk without their consent, if doing so raises the average welfare of society.	Rawlsian ethics (Rawls 1999). The welfare of a few (especially the worst off) should not be sacrificed for the benefit of many.
The first principle of radiation protection assures that radiation producing activities do more good than harm (utilitarian). The job of radiation protection professionals isn't to judge the legitimacy of the political process by which exposure-producing activities arise. Their job is simply to manage radiation risks from existing activities.	The public should not have to bear the health or economic cost of exposure-producing activities spawned by undemocratic (illegitimate) processes. Illegitimate enterprises should be curbed and the costs of full protection from past illegitimate activities should be borne by the illegitimate enterprises themselves.

culture. It is not caricature to note that, in the process of framing and analyzing a LLW problem, they tend to focus on natural science dimensions, often giving limited attention to the problem's social, ethical, and historical components. They are *technical rationalists* who, in the pursuit of scientific rigor, value reduction (simplification), quantification, and measurement. In disputes, they defer to those with the most prestigious and prodigious technical credentials. They define risk in narrow terms as expected mortality and morbidity. They frame the LLW problem largely as one of acceptable risk, leaving off the table broader issues such as confidence in institutional vigilance, or the fairness of the process by which "acceptable" is defined.

By contrast, many staff of public interest groups as well as many of the public itself are *cultural rationalists* who see the question of acceptable risk as a subset of the broader question of acceptable morality and decency (Douglas 1985). The boundaries that cultural rationalists draw around LLW issues extend beyond those set by technical rationalists. Whereas technical rationalists ask "What is a sufficiently safe way to deal with LLW?" cultural rationalists ask "Why are we producing LLW in the first place?" Cultural rationalists value fair process over technical rigor. They are more concerned with assuring that everyone is heard and with confronting contextual issues than with reducing the problem to a mathematically solvable system. To resolve disputes, cultural rationalists prefer an egalitarian process in which technical credentials confer no privileged status.

Cultural rationalists don't reject a scientific approach to problem solving. But they are critical of technical rationalists who strip a complex policy problem of its "soft science" components in order to make it solvable by "hard science" methods. Cultural rationalists support rigor and consistency, but only as part of an analytic-deliberative process that integrates the hard and the soft, and uses input from all stakeholders.

In the sections below, key areas of conflict between technical and cultural approaches to LLW management are explored. These areas include fairness of process and outcome, objectivity of risk management authorities, expert sensitivity to public sensibilities, self-serving spin, and the utility of risk assessment.

FAIR PROCESS AND FAIR OUTCOME

Although the fundamental guidance documents for radiation protection (ICRP 1991; NCRP 1993) have long made reference to various ethical principles (e.g., justification, optimization/as low as reasonably achievable, dose-limitation/acceptable risk), published rationales for most risk-management practices proposed by the radiation protection community are rather light on ethical analysis (Shrader-Frechette and Persson 2002). Yet it is ethical concerns that are cited most often by public interest groups involved in debates on LLW management. These can be divided into concerns about procedural equity (fair process) and distributional equity (fair outcome).

Procedural equity

Because different stakeholders inevitably disagree about how costs, risks, and benefits should be allocated in society, democracies depend on principles of fair process to make public policy decisions legitimate. How a participatory process is designed and implemented determines both whether it is moral in a normative sense and whether stakeholders consider the resulting policy decision to be justified, independent of whether they concur with the decision itself. Over the past several decades, social scientists have made great progress in understanding the properties of different kinds of participatory processes (Chess and Purcell 1999), but this knowledge has been slow to diffuse into practice (Petts 2004). Public interest groups have noted many problems with various participatory processes in which they have

engaged on LLW issues (Magee et al. 2002). These problems include failure of risk-management organizations to involve stakeholders at the earliest stage of the decision process, insufficient notice given to stakeholders to permit them adequate preparation, lack of acknowledgement of and response to stakeholder comments by risk-management organizations, and lack of transparency.

Because decisions on LLW policy are laden with value judgments (e.g., acceptable levels of risk, acceptable risk-cost trade-offs, rights of future generations), public interest groups find procedures illegitimate that don't involve representatives from outside the technical community of radiation professionals: *". . . this science panel is not balanced with enough representation from public interest groups whose sole purpose is to protect the public health and environmental resources. Our recommendations for greater participation by qualified representatives from non-profit public interest organizations have been largely ignored. A panel with greater diversity would reflect the range of views and would be of greater value to achieving a consensus."*—P. Klasky, Bay Area Nuclear Waste Coalition (Klasky 1999)

Imposition of risk without the informed consent of those who bear it has been an important reason for public interest groups' opposition to the recycling of radioactively-contaminated materials: *"The American people are not able to give their informed consent regarding whether they want radwaste in their children's braces or tricycles, since they are unaware of where this irradiated material was deposited and where it continues to recycle through society, in their midst."*—D. D'Arrigo, Nuclear Information and Resource Service (Maloney 2004)

Issues of fair process have plagued the nuclear power industry since its inception. The anti-nuclear power demonstrations of the 1970's in the United States were largely a reaction to the lack of meaningful official channels through which the public could engage in policy discussions involving the growth of nuclear power and the siting of new plants. In the view of many public interest groups, the current fleet of nuclear power plants in the United States has no legitimate right to exist because of the non-participatory nature of the decision processes by which they came into existence. As a result, public interest groups view LLW from nuclear power as deserving of tighter regulation than LLW from technologies such as nuclear medicine, which would not exist without explicit patient consent to treatment.

Distributional equity

Different theories of justice have different prescriptions for how costs and benefits should to be distributed across individuals in society (Davy 1996). Utilitarian justice, for instance, calls for providing the most good to the most people, even if that means causing harm to some. Rawlsian justice (Rawls 1999), in contrast, calls for taking only those actions that make no one worse off, even if that means foregoing opportunities that might make the average person better off.

Distributional equity issues figure strongly in decisions about both LLW facility siting and the recycling of radioactivity-contaminated materials. The radiation-using community makes the utilitarian argument that any population health risks that might be associated with a LLW disposal facility are outweighed by the societal benefits of the activity that produced the waste. Public interest groups, applying a Rawlsian view, argue that coercing communities to accept risks from a LLW facility is immoral, regardless of the societal benefits of the activity that generated the waste.

In advocating the recycling of radioactively-contaminated materials, the nuclear industry makes the utilitarian argument that the value of the materials to be recycled outweighs the population health risk that would result from additional radiation exposure. Public interest groups, again applying Rawls' views, argue that the nuclear industry has no right to infringe on individuals' health, nor to impose the economic risks of radiological contamination on other industries (e.g., recyclers, manufacturers) (D'Arrigo et al. 2003).

Representatives of several public interest groups (Ledwidge et al. 2004) recently called attention to the weakness of risk-benefit analysis in radiation protection. Despite the fact that one of the three guiding principles of radiation protection, as prescribed by the ICRP (1991), is to assure that the benefits of any radiation-producing activity are sufficient to justify its health risks, guidance documents for radiation protection offer little explicit analysis to demonstrate adherence to this principle. Moreover, although the principles of radiation protection allude to fairness, they provide no guidance as to how the interests of individuals, corporations, and society as a whole are to be weighed under different circumstances. This inattention to values is in striking contrast to the enormous detail that guidance documents provide on how to analyze the physical and biological components of a radiation protection decision. The central role of values in policy decisions (Keeney 1992) would seem to demand more complete treatment of this long-neglected area.

OBJECTIVITY OF RISK MANAGEMENT AUTHORITIES

Public interest groups are wary of biases that might arise because many technical professionals responsible

for managing LLW belong to organizations that use, generate, or gain revenue from the use of radioactive materials. Although most technical rationalists would probably argue that they can make objective judgments under such conditions of conflict of interest, recent work by psychologists has shown that succumbing to a conflict of interest is typically an unintentional and unconscious process that has to do with the biased way in which humans process information (Chugh et al. 2005). When confronted with new evidence, those wanting to believe something (e.g., low doses of radiation are benign) ask themselves "Can I believe it?" whereas those who don't want to believe that thing ask themselves "Must I believe it?" Seen in this light, public interest groups' wariness of radiation risk management by the radiation-using community is not unreasonable.

LLW proceedings have not been free of more direct conflicts of interest either. In response to conflict-of-interest concerns raised by citizen groups (Hauter 2001), in 2000–2001 both U.S. Nuclear Regulatory Commission (U.S. NRC) and U.S. Department of Energy (U.S. DOE) cancelled contracts to evaluate radioactive metals recycling with a consultant that had an active contract with another party to recycle radioactive materials from U.S. DOE facilities. In its termination letter, NRC noted that the contractor "has conflicting roles which may bias its judgment in relation to its work for NRC."

Other than conflict of interest, objectivity in the community of radiation protection professionals (and in public interest groups) is compromised by inbreeding and "groupthink" (Janis 1982), the former limiting input of "new blood" from disciplines and institutions outside the traditional sources of supply, and the latter inhibiting individuals within the existing "in group" to challenge the status quo. Historically, these factors have repeatedly impeded the evolution of science (Bauer 1994) by forming barriers to change that could only be overcome by the most persistent advocates wielding the most complete and compelling evidence against the dominant paradigm.

EXPERT FRAMES AND PUBLIC SENSIBILITIES

Most past attempts at siting nuclear waste repositories have met with vociferous public outcry. Freudenburg (2004) attributes this public reaction to risk managers' insistence on technical rationality in the siting process. He cites several reasons that technically-framed, expert-dominated decision processes are doomed:

1. Experts don't know all the facts. When examples of expert shortcomings, such as lack of local knowledge, come to light in the course of a siting process, experts lose credibility;
2. Expert processes are replete with subjective and often implicit judgments about methodological and ethical values (e.g., acceptable dose limits, acceptable risk-cost trade-offs, time horizons, extrapolation of models). Expert processes often do not acknowledge the subjective nature of these judgments, nor seek explicit input from the public regarding them. This results in loss of legitimacy;
3. Expert processes typically do not analyze the socio-economic consequences of siting decisions. In particular, expert panels haven't included in their analyses the predictable public response (e.g., demonstrations, property value loss, stigmatization) to contentious policy announcements. When such responses inevitably occur, experts blame the public (and public interest groups) for being irrational. This is akin to killing the messenger; and
4. Expert processes often dismiss citizen concerns "as being ill-informed, ignorant or otherwise invalid." Such dismissal predictably generates anger, alienation, and spite. Experiments in the psychology lab show that spiteful people can prefer lose-lose to win-win outcomes (Pillutla and Murnighan 1996). That is, wronged parties seek to assure that if they don't get what they want, no one will get what they want.

Wynne has explored scientists' inability to understand the limits of legitimacy of the technical framing of risk-management issues: *"(Scientists) fail to see that a definitive element of public judgment. . . is a combined ethical–intellectual judgment of the exaggerated claims being made by scientific experts about the intellectual power of the scientific risk knowledge which supposedly has sovereignty over the larger issue of consequences, and which is even assumed to define the essential meaning of the public issue. . . "* (Wynne 2001).

In other words, scientists seem ignorant of the fact that the public questions their wisdom precisely because scientists insist on a purely technical framing of risk-management issues. This inability of the technical risk management community to recognize the legitimacy of alternative perspectives comes across as condescension and is a target for mockery:

"(NRC's) concept of public involvement is not to listen to people, but to go out and 'educate' us so that we agree with them."—M. Ewall, Pennsylvania Environmental Network (Ewall 1995)

"It's hard to imagine a nuclear enterprise more tone deaf to public concerns or a more cockamamie scheme than taking radioactive waste and disposing of it in consumer products." —D. Hirsch, Committee to Bridge the Gap (Bess 2001)

SPIN AND PUBLIC COMMUNICATION

Whether consciously or not, partisans in the LLW debate spin their rhetoric to advance their positions. Public interest groups criticize the nuclear industry and regulators for several types of spin. One involves the use of labels that soften the perceived hazard, a practice that has been dubbed "linguistic detoxification" (D'Arrigo et al. 1999). The term "low level," for instance, connotes "low hazard" to the layman (Ewall 1995), even though some LLW can be dangerous if handled inappropriately. Even the term "disposal" is misleading (Johnsrud 1999) because it connotes permanence, thus limiting questions in the public's mind about the extent to which burying LLW removes it from the biosphere. In comments solicited by NRC as part of its "Rulemaking on Controlling the Disposition of Solid Materials," NRC was accused of purging the word "radioactive" from the rulemaking title in order to generate less public attention and concern (D'Arrigo et al. 2003). Another spin tactic noted by public interest groups involves downplaying the significance of nuclear power as a source of LLW (Ewall 1995). The 1999 LLW position statement of the Health Physics Society, for instance, listed "medical research" first in its list of LLW sources,[†] even though nuclear power is responsible for the majority of LLW, by almost any measure. Given the sensitivity of partisans to the spin content of their opponents' rhetoric, it may be difficult to improve the quality of stakeholder deliberation on LLW issues unless parties purge their messages of provocative spin.

Risk Analysis

Public interest groups are critical of the risk assessment practices that undergird various LLW proposals. On materials recycle, they are skeptical of assumptions that screening on an industrial scale can prevent incidents of untoward exposure to consumers. Technical procedures for screening aren't foolproof (e.g., only gamma sources can be detected at a distance through surrounding materials). Moreover, the effectiveness of any screening system depends on recyclers adhering to regulations, a prospect that might seem dubious to those familiar with the history of regulatory compliance. To date, assessments of recycling risks have not addressed these weaknesses.

In the case of LLW disposal facilities, public interest groups question the ability of risk assessors to account for all possible failure modes, and to realistically characterize the failure modes that are identified. At a meta-level, public interest groups extrapolate from the history of technological risk management in general (Chiles 2001) and LLW management in particular, noting that both are peppered with examples in which protections failed in unexpected ways: *"Every low-level radioactive waste facility in the U.S. to date has failed to contain radioactive elements; often, with disastrous results as was the case in Maxey Flats, West Valley, New York, Richland, Washington, Sheffield, Illinois, and Beatty, Nevada."*—E. Epstein, Three Mile Island Alert[‡]

In this broader context of the history of technological failure, skepticism of risk assessments of proposed LLW dispositions does not seem irrational.

THE CHALLENGE

Public interest groups are among the most valuable resources of democracy. Those with interest in the LLW issue have challenged the radiation protection community to acknowledge the full complexity of the LLW problem and to reach beyond the comfortable domains of physics and biology in devising ethically defensible and politically realistic solutions. In a 1996 report (Stern and Fineberg 1996), the National Academy of Sciences called on risk managers to embrace multi-stakeholder analytic-deliberative processes, noting the promise that such processes hold for mutual learning, better quality decision-making, and enhancement of public trust in risk-management institutions. Serious attention to this call might move the debates over LLW disposition toward a more gratifying equilibrium. Given the substantial inertia of stakeholder frames and opinions, reaping such benefits may require patience and persistence extending beyond any one venue or period (Bedsworth et al. 2004). The radiation protection community could make a lasting contribution by applying the same high standards for deliberation and rigor to the social and ethical components of radiation protection as it does to the hard science aspects of its mission. Bauer (1994) likens using monodisciplinary science for understanding complex phenomena to assembling a jigsaw puzzle by assigning handfuls of randomly selected pieces to different groups of people who are not allowed to share information. By treating the social context in which LLW options are debated as a system that can be subjected to study and learning, the science of radiation protection can move to a higher plane. Ultimately, policy processes that facilitate broader participation and deeper understanding of participants' positions may not lead to any greater agreement on which policy options are best, but they will lead to sharper identification of which facts and

[†] Health Physics Society. Low-level radioactive waste: Position statement. Adopted: October 1993. Updated: July 1999.

[‡] Epstein E. Low-level radioactive waste. Presentation to the League of Women Voters, Harrisburg, PA, 23 November 1993.

values are the source of disagreement, and a consensus that principles of procedural justice were well served.

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