CITATION

TITLE: RISK, V.6:2

AUTHOR: Shrader-Frechette

PUBLISHER

YEAR Spring 1995

PAGES 115-126

File # 020702014_Shrader

Evaluating the Expertise of Experts

Kristin S. Shrader-Frechette*

Introduction

In 1994, the National Research Council, National Academy of Sciences (NRC/NAS) Review Committee on Risk-Related Studies issued its evaluation of NAS risk studies. The authors charged that recent reports failed to maintain adequate distinction between risk assessment and risk management.[1] They said assessments should provide "an independent analysis" of risk,[2] and therefore "explicitly distinguish conclusions... based on facts... from judgments based on values."[3] The good news about these recommendations is that they attempt to provide a lock on the scientific objectivity and consequent credibility of risk assessment, to secure it from the subjectivity of risk management and to reaffirm the role of expertise in assessment. The bad news is that the recommendations seem (perhaps unintentionally) to rebut the claim rights of the public to participate in both risk assessment and risk management.

According to one version of the dominant NRC/NAS paradigm,[4] known as "the Redbook," experts accomplish assessment while stakeholders, members of the public, should not play a role until the later stage of risk management. As the Redbook put it: "If risk management considerations... are seen to affect... a risk assessment, the

* Professor Shrader-Frechette is Distinguished Research Professor at the University of South Florida. She earned her undergraduate degrees (Mathematics and Physics) from Xavier University and her Ph.D. (Philosophy) from the University of Notre Dame.

1 National Research Council Review Committee on Risk Related Studies, Letter Report on NAS Risk-Related Reports (1994).

2 *Id.* at 8.

3 *Id.* at 12.

4 NRC/NAS Committee on the Institutional Means for Assessment of Risks to Public Health, **Risk Assessment in the Federal Government** (1983) (the "Redbook"); *see also,* Carnegie Commission Task Force on Science and Technology in Judicial and Regulatory Decisionmaking, **Risk and the Environment** 76 (1993).

credibility of the assessment... can be compromised."[5] Obviously much of this paradigm is correct. Separation between assessment and management encourages people to make the epistemic warrants for their claims explicit and thus to make their science more objective.[6] It helps to avoid unscientific assessment and bad management.[7] Maintaining too sharp a distinction, however, has led to an "uneasy divorce" between risk assessment and risk management, in part because many risk assessors have ignored the value implications of their methodological judgments.[8] Also, the divorce may lead to uninformed and therefore faulty risk-management decisions.[9]

My concern is that too strong a distinction between risk assessment and risk management can lead to the hegemony of expertise in assessment areas where experts alone have no right to exercise complete control. Too strong a distinction can underemphasize the unavoidable value judgments in risk assessment, overemphasize the role of technical experts, thus disenfranchise the public who ought to have a voice in risk assessment as well as management.

Of course, although the rights of stakeholders to participate in the policy decisions of risk *management* are not as problematic, the public's role in risk *assessment* is controversial because the standard view is that it is a "scientific process,"[10] one in which only scientists have a justification for participation. In these remarks, I challenge the standard view that risk assessment is a purely scientific process and therefore one in which the public has no right to participate; argue that procedures for public involvement in risk assessment need not threaten

5 The Redbook, *supra* at 152.

6 Kristin Shrader-Frechette, **Risk and Rationality** 43–44 (1991).

7 Ellen Silbergeld, *Risk Assessment and Risk Management: An Uneasy Divorce*, in **Acceptable Evidence: Science and Values in Risk Management** 102 ff (Deborah G. Mayo & Rachelle D. Hollander, eds. 1991).

8 *Id.* at 107 ff.

9 *See, e.g.*, Richard M. Sedman & Paul W. Hadley, *Risk Assessment and Risk Management: Mending the Schism*, 3 **Risk** 189 (1992).

10 *See, e.g.*, NRC/NAS Committee to Review Risk Management in the DOE's Environmental Remediation Program, **Building Consensus through Risk Assessment and Management of the Department of Energy's Environmental Remediation Program** 16 (1994).

scientific objectivity, as proponents of the standard view claim; and argue that there are important strategies for involving the public and moving to what Jonathan Lash calls an "integrated view" of assessment.[11]

Experts Alone Ought Not Dictate Risk Assessment

At least four basic reasons give the public a right to participate in risk assessments, despite their largely scientific character. The first and most basic is *logical:* Numerous uncertainties underlie all of risk assessment; how to behave in situations of scientific uncertainty is not a scientific, but a policy, issue, one in which the public ought to have a say. Were there no scientific uncertainties in risk assessment, grounds for public participation would be weaker. As an NRC Committee put it: Uncertainty causes the invocation of value-based judgments.[12]

A second reason is *ethical.* Because assessments have consequences not only for knowledge but also for public welfare, the public has a right to participate. If my ox is in danger of being gored, I have the right to help determine how to protect it, even if I may be wrong.

A third reason for public participation is *ontological.* Because risks do not affect merely current health and safety, but also human autonomy, consent, distributive equity, equal opportunity, future generations, civil liberties, social stability and so on, scientific experts ought not be the sole assessors. Assessments of multiattribute risks should be the products of social, ethical, cultural and legal rationality — not merely the projects of a bounded scientific rationality.

Fourth, because the *applied* science used in risk assessment presupposes democratically determined goals, it can never be value-neutral.[13] If the standard view of risk assessment disallows public participation, it errs in reducing democratic and procedural values to technocratic and scientific ones. The applied nature of risk assessment requires both democratic and scientific control.

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11 *Id.* at 38.

12 *Id.* at 19.

13 *See* Nicholas Ashford, *Science and Values in the Regulatory Process,* 3 Statistical Sci. 377 (1988).

But how can democratic participation in some parts of assessment be *reasonable* if we maintain the distinction between merely subjective or perceived risks known by the public and actual risks known by the experts?[14] A partial answer is that, although some risks are merely subjective, faulty perceptions are not the prerogative of the public alone. All risks and risk estimates are perceived; at least because they are unavoidably influenced by the categories, presuppositions and models of the knower, they are susceptible to some level of uncertainty.

A major uncertainty is whether to define risk according to the standard "body-count" view, as an expected number of deaths or injuries, or to take account of other factors such as distributive equity and consent. Uncertainty also arises because virtually no risk probabilities reflect actual frequencies. Even the best estimates often vary by at least two orders of magnitude.[15] Likewise, some of the most important contributors to risk, such as human error, are not amenable to quantification. More generally, risk estimates vary because they are often based on different exposure or response models.[16] Still other uncertainties arise, as Kahneman, Tversky and others have shown,[17] from heuristic judgmental strategies — such as representativeness and overconfidence — to which experts are just as susceptible as laypeople. To the degree that assessments rely on uncertain perceptions or models, the public deserves a voice in the assessment decisions about appropriate ethical behavior in situations of uncertainty. The public deserves a voice because different ways of responding to scientific uncertainty have different consequences for assessment, policy and welfare.

Although science, as such, does not always have consequences for public welfare and hence does not always involve judgments about *ethical values,* no science can avoid judgments about *methodological values.* Collecting and manipulating data, for example, requires goals

14 *See* William R. Freudenburg, *Perceived Risk, Real Risk: Social Science and the Art of Probabilistic Risk Assessment,* 242 **Science** 44 (1988).

15 *See* Shrader-Frechette, *supra* note 6, at 81; *see also* Roger Cooke, **Experts in Uncertainty: Opinion and Subjective Probability in Science**, 30 ff (1991).

16 *See* Shrader-Frechette, *supra* note 6, at 82.

17 *See id.* at 83.

and hypotheses that are methodological values. Without these goals and hypotheses, scientists would not have a criterion for which data and models were relevant in a particular situation, and which were not. Adjudicating disputes about which scientific methods or models to use thus ultimately requires an appeal to methodological values. These methodological values are more certain in situations where the science and its applications are well understood. Yet, if the science and its applications to a particular hazard were well understood, we wouldn't need to do a risk assessment. We could simply apply deterministic scientific laws and precisely predict hazards. Hence, because risk assessment involves uncertainty and applications of science, it requires value judgments.

None of these remarks about the value ladenness of risk assessment are anything new to persons who study scientific methodology. As the Redbook admitted:[18]

> when scientific uncertainty is encountered in the risk assessment process, inferential bridges are needed to allow the process to continue.... The Committee has designated these *inference options.*

After listing five pages of inference options (such as what degree of test confirmation should be necessary and how one should extrapolate from small to larger populations),[19] the committee admitted: "policy considerations inevitably affect, and perhaps determine, some of the choices among the inference options."[20]

But if the Redbook admits that policy influences choices among inference options, then it is arguable that the public ought to have a voice in the evaluative or policy-related aspects of assessment. Why, then, does the Redbook argue that risk management ought not affect risk assessment?[21] One reason may be language. The Redbook says that policy choices affect inference options in risk assessment, but it carefully uses the language of "inference options," not the language of "methodological value judgments."[22]

18 *Supra* note 4, at 28.

19 *Id.* at 28–33.

20 *Id.* at 33.

21 *See id.* at 152.

However, even if the Redbook calls methodological value judgments "inference options," both words flag choices under some degree of uncertainty, choices having consequences for public health and safety. Therefore the options or value judgments raise issues about which those — whose welfare is affected — ought to have a voice.

Perhaps another reason the Redbook appears to contradict itself in claiming that policy choices affect risk assessment, and yet that risk management ought not affect assessment, is that the limits of scientific expertise in assessment are not clear. Even the most recent NRC reports continue to affirm both that risk assessment is a *scientific* process[23] and that *policy* judgments are unavoidable in it.[24] Also, because they focus only on *technical* uncertainties, the standard discussions of assessment appear to claim too wide a role for experts. The Redbook notes, for example, that:[25]

> The uncertainties... in risk assessment can be grouped in two general categories: missing... information on a particular substance and gaps in current scientific theory.

In addition to gaps in scientific information or theory, however, the Redbook seems to have ignored what I call "framing" uncertainties and institutional uncertainties.[26] Institutional uncertainties arise because of the inability of particular assessors or institutions to carry out reliable assessments. As one NRC committee admitted: "the quality of risk assessment depends in part on the capability of the analyst."[27] The

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22 This reminds me of how the Nuclear Regulatory Commission avoided the word "accident" in its formal documents, instead using the phrase "extraordinary nuclear occurrence;" *see* Kristin Shrader-Frechette, **Nuclear Power and Public Policy** 96 ff, 108 ff & 131 ff (1983). It also reminds me of the conversation in **Through the Looking Glass**, when Humpty said to Alice: "When I use a word... it means just what I choose it to mean."

23 *See, e.g.*, **Building Consensus**, *supra* note 10, at 11, 13, 16 & 27.

24 *See, e.g., id.* at 1, 3, 17, 18 & 24.

25 The Redbook, *supra* note 4, at 28. *See also* Committee on Risk Assessment Methodology, **Issues in Risk Assessment** 261 (1993) (e.g., identified "three general categories of uncertainty that affect all types of risk assessments: measurement uncertainties... conditions of observation... inadequacies of models." The committee mentioned nothing like framing uncertainty or institutional uncertainty.)

26 Uncertainties may be grouped according to sources or according to sorts. *See, e.g.*, Silvio Funtowicz & Jerome Ravetz, **Uncertainty and Quality in Science for Policy** 21 ff (1990).

institutions need to be, among other things, neutral, credible and scientifically responsible.[28]

Framing uncertainties arise from the way assessors interpret and define relevant questions. Such uncertainties are crucial because those who frame the questions often control the answers. For example, in the Department of Energy's (DOE's) 1992 Early Site Suitability Evaluation (ESSE) of the proposed Yucca Mountain high-level radioactive waste facility, it framed the question of site assessment in terms of only two options.[29] Scientists were told to conclude that the site was either suitable or not, and that inability to prove it unsuitable was a sufficient condition for site suitability.[30] The DOE did not allow a no-decision finding,[31] even though peer reviewers unanimously warned that:[32]

> many aspects of site suitability... predictions involving future geologic activity... rates of tectonic activity and volcanism... will be fraught with substantial uncertainties that cannot be quantified using standard statistical models.

By framing the question so as to disallow a "no decision" finding, the DOE arguably commits the logical fallacies of appeal to ignorance and begging the question. Inability to prove a site unsuitable is not a sufficient condition for concluding it is suitable, especially given a lack of comprehensive site data.[33] Logic and fairness tell us that this framing biases the assessment conclusion. By ignoring value judgments associated with framing, and by categorizing uncertainties in purely technical terms,[34] the standard risk paradigm overemphasizes the expert *assessment* and underemphasizes stakeholder *assessment.* Instead, as the Academy committee reviewing the DOE's Environmental Remediation Program concluded:[35]

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27 *See, e.g.,* **Building Consensus,** *supra* note 10, at 21.

28 *Id.* at 37–38.

29 Kristin Shrader-Frechette, **Burying Uncertainty: Risk and the Case against Geological Disposal of Nuclear Waste** 115 (1993).

30 *See id.* at 115, for ESSE quotation.

31 *See id.* at 119, for ESSE quotation.

32 *Id.* at 118.

33 *See id.* at 103–126.

34 *See* NRC/NAS Committee on Risk Assessment of Hazardous Air Pollutants, **Science and Judgment in Risk Assessment** 9-3 through 9-6 (1994).

> the multiple concerned parties, or stakeholders, need to be involved throughout the whole process [of risk assessment] beginning with planning, not just in the review of the results.

The standard paradigm also fails to address other important, nontechnical uncertainties arising because of the way institutional goals, such as promoting a particular technology, influence assessment. John Kemeny, Chair of the committee that investigated Three Mile Island, called the Nuclear Regulatory Commission "a total disaster. It was clearly not part of the solution but a serious part of the problem."[36] Although he was speaking of institutional bias in risk management, similar concerns could affect risk assessment. Indeed, if Slovic, Layman and Flynn are correct,[37] then institutional biases or uncertainties may explain the strong positive correlation between lack of trust in particular risk assessors and perceived risk. Several Congressional investigations and a 1994 NRC Report indicated that "the lack of trust in DOE," for example, is a major impediment to reaching consensus" on certain decisions.[38] Because such institutional uncertainties have potential consequences for public health and safety, the public has a right to help determine assessment responses to them.

Public Involvement in Assessment Does Not Threaten Objectivity

In response to framing, institutional and other uncertainties, a major objection is that allowing public participation reduces scientific objectivity. Such an objection, however, begs the question of whether purely scientific objectivity is appropriate. Such objectivity may not be appropriate if the NAS is correct that choosing particular "inference options" is influenced by policy.[39] Because of this, the objectivity appropriate to many aspects of risk assessment may not be the *scientific objectivity* of *excluding* outside evaluative influences, but

35 **Building Consensus**, *supra* note 10, at 1.

36 Cited in Clayton Gilette & James Krier, *Risks, Courts and Agencies*, 138 U. Pa. L.Rev. 1096 (1990) (*See id.* for discussion of scientific versus participatory risk assessment).

37 Paul Slovic, Mark Layman & James Flynn, *Perceived Risk, Trust and Nuclear Waste*, in **Public Reactions to Nuclear Waste** 64 (1993).

38 **Building Consensus**, *supra* note 10, at 1.

39 The Redbook, *supra* note 4, at 37.

rather the *procedural objectivity* of *balancing* influences through representative participation. Giving stakeholders a voice in the inference options or value judgments in assessments is one way to guarantee procedural objectivity.

Another response to worries about objectivity is to recognize that, even if scientists and stakeholders disagree about how to deal with assessment uncertainties, the stakeholders are not necessarily irrational in being averse to particular types of risk. After all, if a medical doctor recommended one procedure rather than another, yet admitted scientific uncertainties that plagued her recommendation, a perfectly rational and objective patient might opt for allegedly riskier behavior because it optimized other values such as comfort, recovery time, or efficiency. Likewise, rational and objective risk assessment might invoke policy values, rather than scientific values, in response to uncertainty.

Of course, objective risk assessment never ought to suggest that members of the public make scientific judgments. Rather, it requires extending the Redbook procedure of specifying the occasions on which particular methodological value judgments or inference options are likely to arise (e.g., in the context of framing uncertainty) and then providing for public participation in determining these specific value judgments or inference options.

Procedural Strategies for Involving the Public in Assessment

To provide for public participation in responding to assessment uncertainty, at least two basic strategies come to mind. One is to use public participation to develop a comprehensive list of "default options" to employ in the face of various assessment uncertainties. Through a variety of arbitration, negotiation, or adversary proceedings,[40] different federal agencies could work with the public to investigate, evaluate and select various assessment default options.

Default options are generic approaches applied at various stages of the risk assessment process, either when there is some uncertainty or when value or policy judgments are required. Default options, such as

40 Kristin Shrader-Frechette, **Science Policy, Ethics, and Economic Methodology** 286–313 (1985); *see also* Shrader-Frechette, *supra* note 6, at 169–219.

how to extrapolate from high-dose animal experiments to low-dose cancer risk to humans,[41] guide risk assessors in the absence of evidence to the contrary, or they tell where to assign the burden of proof. For instance, when framing and characterizing risk, at the outset of assessment, one default option might be to assign the burden of proof to those who want to limit risk to a purely quantitative definition or to those who want to exclude consideration of the social, legal and ethical aspects of risk, such as threats to future generations or to equitable risk distribution. Admittedly consideration of such social and ethical risks "is not standard practice in the field of risk assessment."[42] Nevertheless, as a NRC Committee (on DOE Remediation) put it:[43]

> the scope of a risk assessment and the risk assessment itself should be influenced by external or even global considerations... of the stakeholders.

Some of the most important default options in risk assessment arguably concern whether to minimize type-I or type-II errors in situations of statistical uncertainty. For a variety of ethical reasons that I have defended elsewhere, I think risk assessors ought to minimize type-II errors (false negatives) rather than to follow the standard scientific practice of minimizing type-I errors (false positives).[44] The rationale for this assessment option is analogous to the rationale behind using maximin decision rules for cases of probabilistic uncertainty involving potentially catastrophic risk.[45]

A second strategy — besides using public participation to develop general, agency-wide default options — would be to use some process of negotiation or adversary assessment to develop case-specific rules of judgment for dealing with uncertainty. For example, the Nevada stakeholders ought to participate in formulating a decision rule for the conditions under which to use porous media models to predict hydrological flow at the proposed Yucca Mountain nuclear waste

41 *See supra* note 34, at 2–4.

42 NRC/NAS Committee on Risk Perception and Communication, **Improving Risk Communication** 38 (1989).

43 **Building Consensus**, *supra* note 10, at 17.

44 *See supra* note 6, at 131–145.

45 *Op cit.* at 100–130.

repository, given that such models underestimate the groundwater transport at heavily fractured sites. Although scientific expertise is necessary to understand the characteristics of porous media models, the health and safety consequences of using such models argue for public participation in deciding whether and under what conditions to use them at the site.[46] Likewise, the public ought to have a voice in deciding case-specific rules regarding whether to characterize Yucca Mountain risks qualitatively or in terms of subjective probabilities. DOE assessors have used subjective probabilities, even though DOE peer reviewers all agreed that there was substantial, "nonquantifiable uncertainty" regarding future seismic, volcanic and tectonic activity.[47]

These two strategies, using public participation to develop default options as well as case-specific rules of judgment, call for integrating public decisionmaking into expert assessment. This might be accomplished, in part, through something like the national and local stakeholder boards recommended by a NRC/NAS risk committee.[48]

The lesson of such "integrated" assessment, to use Lash's term,[49] is that the public alone may be uninformed, whereas expert assessors alone may ignore important uncertainties, value judgments and social risks. Expert judgment, in particular, is insufficient for setting default options and rules of judgment in risk assessment because (1) the rules must deal ethically and evaluatively with uncertainty, (2) risk consequences affect public welfare, and (3) risk consequences, not being merely technical, ought not be assessed merely by scientists and technicians.

To relegate members of the public to participation only in risk management and not also in risk assessment is to commit one version of what Kenneth Keniston called "the fallacy of unfinished business,"[50] the fallacy of assuming that all our risk controversies can be solved by "business as usual" — by more and better technical analyses. To avoid

46 *See supra* note 29, at 61–65.

47 For the DOE peer reviewers' statement, *see supra* note 29, at 106–107.

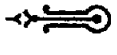
48 **Building Consensus**, *supra* note 10, at 38.

49 Jonathan Lash, *Integrating Science, Values and Democracy: Comparative Risk Assessment As a Process for Pluralistic Policy Development*, in **Setting National Environmental Policies** (Adam Finkel & Dominic Golding, eds. 1992).

50 *See* Shrader-Frechette, *supra* note 40, at 106 ff.

the fallacy of unfinished business, we need to learn to recognize the social, ethical and procedural dimensions of risk assessment. This does not mean, of course, that we exchange the flaws of technocratic expertise for those of democratic participation. Members of the public, as well as experts, are prisoners of their own environments.[51] We need experts and the public, facts and values, assessment and management, science and policy. We need expert analyses integrated with publicly chosen default options and rules for judgment under uncertainty.

In remarrying risk assessment and management, expertise and participation, we need to realize that either uninformed participation or misplaced expertise can jeopardize the union. As Ralph Nader put it: "If scientists think lawyers can present one-sided cases, they may wish to rediscover themselves."[52] The same can be said for members of the public.



51 This point is made well by Gilette and Krier, *supra* note 36, at 1027–1109 — esp. at 1108.

52 Ralph Nader, *Obligation of Scientists to Respond to Society's Needs* in **Scientists in the Legal System** (William A. Thomas, ed. 1974).