Comment: Pigford, Shrader-Frechette & the NRC Report on Yucca Mountain

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Introduction

Recently, Pigford[1] and Shrader-Frechette[2] commented on **Technical Bases for Yucca Mountain Standards** (TBYMS).[3] In the spirit of trying to start a constructive dialogue, I raise several questions related to their comments and the report. Concerns include the incomplete justification for and the uneven application of intergenerational equity and a failure to consider conflicts between *inter*generational and *intra*generational equity in resource allocation.

The Disparity in Treatment between Long-Lived, Non-Radioactive and Radioactive Wastes

Wastes containing elemental carcinogens, such as arsenic, chromium and nickel can be disposed of in a licensed Resource Conservation and Recovery Act (RCRA) disposal facility. Siting requirements for such a facility, facility design and the period for management responsibility all point to a relatively short time horizon.[4] The same is true for "cleanup" alternatives accepted for many sites containing such carcinogens and toxic substances like mercury and cadmium. These are frequently left in-situ, capped or stabilized.[5]

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1 Thomas H. Pigford, *Maximum Individual & Vicinity-Average Dose for a Geologic Repository Containing Radioactive Waste,* 8 **Risk** 9 (1997).

2 Kristin S. Shrader-Frechette, *Overview of the Academy's Yucca Mountain Recommendations,* 8 **Risk** 25 (1997).

3 A 1995 National Research Council Report.

4 David Okrent, *On Intergenerational Equity and Policies to Guide the Regulation of Disposal of Wastes Posing Very Long Term Risks*, UCLA-ENG-22-94; *see also,* David Okrent, *Issues Related to the USEPA Probabilistic Standard for Geologic Disposal of High-Level Radioactive Waste,* 2 **Proc. Int. Conf. Safewaste 93**, 124-34 Avignon, France, June 13-18, 1993.

It is not difficult to postulate hypothetical, but realistic, hazardous chemical disposal sites (or treated Superfund sites) that, in principle, could lead to very substantial individual risks of cancer (approaching unity) to people living hundreds or thousands of years in the future.[6] Real sites of this kind exist.

Yet, for the geologic disposal of high-level radioactive and transuranic wastes, the Environmental Protection Agency (EPA) has always been very much more stringent. In its original 1985 regulation,[7] it adopted release limits and probabilities of occurrence yielding the result that for the entire world population, significantly less than 1,000 statistical premature deaths (SPD) would occur in 10,000 years (average of 0.1 SPD per year) due to releases from the repository. That standard also included stringent exposure limits for groundwater for 1,000 years.

There and in its final 1993 standard (not for Yucca Mountain), EPA took a position against discounting predicted statistical future health effects out to 10,000 years but in favor of the limitation on radiation exposure for future generations being at least as stringent as at present. It ignored a 1977 report by a Committee of the National Academy of Sciences recommending that such discounting be performed.[8]

Further, the 1993 rule was more stringent than the 1985 version in that it provided more restrictive limits on individual exposure to individuals for 10,000 years and required that the groundwater contamination not exceed proposed general limits.

The Technical Bases for the TBYMS Report[9]

The Energy Policy Act of 1992 states "the Administrator of the EPA shall contract with the National Academy of Sciences (NAS) to

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5 The Presidential/Congressional Commission on Risk Assessment and Risk Management, 2 **Risk Assessment and Risk Management in Regulatory Decision-Making, Final Report** (1997).

6 David Okrent & Leiming Xing, *Future Risk from a Hypothesized RCRA Site Disposing of Carcinogenic Metals, Should a Loss of Societal Memory Occur,* 38 **J. Haz. Mat.** 363 (1993).

7 *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level Radioactive and Transuranic Wastes;* Final Rule, 50 **F.R**. 38066.

8 **Decision Making in the Environmental Protection Agency**.

9 *Supra* note 3.

conduct a study to provide... findings and recommendations on reasonable standards for protection of the public health and safety...." (applicable to a repository at Yucca Mountain). The Act goes on to request that the NAS address three questions — in particular, whether a standard based upon doses to individuals will provide reasonable protection of the health and safety of the general public.

The 1992 Act does not limit the NAS to a technical study. Robert Fri, Chair of the TBYMS Committee states in his preface to the Report, "we have recognized that committee members can speak as experts only on matters of science, but we have not construed our assignment so narrowly as to limit the usefulness of our recommendations for standard-setting in the real world. In short, we have commented on policy issues where we thought it was necessary."

The narrow approach taken by the NAS is troubling. Why should it not comment on policy matters, if relevant "to provide findings and recommendations on reasonable standards for protection of the public health and safety"? Previous committees have certainly made policy findings and recommendations. If the original committee lacked certain needed disciplines, this could have been remedied.

Comments on the Committee Report

The TBYMS Committee finds that there is no scientific basis for limiting the time period of an individual risk standard and expresses the belief that compliance assessment is feasible for most physical and geologic aspects of repository performance on the order of a million years at Yucca Mountain, and that at least some potentially important exposures might not occur until after several hundred thousand years. The Committee recommends that "compliance assessment be conducted for the time when the greatest risk occurs, within the limits imposed by long term stability of the geologic environment." Although it is written as if it is a scientific recommendation, this is the principal *policy* recommendation. And it was made from much too narrow a perspective.

In the Report summary, it is followed by a paragraph which suggests that a health-based risk standard could be specified to apply uniformly over time and generations, and that this would be consistent

with the principle of intergenerational equity. The paragraph concludes "Whether to adopt this or some other expression of intergenerational equity is a matter for social judgment."

In effect, the principle of intergenerational equity is given quasi-endorsement for this application. The Committee did not examine the regulatory disparities in the disposal of radioactive wastes and the disposal (or cleanup) of toxic wastes, such as arsenic, nickel and chromium, that never decay, but for which the time horizon has usually been about 100 years. The Committee was supplied technical details on this matter,[10] but chose to state that they had not compared the bases for regulating the two kinds of long-lived wastes.

Only for the geologic disposal of high-level radioactive wastes are large expenditures made to protect generations tens to hundreds of thousands of years into the future. This is singular — no other activity posing far-future risks faces such a goal. However, such expenditures leave fewer resources to work for *intra*generational equity within the U.S. and throughout the world. The TBYMS Committee Report makes no note of this important conflict.

No philosophic justification is given for the recommendation that compliance assessment be conducted for the time when the greatest risk occurs. Furthermore, there is absolutely no basis for knowing what kind of society may exist in the vicinity of Yucca Mountain in 100,000 years. Subsistence farmers able to drill deep wells have lived there less than 200 years. Any compliance assessment in terms of such inhabitants would be purely hypothetical, assuming the uncertainties and gaps in knowledge permit plausible calculations.

Also not accounted for are other relevant issues, such as the possibly advanced state of technology, including medicine in the future, and the body of opinion favoring some kind of discounting of future health effects, not only from the world of economics[11] and a prior NAS Report,[12] but also from actual practices now accepted or tolerated. These and other similar matters should have been actively considered with the policy issue of when to assess compliance. That the time of

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10 *Supra* note 4.

11 Kenneth J. Arrow, *Is There a Role for Benefit-Cost Analysis in Environmental, Health and Safety Regulation?* 272 **Science** 221 (1996).

12 *Supra* note 9.

compliance is a major policy matter can be seen from the comments received by EPA[13] on the TBYMS Report, and from the proceedings of the Seventh Annual International Conference on High Level Radioactive Waste Management.[14]

Unfortunately, the International Commission on Radiation Protection (ICRP) and many others dealing with radiation protection have adopted the concept of intergenerational equity for geologic disposal of high-level radioactive wastes without explicitly considering the conflict with intragenerational equity or the way society deals with other activities that pose risks in the very far future. Fortunately, some bodies like the Staff of the U.S. Nuclear Regulatory Commission (NRC)[15] and the National Radiological Protection Board[16] of the UK have proposed a significantly shorter time at which to assess compliance for a varying set of reasons.

Assessing compliance hundreds of thousands of years into the future

Many groups disagreed with the Committee's belief that regulatory compliance could extend out to a million years. These include a technical review board,[17] NRC staff[18] and its Advisory Committee on Nuclear Waste.[19] A representative of the Electric Power Research Institute has said "Requiring licensing basis calculations out that far in time asks for more than science can deliver."[20] I agree.

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13 Raymond L. Clark, *Background on 40 C.F.R. § 197: Environmental Radiation Protection Standards for Yucca Mountain*, paper presented at 7th Annual Int. Conf. on High Level Radioactive Waste Management, Las Vegas, NV, April 29-May 3, 1996. *See also,* Lawrence Weinstock & Raymond L. Clark, *The National Academy of Sciences Report and Environmental Radiation Standards for Yucca Mountain, id.* at 267-68.

14 *Op. cit.*

15 J. P. Kotra, M. V. Federline & T. J. McCartin, *NAS Recommendations and Current Legislative Proposals, id.* at 269.

16 National Radiation Protection Board, 3 **Board Statement on Radiological Objectives for the Land Disposal of Solid Radioactive Wastes** (1992).

17 Clark, *supra* note 13.

18 *Supra* note 15.

19 P. W. Pomeroy, Letter from Advisory Committee on Nuclear Waste to Honorable Shirley Ann Jackson, Chairman-NRC, *Time Span for Compliance of the Proposed High-Level Waste Repository at Yucca Mountain, Nevada,* June 7, 1996.

20 John H. Kessler, *Initial EPRI Reaction to the NAS Yucca Mountain Standards Recommendations*, Proc. 7th Int. Conf. High Level Radioactive Waste Management, Las Vegas, NV, April 29-May 3, 1996, pages 282-284.

Pigford's and Shrader-Frechette's Positions[21]

My problem with Pigford's position is the same as that with the TBYMS Report. His dissent, and his noted position both support the assessment of compliance out to the time of maximum dose. Pigford believes the regulation should be more strict than the Committee recommends. He does not mention the current dichotomy in disposing of long-lived, non-radioactive chemical waste, nor the different way society treats other activities that pose equivalent future risks. He, like the ICRP[22] has chosen to take a narrow perspective.

Shrader-Frechette[23] likewise does not mention the dichotomy in current practices addressing the risks of similar activities or long-lived wastes.[24] However, while she supports the TBYMS recommendation for a risk standard at the distant future time of peak risk, she goes on to refer to a Department of Energy peer reviewers' report concerned with large uncertainties in the prediction of future geologic activity. She then poses her own questions about the reliability of million year performance assessments.[25] Is she arguing that society needs to assess compliance out to the time of maximum risk, but it can't; hence, the problem is unsolvable, at least by geologic disposal?[26]

Concluding Remarks

I recognize that I appear to be trying to swim upstream against a flood of opposite opinion. Still, important questions remain and deserve to be confronted.



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21 *Supra* note 1.

22 International Commission on Radiological Protection, **1990 Recommendations of the International Commission on Radiological Protection** (1991).

23 *Supra* note 2.

24 *Id.* at 28.

25 In agreement with Kotra et al., *supra* note 15, Pomeroy, *supra* note 19 and Kessler, *supra* note 20.

26 Elsewhere, she has argued for negotiated use of temporary, above ground, storage for approximately 100 years before deciding on geologic disposal, e.g., **Burying Uncertainty: Risk and the Case Against Disposal of Nuclear Waste** (1993).