

Oral Presentation

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I come before this subcommittee as a historian of science. Before I moved over to history, my background was in physics, and recently I have been working on the history of nuclear waste R&D. It would seem to me there are insights this history can offer you as you think about designing for the future. I will center my remarks around fuel cycle alternatives, but the challenges here look a lot like those facing the Commission at large. I will begin my presentation by describing how those matters look to a historian who has followed the waste story—and who has been following your discussions, since this Commission is creating the history I work on.

What is happening in this Commission's meetings is like nothing in the historical record. It has been stated, openly, that Yucca Mountain has taught us a lesson: that the system around nuclear waste policy is broken, that a great deal of excellent work and fine intentions and thoughtful consideration has still left us entirely stuck. Historians are interested in moments like this one, moments when old ways of doing business are rethought and revised. The present moment truly has that kind of potential. The closest thing I can find to it in the historical record is the remarkable openness of the mid-1950s. I will come back to the 1950s; for the moment, let me say I am watching to see what you will do with this historical moment you have been handed.

From a historian's perspective, there are two distinct sets of questions you are facing, coming out of two different time periods. The first comes out of the late 1970s and 1980s, and it is a challenge of legislative and organizational design. In short form, how can we fix the Nuclear Waste Policy Act—seemed like a good idea at the time—and devise a new institutional structure to house waste management—because the one that was put in place among the DOE, EPA, and NRC has had problems. To be brief, this is one set of challenges, around legislative and organizational design.

The other set of challenges has its origins further back. These are challenges around designing policies, and an R&D program in support of them, that respond to public input and public concerns. Whatever else one thinks about Yucca Mountain, it is a good example of a project that has suffered on this score. The challenge of public responsiveness is not one that's historically gotten much attention in the R&D phase of nuclear projects in this country. The pattern goes back to the DOE's predecessor, the Atomic Energy Commission. The basic strategy was put in place not long after the Second World War; the formative decade was the 1950s, when the AEC began to take on the job of projecting a civil nuclear industry, alongside the weapons program it was created to run.

Today is not infact the first time the United States has asked how alternative fuel cycles, waste characteristics, and disposal options go together. At the very beginning of R&D on disposal in the 1950s, it was an active and troublesome issue. This was a time when massive expansion was being forecast for nuclear power, when the options on the table went well beyond

light water reactors, when even PUREX reprocessing was just a half-decade old. Scientists in the national labs were asking about alternative fuel cycles and waste characteristics, trying to figure out what choices to lead with.

This was the 1950s, and so much was open: open in part because scientists and engineers at Oak Ridge, Hanford, and elsewhere had no experience with waste (and little experience with fuel cycles) beyond what was sitting in their backyards. They were facing a future of almost unlimited alternatives, few of them hemmed in by technical or societal constraints or gauged by what other countries were doing. So they were doing a blank-slate analysis: What kinds of wastes would different fuel cycles produce? How would the consequences play out for storage, transportation, and disposal? And central to all of this, how much would it cost? Their estimates were pretty rough; these were very hard problems to tackle. Most of the research moved on to other, more tractable questions—largely, technical problems that seemed decoupled from societal, meaning political or market, outcomes (beyond sheer order-of-magnitude estimates of the scale of the problem).

Beginning in the 1950s, in the face of such openness, this became how the AEC did research: questions about the fuel cycle were defined as technical challenges. The deference the AEC received meant it had to deal very little with societal acceptance, much less do research on it, until ten or twenty years later on. When change did come, it was due to developments around the AEC's handling of potential controversies, such as its ways of dealing with leaking waste tanks at Hanford, and to conflicts between the AEC and the states being preliminarily considered for new waste disposal plans. On a larger scale, the new challenges on the scene went back to larger social conflicts arising around nuclear power—and, just as importantly, to a society-wide displacement away from trust in existing institutions, in government, industry, and science. This loss of trust was partly about nuclear, but it was not solely about nuclear; it showed up in many other domains. It had a great deal to do with skepticism about inherited institutional arrangements and the disinterestedness or truthfulness of experts working for some government agencies or large corporations. It was not about antinuclear activism alone, sometimes characterized as a stirred-up, fearful public that mainly needs education on technical facts.

A great deal changed over the AEC's lifecycle and into DOE's era. We reside on the other side of the divide. Historians should not go predicting the future, but I will wager one thing: there will probably be social and political complications around fuel cycle alternatives, as there have been around waste. Whether these are disputes over the relative credibility of scenarios for proliferation, or public confidence in assurances that the new technologies are safe, or arguments over the claim that new fuel cycles are needed to help with the waste problem, or substantial government investment in R&D that will help private firms, or transportation or facility siting or trust or transparency or whatever: the issues we have seen before probably will not disappear, and new ones will be added. (And that leaves aside the complications if something goes wrong.)

In the context of waste, DOE, as well as the National Academy, did start engaging some of these problems. Social scientists were brought in; often they went away feeling unheard. Still, the challenges around Yucca Mountain and, more positively, WIPP have opened up some new activity around public acceptance. There is thus a base to build on. There has also been much more comparative experience. There is, first, internationally comparative experience: experience

gained by other countries that are also dealing with waste management. (Here is the back-door benefit to not being out alone in front, as the U.S. was in the 1950s, even the 1970s and 1980s.) And, second, there is comparative experience in other controversial technical domains that have come along in the meantime. An example from the last decade is the National Nanotechnology Initiative, which has taken on questions of public acceptance in interesting and provocative ways. (Provided as supplementary material: Cyrus C. M. Mody, “The Larger World of Nano,” *Physics Today* (October 2008), 38-44.)

The Commission has a chance to consolidate that experience. The challenges that are with us from the 1970s and 1980s—those around legislative and organizational design—probably need to be addressed in the short term. The challenges still around from the 1950s, on the other hand—to design R&D programs that fit better with contemporary social reality—are adaptive, evolving challenges with a time constant of decades. They can be addressed in the waste disposal program, assuming the present moment is recognized for what it is; they can be addressed in fuel cycles as well. They can be addressed if we can broaden a lesson from our experience with repositories. This is one thing that I as a historian am curious to see if the Commission will do.