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From the Standards Blog

19 A Standard for the Ages

We're used to thinking about standards that specify all manner of measurable attributes - size, wavelength, voltage, and so on. But what happens when a standard must take time into account, especially when it's a *whole lot* of time?

Recently, a Federal Court of Appeals in the District of Columbia determined that even 10,000 years is not enough time, when it comes to setting standards for the safe storage of atomic waste.

The standard and the legal case at hand involve the proposed national nuclear waste storage site in Yucca Mountain, Nevada, in pursuit of which the Department of Energy (DOE) has spent more than \$9 billion during the better part of two decades. The site is intended to provide permanent storage for the atomic wastes created over the past 60 odd years by the U.S. military and private sectors. Some of these wastes have halflives of over one million years.

It is easy to agree that a permanent storage site should be designed to avoid, to the greatest extent possible, the escape of deadly radioactive wastes. It is also easy to agree that the design of such a facility must be durable, and that the site should be located where any accidental escape from a containment vessel would be unlikely to escape into groundwater or the atmosphere. But how safe is safe enough, when the time dimension shades into what (in human terms) is effectively eternity?

In the most recent Yucca Mountain legal decision, a three-judge panel of the Appeals Court did not rule on how close to eternity atomic waste must be contained in order to be completely safe, but it did conclude that 10,000 years is not close enough.

One of the factors that the judges found to be significant was a National Academy of Sciences (NAS) report that determined that the leakage paths of escaped wastes could be predicted for as much as one million years. Given that the NAS believed it possible to predict leakage for much more than 10,000 years, the court held that this relevant information must be taken into account in site design, especially since a 1992 federal law relating to the burial of atomic waste specifically obligated the DOE to heed the Academy's recommendations.

But if 10,000 years is not enough, what is?

The NAS thinks that 300,000 years is the right number, given that it estimates that radiation leakage at Yucca Mountain is likely to peak in about 270,000 years. At that time, someone standing outside the public boundary of the site would absorb about 60 times the amount of radiation deemed to be safe.

Of course, such a determination begs the question of whether any standard can purport to be meaningful over such a vast period of time, given the vagaries not only of geologic processes, but the unpredictable behavior of people as well. Serious thought has been given to whether human society can avoid a serious breakdown during even the next few thousand years, and therefore whether any danger sign placed at the site could be understood by our descendants after such a collapse.

Ultimately, the atomic waste storage question has more to do with standards of responsibility than with setting requirements for geologists and engineers. However far a court may decide to push a

standard, it is impossible to know whether humanity will be capable of knowing what lies under the mountain over such a span of time, if indeed humanity manages to continue to exist for so long a period at all.

In the end, those setting an atomic waste storage “standard” must accept that at best such a set of requirements can mitigate, but not eliminate, the danger to human and animal life in the distant future. Were the goal to be to effectively manage risk for the full duration of the existence of atomic waste, then standards would address production as well as storage. Only by limiting the creation of atomic by-products to those that have half-lives that are realistic in human terms can any standard purport to provide a potentially complete solution.

Presumably, such a result is not now technically achievable. As a result, what the courts must adjudicate is the standard of our society’s conscience – how long is “long enough,” knowing that the standard ultimately approved will never be truly sufficient? And is such a standard truly a safety standard at all, or rather a measure of the limits to our sense of responsibility for life on earth?

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Useful Links and Information:

United States Court of Appeals Decision on Yucca Mountain:
www.epa.gov/radiation/docs/yucca/dc_circuit_ruling.pdf

DOE Statement on U.S. Court of Appeals Decision Regarding Yucca Mountain:
www.energy.gov/engine/content.do?PUBLIC_ID=16149&BT_CODE=PR_PRESSRELEASES&TT_CODE=PRESSRELEASE

Office of Civilian Radioactive Waste Management public website for Yucca Mountain:
www.ocrwm.doe.gov

National Academy of Science “Technical Bases for Yucca Mountain Standards”:
<http://books.nap.edu/books/0309052890/html/R1.html#pagetop>

EPA Yucca Mountain website FAQs:
Radiation Protection Standards

- Who set the standards for protecting the public from exposure to radiation at Yucca Mountain?
- What is the basis of EPA's standards?
- Did the public have an opportunity to participate in developing these radiation protection standards?

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