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Before the
Subcommittee on Clean Air and Nuclear Safety
Committee on Environment and Public Works
United States Senate
June 7, 2012

Mr. Chairman and members of the Subcommittee, good morning. My name is Daniel Metlay. I am a senior professional staff member at the U.S. Nuclear Waste Technical Review Board. The Board was created in the 1987 amendments to the Nuclear Waste Policy Act to provide an ongoing and independent technical and scientific evaluation of activities undertaken by the Secretary of Energy related to implementing the Nuclear Waste Policy Act. The Board's 11 members are technical and scientific experts who are nominated by the National Academy of Sciences and appointed by the President. A small professional staff supports the work of the part-time Board members. I am a member of that staff. I hold a Ph.D. in public policy, and I have a scientific undergraduate degree. Over several decades, I have held various positions in academia and in government related to nuclear waste management and disposal. A short biography is attached to this statement. My responsibilities on the Board staff include nuclear waste transportation, institutional issues, and, most particularly, the ongoing work in other countries for managing their high-level radioactive waste and spent nuclear fuel.

Today, I have been asked by the Subcommittee to provide a historical perspective on efforts in this country and in other countries for establishing a consent-based process for siting nuclear waste storage and disposal facilities. Developing such a consent-based approach to siting was a major recommendation of the Blue Ribbon Commission on America's Nuclear Future (BRC).

Before I begin, I want to make clear that I can only convey Board comments that are part of publicly available Board documents; I cannot speculate about Board opinions, findings, or recommendations. What I will try to do is provide relevant general information that is based on my own experience and expertise and on information that is included in two Board publications: *Survey of National Programs for Managing High-Level Radioactive Waste and Spent Nuclear Fuel*, issued in October 2009; and *Experience Gained From Programs to Manage High-Level Radioactive Waste and Spent Nuclear Fuel in the United States and Other Countries*, issued in April 2011. I also have attached to this statement a letter that the Board wrote to the Secretary of Energy on the BRC recommendations. These and all other Board documents, including Board presentations and correspondence to the BRC, are available on the Board's Web site at www.nwtrb.gov. I hope that the Committee will find these perspectives useful as context for considering BRC recommendations on establishing a consent-based process for siting a nuclear waste storage or disposal facility in the United States.

I will begin today by talking generally about the requirements for developing a siting process. I then will provide a brief history of efforts in this country to site and develop storage and disposal facilities for high-level radioactive waste and spent nuclear fuel. I next will discuss factors affecting consent-driven site-selection activities in other countries. I will end with some tentative conclusions that might be drawn from these efforts and with a short discussion of some factors that may limit the lessons that can be applied to this country from international experience.

Designing a Siting Process

Site-selection strategies for a deep-mined geologic repository necessarily involve passing candidates through what is, in effect, two different "filters." On the one hand, detailed and

quantitative technical requirements have to be met. They include such issues as suitability criteria related to geologic stability, hydrologic conditions, geochemical conditions, disruptive processes, coupled processes, and operational practicality. On the other hand, sites could be disqualified because of nontechnical considerations, such as the “lack of social acceptance, high population density, or difficulty of access.” These two filters, the “technical” and the “non-technical,” can be applied in any order, although the suite of sites eventually selected might be different.

In constructing the filters, formal processes need to be crafted that can be used to establish technical criteria, prescribe how the criteria will be updated, specify how a “safety case” will be constructed, lay out compliance methodologies, and provide resources for public involvement and support of local and state oversight activities. Describing every aspect of these filters and how they have been applied would require a very long discussion. I will limit my testimony to the experiences in the United States and internationally that are relevant to the BRC’s recommendation for a consent-based site-selection process

History of the U.S. Program

Members of the Subcommittee are familiar with how the waste management program in the United States has evolved to its present state. I will mention just a few salient episodes.

Early efforts to develop a permanent repository for high-activity radioactive waste focused on finding a site in salt, a host-rock recommended in a 1957 National Academy of Sciences report. In 1970, on the basis of some preliminary investigations undertaken by Oak Ridge National Laboratory, the Atomic Energy Commission (AEC) announced plans for siting a repository for high-activity waste at an abandoned salt mine near Lyons, Kansas. The AEC’s announcement took state and local officials by surprise. The State Geologist, strongly supported

by the Kansas congressional delegation, opposed this siting effort. In the end, unresolved technical issues forced the AEC to abandon its plans in 1974. Subsequently, two other salt formations were considered as potential locations for a repository. Community leaders in Carlsbad, New Mexico, launched an initiative to persuade the AEC to look at potential repository sites in the Permian Basin; at the same time, the federal government sought permission from governors to investigate possible locations for a repository in the Salina Basin around the Great Lakes. The latter efforts provided futile, but, as the Subcommittee knows well, a sustained campaign by congressional, legislative, and community leaders around Carlsbad resulted in the construction of the Waste Isolation Pilot Plant (WIPP) repository, which began receiving transuranic-contaminated waste in 1999.

Problems encountered in trying to site a repository for high-activity radioactive waste led policy-makers in the late 1970s and early 1980s to try developing principles that would form the basis of a national policy for managing and disposing of spent nuclear fuel and high-level radioactive waste. President Jimmy Carter created the Interagency Review Group on Nuclear Waste Management (IRG) in 1978. Represented on the IRG were more than 20 federal agencies that had a “stake” in the long-term management of high-activity waste. Of particular importance was the IRG’s recommendation that a policy of “consultation and concurrence” be adopted. Such a policy would walk a fine line between, on the one hand, outright federal preemption of any state role in siting a repository, and, on the other, an absolute state veto, exercised at one specific moment in time. Instead, the IRG argued for an adaptive process with full involvement by affected states. “Under this approach, a state effectively has the continuing ability to participate in activities at all points throughout the course of [site investigations] and, if it deems appropriate, to prevent the continuance of Federal activities.”

Although other elements of the IRG recommendations found their way into the Nuclear Waste Policy Act (NWPA), which passed in 1982 after almost 4 years of debate, Congress transformed the notion of “consultation and concurrence” into “consultation and cooperation.” The NWPA also provided that the President’s decision to develop a repository could be vetoed by the governor of the *situs* state. That veto, however, could be overridden by a majority vote in both Houses of Congress.

To increase geographic equity, the Act also authorized the development of two repositories, presumably one in the eastern United States and one in the west, which would be selected after a technically based evaluation process. Three western sites eventually were chosen that would be characterized simultaneously for their suitability as the location of the first repository. As opposition grew in the eastern United States to a second repository, Secretary of Energy John Harrington suspended the second repository program in 1986.

In 1987, Congress tried to address the resistance that had developed over time to some of the policies and practices established in the NWPA. Congress amended the NWPA in December of that year and identified Yucca Mountain in Nevada as the sole site to be characterized for a first repository. The Office of the Nuclear Waste Negotiator also was created in the Amendments Act. The Negotiator was authorized by the legislation to “find a State or Indian tribe willing to host a repository or monitored retrievable storage facility at a technically qualified site on reasonable terms and...to negotiate with any State or Indian tribe which expresses an interest in hosting a repository or monitored retrievable storage facility.” After several years of effort, the first Negotiator, David Leroy, and then his successor, Richard Stallings, were unable to reach an agreement with a willing host, although one Native American

tribe, the Mescaleros of New Mexico, expressed some interest. Congress defunded the Office of the Nuclear Waste Negotiator in 1995.

For more than 20 years after passage of the Amendments Act, the Yucca Mountain site was technically evaluated by the U.S. Department of Energy (DOE), even as the State of Nevada voiced its strong and unwavering opposition to locating a repository at the site. In early 2002, DOE recommended to President George W. Bush that the site be developed as a repository. Congress overturned a veto of the President's suitability decision by the state of Nevada later in 2002. In 2008, DOE submitted a license application for a Yucca Mountain repository to the U.S. Nuclear Regulatory Commission. DOE requested that the license be withdrawn in 2010. A final decision on whether the licensing process will proceed is pending in the courts.

Now I will move on to a discussion of factors that have shaped the site-selection approaches of other countries.

International Experience in Site Selection

Almost universally, policy-makers have determined that disposal of high-activity waste in a deep-mined geologic repository is the preferred option for protecting human health and the environment for many millennia. In the last 40 years, the United States and other nations have initiated roughly two-dozen efforts to identify or create processes for identifying potential repository sites. Only three of those efforts have identified a potentially suitable site *and* are still on track. In no case has a license been issued by the cognizant regulatory authority to construct a deep-mined geologic repository for high-activity radioactive waste. The experience in selected countries can be summarized briefly.

France

When the call went out for volunteer communities to host underground research laboratories both in clay and in granite, potential host localities knew from the start that if the laboratory site or a site nearby were found to be technically sound, then a full-scale repository might be constructed there. Two communities stepped forward. However, the granite formation underlying one of them proved technically unsuitable for repository development. After several years of informal consultations and negotiations by the French Government, no other community was willing to volunteer to host an underground laboratory in granite. Today, the village of Bure, the community that agreed to host an underground laboratory in clay, strongly supports activities conducted by the implementer, the National Radioactive Waste Management Agency (ANDRA), related to constructing a repository. Noteworthy, however, is that when ANDRA called for volunteers to host a separate repository for long-lived, intermediate-level waste, several communities in the same province as Bure declined.

Sweden

Perhaps the most encouraging example of the efficacy of a consent-based siting process is the approach used in Sweden. In the 1970s, the implementer there, Swedish Nuclear Fuel and Waste Management Company (SKB), developed a disposal concept, which evolved incrementally into the current concept, KBS-3. The disposal concept received strong technical support from the international scientific community. It could be employed throughout most of Sweden, which lies largely on the granitic Baltic Shield. In the late 1980s, SKB unilaterally sought to characterize sites in several areas. That effort was met by strong opposition and blockaded entry roads. Reassessing the situation, SKB approached four northern municipalities, asking for their consent to initiate site investigations. Two municipalities declined early on;

referenda were held in two others, and, by varying margins, those municipalities also declined to participate further. Without hesitation, SKB stopped its work in all four places.

Subsequently, SKB invited approximately a dozen communities to join in a process to explore whether they would be interested in hosting a repository for high-activity waste. At the end of a very extensive engagement process, two municipalities, Osthamar and Oskarshamn, signaled that they were prepared to host such a facility. SKB ultimately selected Osthamar.

United Kingdom

In 2006, the government of the United Kingdom approved a new approach—Managing Radioactive Waste Safely—for developing a repository. Key to that new approach was an invitation for willing and informed communities to express an interest in hosting such a facility. The response from communities in the United Kingdom, however, has been quite subdued to date. Several borough and county councils near the Sellafield reprocessing plant in West Cumbria have begun investigating whether they should participate in the new initiative. Studies by the British Geological Survey suggested that at least some of the “rock” in the area might be suitable for constructing a repository. A decision by the West Cumbria partnership on whether to participate is expected in the fall. Ironically, the same councils that denied local planning permission for constructing an underground research laboratory 20 years ago are the ones now considering participation in the repository program. One important factor that may have caused this shift in attitude has been the concerted efforts by the U.K. implementer, the Nuclear Decommissioning Authority, to establish trustworthy relations with the localities.

Canada

Perhaps the most promising national initiative that relies on a consent-based siting process has unfolded in Canada. Adopting a very deliberate and careful approach to understanding the views of Canadians, especially those belonging to that country's aboriginal people, the implementer, the Nuclear Waste Management Organization (NWMO), put forward a plan for adaptive management of Canada's high-activity waste. NWMO is working with more than a dozen communities that have expressed interest in learning more about the implications of hosting a deep-mined repository.

Japan

In sharp contrast to the Canadian experience, more than a decade ago, Japan's implementer, Nuclear Waste Management Organization (NUMO), called for volunteers to participate in a stepwise siting process. Although the mayor of one southern Japanese town accepted NUMO's offer, opposition quickly developed at both the local and prefectural levels. The mayor was recalled; no other community has come forward since. After the damage caused to the Fukushima-Daiichi reactors and spent-fuel storage pools by last year's earthquake and tsunami, the prospects for volunteers now appear to be even slimmer.

Switzerland

In Switzerland, the steps of the typical siting process have been reversed. Under the country's Sectoral Plan, the implementer, National Cooperative for the Disposal of Radioactive Waste, first identified potential regions where Opalinus clay might be suitable for locating a repository. Altogether, five regions were identified in the first phase of the plan. Now, in the plan's second phase, discussions are under way with communities in the regions to determine if

any of them are prepared to host a facility for disposing of high-activity waste. Ultimately, the Swiss Federal Government will decide where a repository will be sited, but that decision could be overturned by a national referendum.

Germany

In many respects, the siting efforts in Germany parallel those in the United States. When, in the 1970s, the State of Lower Saxony invited the German Federal Government to develop a repository in salt near the community of Gorleben, that expression of interest aroused considerable controversy nationally. Although the site is still under consideration 35 years later, its selection remains problematic.

What Can We Learn from U.S. and International Experiences?

In discussions of the international efforts for implementing a consent-based approach, it is important to remember, as noted above, that there are several aspects to the process that can have significant consequences for the outcome. First are technical factors, including choices about what reactor technology to adopt and about what nuclear fuel cycle to pursue. Others are social and political in nature, including how concerns about intergenerational equity should be addressed and what pace should be followed in implementing a long-term management option. Importantly, the interdependencies, both subtle and overt, among the technical, social, and political forces are inescapable.

Because of those interdependencies, what characterizes national programs most notably is their variety. In some cases, efforts to identify candidate sites have focused from the beginning on specific host-rock formations. The choice of those formations has been dictated by constraints imposed by a country's geology or land-use patterns, by a view that particular host-

rock formations possess distinctive advantages in terms of isolating and containing high-activity radioactive waste, or by a combination of these rationales. In other cases, efforts to identify candidate sites cast the net more broadly by enumerating generic qualifying and disqualifying conditions. Qualifying conditions must be satisfied for a candidate site to be considered acceptable; disqualifying conditions eliminate a candidate site from further consideration.

An additional source of variation among national programs can be traced to policies that govern the sequence for accepting or rejecting a candidate site. A country can adopt a “serial” policy whereby sites would be evaluated formally one by one until a suitable site is found. Alternatively, a “parallel” approach can be adopted in which at least two candidate sites would be characterized simultaneously and compared.

Just as the construction of the technical filter introduces considerable variation in strategies for selecting candidate sites for a deep geologic repository, so does the construction of the nontechnical filter. Arguably this filter’s most important property relates to the power that a state or community can exercise. Since the early 1990s, nations outside the United States increasingly have constructed their nontechnical filters in ways that empower local jurisdictions. Especially when issues of federalism come to the fore, how power is distributed between the central government and state governments can be very consequential, as the cases of Japan, Germany, and the United States illustrate. So does the situation in Switzerland. There, a change in the law governing the management of high-activity waste eliminated the possibility of a cantonal referendum after one canton (roughly equivalent to a U.S. state) disapproved of the siting of an intermediate-level waste repository.

Experiences in the United States and other nations also suggest that communities already hosting nuclear facilities or communities where benefits might make a significant economic or

social difference may be especially receptive to being considered a candidate repository site. For example, in Sweden and Finland, candidate sites were identified in communities with nuclear reactors, and in the United Kingdom, borough and county councils in West Cumbria near the Sellafield nuclear facilities have expressed interest in becoming considered a repository site. For many, but not all, municipalities and states, the prospect of receiving generous benefit packages is instrumental in gaining community acceptance for a repository.

Lessons from all of these siting experiences have not been lost on the directors of national waste-management programs. Siting efforts now under way in Canada and the United Kingdom reflect these lessons, and the recommendations by the BRC in the United States are in line with this “new” understanding:

- *Potential host communities must at least acquiesce to site investigations.* Carlsbad, New Mexico, the town closest to WIPP, assertively lobbied for the facility. The Meuse and Haute Marne districts surrounding Bure in France welcomed the construction of a URL, knowing that if the argillite clay there was suitable, a full-scale repository might be constructed nearby. In Finland and in Sweden, the town of Eurajoki and the municipality of Osthamar, respectively, responded positively to invitations from the two national implementers, Posiva and SKB, respectively.
- *Implementers must work intensively to engage potential host communities by establishing a strong, long-term local presence.* DOE required that officials involved with the WIPP project and researchers from National Laboratories live in Carlsbad, New Mexico, even requiring those not already living there to relocate. In France, a Local Information and Oversight Committee has been established so that representatives of communities in the Meuse and Haute-Marne districts near Bure can continuously interact with ANDRA. In

Sweden and Finland, the potential repository host communities had already become familiar with the implementers because they (or their consortium members) had operated nuclear reactors at those sites for a long time. In each case, however, interactions were intensified when the municipalities began to be considered potential locations for deep-mined geologic repositories.

- *Potential host communities must have a realistic, practical way to withdraw from the siting process.* The state of New Mexico was a full partner in negotiating the terms of the Land Withdrawal Act that permitted WIPP to operate. In France, the districts near Bure willingly accepted the prospects of hosting a deep-mined geologic repository when they volunteered to host the research laboratory. Yet, despite considerable effort by the French Government, no community located above a granite formation was willing to step forward, and none were forced to. In Finland, Eurajoki’s consent was required before Parliament could pass the “decision-in-principle” to site the proposed geologic repository. In Sweden, Osthamar must agree to the granting of a license by the government. If the municipality decides for some unexpected reason to exercise its veto power, the veto could, in theory, be overridden by the government. As a pragmatic matter, however, national culture and historical precedents would make such an override highly unlikely.

In the United States, the experience of the Nuclear Waste Negotiator may be especially relevant because that effort was truly consent-based. The Negotiator was given authority to search for a voluntary host for a storage facility or a permanent repository site and could negotiate a package with any acceptable incentives. Approval by act of law would be required to complete the process. Some local communities expressed interest, but the states in which they were located prevented them from pursuing an agreement with the negotiator. Some Native

American Tribes sought agreements, but funding was eventually eliminated for the Office of the Negotiator by Congress. It is not clear what factors would lead to a different outcome if that effort were reinitiated today.

Finally, public trust in the institutions involved in a consent-based site-selection process is an essential element underlying the potential for success of all the efforts I have discussed today. Vitally important is that entities and localities that might consider hosting a storage or disposal facility for high-activity waste have confidence in the credibility of the process and the trustworthiness of the implementer of the program.

Summary

In closing, I would observe that few public policy issues rival the management of high-activity radioactive waste in terms of the demands placed on scientific research and engineering practice and the controversy that is engendered. After decades of dedicated work in more than a dozen nations, evidence is beginning to increase confidence that “solutions” can be found to this pressing environmental problem. More important, lessons are being learned about how to design social processes that lead to technically and politically defensible outcomes. Given this progress, and because the stakes are so high, it would be unfortunate if temporization displaced action.