



## 6. A CONSENT-BASED APPROACH TO SITING AND DEVELOPING FUTURE FACILITIES FOR NUCLEAR WASTE MANAGEMENT AND DISPOSAL

Having examined decades of experience in siting nuclear waste facilities in the United States and abroad, the Commission concludes that the United States needs to adopt a ***new approach to siting and developing nuclear waste management and disposal facilities in the future.***

We believe siting processes for all such future facilities are most likely to succeed if they are:

- (1) Consent-based—in the sense that affected communities have an opportunity to decide whether to accept facility siting decisions and retain significant local control.
- (2) Transparent—in the sense that all stakeholders have an opportunity to understand key decisions and engage the process in a meaningful way.

(3) Phased—in the sense that key decisions are revisited and modified as necessary along the way rather than being pre-determined.

(4) Adaptive—in the sense that process itself is flexible and produces decisions that are responsive to new information and new technical, social, or political developments.

(5) Standards- and science-based—in the sense that the public can have confidence that all facilities meet

rigorous, objective, and consistently-applied standards of safety and environmental protection.

(6) Governed by partnership arrangements or legally-enforceable agreements between the implementing organization and host states, tribes, and local communities.

The Commission recognizes that the NWPA and subsequent actions by Congress have established Yucca Mountain in Nevada as the site for a deep geologic nuclear waste repository, provided the repository license application submitted by DOE is found by the NRC to meet relevant requirements. The Commission takes no position on the Administration's request to withdraw the license application. We simply note that the U.S. inventory of SNF will soon exceed the amount that can be legally emplaced at Yucca Mountain until a second repository is in operation. So under current law, the United States will need to find a new repository site even if Yucca Mountain were to go forward. We believe the approach set forth here provides the best strategy for assuring continued progress, regardless of the fate of Yucca Mountain.

The remainder of this chapter discusses the basis of this Commission recommendation—including key lessons learned from past siting efforts—and elaborates on the details of the adaptive and staged approach we are recommending for siting new facilities.

## 6.1 LESSONS LEARNED FROM U.S. EXPERIENCE IN SITING NUCLEAR WASTE FACILITIES

The difficulty of siting any type of facility that handles, stores, or disposes of highly radioactive materials has been at the heart of the federal government's failure to deliver on its waste management obligations to date. Three examples from the U.S. experience are particularly instructive for future siting efforts: the currently suspended program to develop a geologic repository at Yucca Mountain in Nevada, the successfully completed and currently operating WIPP disposal facility for transuranic defense waste in New Mexico, and a series of thus far unsuccessful public and private efforts to establish an MRS facility for commercial SNF. Each of these experiences is summarized as part of the historical overview provided in chapter 3 of this report. In this section, we highlight lessons learned from these past siting efforts that helped inform the Commission's recommendations.

In the history of the U.S. nuclear waste management program, the contrasting experiences with Yucca Mountain and WIPP offer important insights. Yucca Mountain was singled out as the sole site to be considered for a first national

geologic repository in the 1987 Amendments to the NWPA and the record since has been one of frequent regulatory and legal deadlock, extreme political controversy and strong state opposition, steadily escalating project costs, and delays measured in decades.

The problems that plagued Yucca Mountain from the outset and that have led to the current impasse are not hard to identify:

- Short-circuiting of the initial site selection process that had the effect of tainting all subsequent state-federal interactions over the project
- Lack of appropriated funds to complete project milestones on time
- Overly prescriptive requirements and rigid deadlines that made it difficult to respond to stakeholder concerns
- Inconsistent program leadership and execution.

All of these flaws only served to exacerbate what was arguably the most important and most enduring problem of all—the fact that the project was strongly opposed, from the time Yucca Mountain was named in 1987 as the only site to be studied, by the majority of Nevada residents and by the state's political leaders. That the project suffered from protracted delays and has now been suspended—after an investment of more than 20 years and billions of dollars in resources—speaks volumes about the difficulty of siting a facility over the objections of the host community, state, or tribe and about the broader shortcomings of the U.S. program.

In stark contrast to Yucca Mountain, the WIPP facility in New Mexico has been operating successfully for more than a decade with broad local and state support, although that project too was often controversial, suffered numerous setbacks in the siting and licensing process, and took years longer to complete than originally planned. The crucial difference in the WIPP case was the presence—also from the outset—of a supportive host community and of a state government that was willing to remain engaged. Starting in the early 1970s and continuing to the present, elected officials and other local leaders in and around the WIPP site, particularly in the Carlsbad business community, made it very clear that they approved of the development and use of the facility to dispose of defense TRU wastes. This unwavering local support helped to sustain the project during periods when federal and state agencies had to work through disagreements over issues such as the nature of the wastes to be disposed, the role of different entities in providing oversight, and the standards that the facility would be required to meet.

Even so, the path to successfully licensing and opening WIPP was neither straightforward nor quick (see text box

in section 3.4.2). On the contrary, it involved years of legal, regulatory, and political activity and complex negotiations between the State of New Mexico and the federal government. Ultimately, local support combined with other confidence-building measures proved sufficient to allay state concerns and allow the project to go forward. But no one could have designed the process that was ultimately followed ahead of time nor could that process ever be replicated.

Attempts to site an MRS facility in the 1980s and 1990s, by contrast, have had more in common with the Yucca Mountain experience in the sense that none of them—despite the availability of unspecified inducements under the 1987 NWSA amendments—succeeded in overcoming opposition at the state level. Outreach by the short-lived Office of the Nuclear Waste Negotiator in the early 1990s prompted a number of communities and tribes to express interest in being considered for a facility, but the program was closed down before any of those possibilities could be fully explored. A subsequent private initiative by several utilities to work directly with the Goshute Indian tribe to open a consolidated spent fuel storage facility on the tribe's Skull Valley Reservation in Utah resulted in the NRC issuing a license but likewise encountered strong state-level opposition and is still being litigated.

In sum, U.S. experience to date clearly underscores the inherent complexity and difficulty of siting nuclear waste facilities, particularly in the face of state-level opposition. At the same time, the record, along with input received from a number of parties during the BRC's deliberations, provides grounds for optimism that it can be done. The WIPP example, in particular, represents an affirmative demonstration that with adequate patience, flexibility, and political and public support, success is possible.

## 6.2 EXPERIENCE WITH NUCLEAR WASTE FACILITY SITING IN OTHER COUNTRIES

In designing a new approach to siting, the United States can also look to a substantial body of experience in other countries. All of the countries the Commission studied (see appendix C) provided useful insights for the U.S. program going forward. Sweden and Finland are furthest along in selecting and developing a repository site, while other countries—like France and Canada—have also made substantial progress (of these countries, Canada provides perhaps the closest analogue to the United States in terms of political structure). In addition, Spain recently selected a site for a consolidated storage facility. Overall, the experience of these countries provides strong support for the Commission's

conclusion that a transparent, consent-based approach built on a solid understanding of societal values has the best odds of achieving success in siting, constructing, and operating key waste management facilities.<sup>116,117</sup>

In Finland, plans to develop a geologic disposal facility for SNF at the island of Olkiluoto have the support of the host community, Eurajoki (which initially vetoed its selection as a repository site).<sup>118</sup> Finland's efforts to site a deep geologic repository and undertake associated environmental impact assessments began in 1983, when the government issued a major policy decision on the management of SNF and on the schedule and process to be used for selecting a final repository site.<sup>119</sup> The siting process entailed three steps. First, a country-wide screening study was undertaken between 1983 and 1985. This was followed, from 1986 to 1992, by preliminary site investigations. In the third phase, from 1993 through 2000, detailed site investigations and environmental impact assessments were conducted for four sites.

All four sites were found to be technically suitable for the final disposal of SNF, but local support for a repository was strongest in the communities of Eurajoki and Loviisa where nuclear infrastructure already existed. Of these two sites, a larger area for surface support facilities was available at Olkiluoto. In addition, because of two existing reactors at Olkiluoto, a large portion of the country's spent fuel inventory was already on the island.

In 1999, Posiva Oy (the company responsible for managing spent fuel in Finland) applied to the Finnish government for a decision-in-principle to go forward with a repository at Olkiluoto. At that point, the government requested statements on Posiva Oy's application from the municipality of Eurajoki and from the relevant regulatory authority. Eurajoki's municipal council voted in favor (by 20 votes to 7) and the Finnish government followed with a positive decision-in-principle in December 2000. After further discussion, Finland's Parliament overwhelmingly ratified the government's decision (by a vote of 159 to 3) in May 2001. Detailed site characterization studies at Olkiluoto began in 2004 with the construction of an underground research tunnel. A license application for the facility is now planned for 2012 with an anticipated start date for repository operations in 2020.

The Swedish waste management company, SKB, is likewise moving forward with the development of a geologic repository for spent nuclear fuel with the consent of the host municipal government. Between 1977 and 1985, SKB identified a number of "investigation areas" in different parts of the country. Such areas were selected for further studies on the basis of existing geological data as well as an assessment



of the ease of getting permission by the land-owner to carry out such investigations (including borehole drillings). This approach gradually met more and more opposition. In 1985, SKB decided to stop these investigations, partly as the result of a governmental request. At that time, geological information had been collected from about 15 locations. An overall conclusion was that it is possible to find sites that meet the stipulated geological requirements for a deep geological repository in most parts of Sweden.

In early 1992 SKB initiated a new siting process. The process started with a letter from SKB to all Swedish municipalities (about 290) explaining SKB's task to find a site for a repository for spent fuel and inviting interested municipalities to voluntarily apply. SKB's invitation resulted in two municipalities agreeing to a feasibility study. These feasibility studies were followed by referendums in both municipalities to ascertain public opinion regarding further participation in the siting process. In both cases, the referendums resulted in a rejection of further participation.

At that point, SKB conducted further feasibility studies and identified five potentially promising sites. Of these, SKB approached the three geologically appropriate communities that already housed nuclear facilities. In 2001, the government approved SKB's proposal to undertake a detailed investigation of these three sites: (1) the existing Forsmark nuclear site near the municipality of Östhammar, (2) Oskarshamn, which was the site of an underground

nuclear research laboratory constructed in the early 1990s and (3) an area in the northern part of Tierp. A few months later, the municipal councils in Östhammar and Oskarshamn consented to further investigations, while Tierp opted out (importantly, either Östhammar or Oskarshamn could have vetoed its selection as a disposal site for HLW).<sup>120</sup> Ultimately, this process worked. Of the two remaining options, Forsmark—which already hosts a large nuclear power plant and an operating repository for short-lived low- and intermediate-level radioactive waste—was ultimately selected in 2009 because it offered better geology. In March 2011, SKB applied to the Swedish government for permits to construct a repository in Forsmark.

A unique feature in the Swedish approach is that, before the final site decision was made, there was an agreement that the community not selected would receive a larger amount of compensation than the community that was selected. The rationale was that the community selected to host the repository would realize additional economic benefits, in the form of construction activity, infrastructure investments, permanent jobs to operate the repository, and ancillary development (e.g., research and fabrication facilities, etc.). The value of these benefits to the local economy was estimated at about \$300 million.<sup>121</sup> Ultimately, the community near Forsmark will receive approximately 25 percent of this estimated value for hosting the repository, while the community at Oskarshamn, which was not

selected, will receive the remainder—approximately 75 percent of the estimated benefits—for participating in the siting process. At this point, the anticipated start date for repository operations is 2025.

France established its Agency for Radioactive Waste Management (ANDRA) in 1991 to develop a strategy and perform research on managing the high-level and intermediate-level long-lived radioactive waste generated by that country's nuclear reactor fleet (prior to this time the process was largely controlled by the industry and the national government). Lines of authority and decision-making responsibility were further clarified with the passage of the 2006 Planning Act, which established the decision in principle to develop a geological repository, to be located at a site and in a geological formation that had already been studied through an underground laboratory. To date, there has been community support for the siting process: local governments in the Meuse/Haute-Marne region volunteered to host an underground site-characterization program and can expect to benefit from a series of measures designed to support local development, including a dedicated tax on basic nuclear installations, along with additional projects. More recently, ANDRA signed a contract with a joint venture of two engineering companies to conduct industrial design work for a deep geological repository for France's high- and intermediate-level radioactive waste. The first conceptual study phase is to be conducted in 2012 and will lead to a public consultation that will take place in 2013.<sup>122</sup>

Canada's Nuclear Waste Management Organization (NWMO) was formed in 2002 after the failure of a decades-long, technically-oriented effort to establish a repository. A commission chartered in the 1990s to review the Canadian program concluded that while the program had conducted the scientific and technical aspects of the program well, it did not enjoy public confidence and had not provided for "social safety." This review led to legislation that established the NWMO.

The NWMO has adapted many lessons from the Finnish and Swedish experience to its approach to nuclear waste management in Canada and pioneered a number of novel steps in its approach as well. The very first step taken by the NWMO was to ask how its attempt to develop a repository would be any different from those of the past. The conclusion was reached that the NWMO should first seek to understand the deeply-held values of citizens, and only then review its options in light of that citizen input.<sup>123</sup> After several extensive iterations with Canadian citizens and stakeholder organizations, the NWMO has explicitly adopted a phased, adaptive approach they call Adaptive

Phased Management. This deliberate, transparent, and highly engaged process has led nine communities to volunteer to engage the NWMO in the earliest stage of discussion and information gathering, prior to considering whether to have surveys conducted. Canada went through an evaluation of its program by an external commission more than a decade ago and fundamentally restructured its approach as a result.

Canada's provincial-level government in some ways mirrors the intermediate level of government comparable to U.S. state government, which does not exist in Finland, France, or Sweden. Canada's progress to date thus provides additional insights and enhances confidence in the siting process we are recommending.

Spain provides the most recent example of a successful consent-based siting process for a nuclear waste facility—in this case, a consolidated storage facility for spent fuel from that country's eight operating and two shutdown reactors.<sup>124</sup> In December 2004 a resolution supported by all parties in the Spanish Parliament called on the government to put an end to dispersed spent fuel storage at multiple reactor sites by developing a central storage facility for the spent fuel, as well as for a small quantity of solidified high-level waste due to be returned from France. In 2006, an inter-ministerial commission of the national government was established to define siting criteria for the facility and to develop and supervise a transparent, democratic, and participatory siting process. In the same year, the commission initiated an information campaign aimed at municipalities in the country (the siting process had no formal role for the autonomous communities, i.e. the large regional governments such as Valencia and Andalucia that are analogous to states). ENRESA, the national waste management organization that would be responsible for designing, constructing, and operating the facility, supported the commission's siting process by performing technical studies and providing information to stakeholders.

The proposed facility—described as a technology park—includes not only the storage facility itself (which will also accept intermediate-level radioactive waste from nuclear power plant decommissioning), but also other facilities intended to support local and regional development, including several laboratories.

In December 2009, the government issued a call for proposals from communities interested in hosting the facility, and by the end of February 2010 eight communities with potentially qualified sites were accepted as candidates. Following an evaluation of the proposals, the commission proposed a preferred candidate site (Zarra, in Valencia) in September 2010, but the government did not formally endorse

the recommendation pending efforts to gain consensus at the autonomous community level. After delays due in part to an acceleration of the schedule for national elections, in December 2011 the new government announced selection of a site in the autonomous community of Castilla la Mancha that had been one of the four top-ranked candidates and enjoyed broader support beyond the host community than had been the case with Zarra. The entire siting process, from establishment of the interministerial commission in 2006 through site selection at the end of 2011, took less than six years.

In addition to hearing from leaders of the Canadian, Finnish, French, and Swedish programs and visiting facilities in Finland, France, and Sweden, several Commission members had an opportunity to travel to Japan, Russia, and the United Kingdom to hear firsthand from leaders of those countries' nuclear waste management programs. As an element of these fact-finding trips, members heard from local government officials and from a variety of non-governmental organizations and other stakeholder groups. In contrast to the U.S. situation, these officials and others expressed a high degree of confidence in the site identification and selection processes used to locate a repository and in the institutions responsible for implementing and overseeing those processes. Although the countries we visited were in various stages of the siting and licensing process, they stressed that several elements were critical in establishing a foundation for trust:

- A clear and understandable legal framework
- An opt-out option for the local affected community, up to a certain point in the process
- The availability of financing for local governments and citizen organizations for conducting their own analyses of the site and siting issues
- Compensation for allowing the investigation and characterization of the proposed site
- A concerted effort to promote knowledge and awareness of the nuclear waste issue and plans for addressing it through mechanisms such as:
  - Seminars, study visits, and reviews conducted by the local government
  - Information to and consultation with local inhabitants
  - Socioeconomic studies and evaluations of impacts on local businesses
- Openness and transparency among and within the implementing organization, the national government, local governments, and the public.

How these elements might be included in a new approach to siting future facilities for nuclear waste and spent fuel management and disposal in the United States is the subject of the next section.

### 6.3 KEY ELEMENTS OF A PHASED, ADAPTIVE APPROACH TO SITING AND DEVELOPING FACILITIES

Based on the history of waste management efforts at home and abroad, the Commission concludes that the United States must commit to a new, more flexible and more adaptive approach to siting and developing facilities in the future. “Learning by doing” has produced substantial improvements in the reliability, safety, and performance of commercial nuclear reactors in the United States. It has also contributed to an impressive track record of safe transport and handling with respect to the transfer of defense TRU wastes to the WIPP facility in New Mexico. Compared to the prescriptive approach used in attempting to develop a repository for spent fuel and HLW at Yucca Mountain, other nations—notably Sweden and Finland—appear to be proceeding with less controversy using an adaptive, staged management approach (recognizing that some other nations using an adaptive approach have not yet succeeded in identifying repository sites).

The notion that such an approach could produce better outcomes for this nation's nuclear waste management program also is not a new one. In a comprehensive 2001 report on the status of efforts to provide for the disposition of HLW and spent fuel,<sup>125</sup> the NAS concluded that “geological disposal remains the only long-term solution available” and recommended that national waste management programs “should proceed in a phased or stepwise manner.”<sup>126</sup>

The Commission concurs strongly with the NAS recommendation. In our view, moreover, the events of the last decade only bolster the case for a phased, adaptive approach because they demonstrate that without political buy-in and trust, progress in the long and demanding process of finding a resolution to our nation's waste management challenges will be extremely difficult to sustain.

Of course, the first requirement in siting any facility centers on the ability to demonstrate adequate protection of public health and safety and the environment. As part of a phased, adaptive approach,<sup>127</sup> the Commission recommends that starting early in the process of exploring a potential site the waste management organization begin to develop a “safety case” that collects in one document the wide range of relevant technical and other information (including information on legal, financial, and managerial aspects of the waste management system) that together provides a basis for confidence in the safety of the proposed facility at the proposed site.<sup>128</sup> The articulation of a safety case provides a way to communicate important information to decision-

makers, stakeholders, and the public; it also helps to promote a broader and more accurate understanding of the scientific, technical, and other bases for decisions about the facility, including ultimately the licensing decision. The purpose of the safety case would not be to expand on requirements already included in the existing licensing process,<sup>129</sup> but rather to make the rationale for decisions about the facility accessible and understandable to the public and to a wide range of decision makers beyond the audience of regulatory experts who are already familiar with the full range of arguments being considered as part of the process.<sup>130</sup>

To support the consent-based siting process we have recommended, the safety case should (1) be easily accessible to all concerned stakeholders and to local, tribal, and state government representatives and (2) should strive to make clear and explicit all the assumptions and evidence that have been considered as part of building the case for confidence in the long-term performance of the proposed facility at the proposed site. In addition, the safety case should be updated as needed to provide an input to decisions throughout the facility development process. It should also be updated periodically after the facility begins operation if agreements with local communities, tribes, or states require a periodic revalidation of the facility's ability to meet safety requirements.

One important implication of pursuing an adaptive staged approach is that the focus is on initial operation of a repository rather than on rapidly disposing of a large inventory of waste.<sup>131</sup> This follows from the NAS description of the characteristics of a successful geologic repository program<sup>132</sup> as one in which:

- A geologic site and engineered system, judged to be technically suitable using the particular country's accepted regulatory, public, and political processes, have been identified
- Operational and long-term safety aspects are made consistent with the current scientific understanding of repository systems, safety features are reviewed; and the necessary licenses are granted
- An ongoing long-term monitoring and observation program designed to substantiate the current scientific understanding of the safety aspects of the repository system is in progress
- Sufficient societal consensus is achieved to allow operations to begin and continue
- Initial waste emplacement has taken place with plans for reversibility
- All necessary safety and security measures are set up to place additional waste, if decided
- Procedures and funding arrangements are agreed to for either:
  - Backfilling (if used), closing, and sealing the repository (if technical and societal confidence in the long-term isolation properties continues), or
  - Maintaining capability for long-term control and monitoring, and capability for treating wastes, if waste retrieval is necessary for technical or societal reasons.

It is very important to recognize that these requirements in turn imply a need for substantial buffer storage capacity in the waste management system so as to decouple the program's ability to accept waste from the emplacement of that waste in a repository for disposal. This in turn would

## SITING NEW NUCLEAR WASTE MANAGEMENT FACILITIES – GETTING STARTED

***First, the Environmental Protection Agency and the Nuclear Regulatory Commission should develop a generic disposal standard and supporting regulatory requirements early in the siting process.*** Generally-applicable regulations are more likely to earn public confidence than site-specific standards. In addition, having a generic standard will support the efficient consideration and examination of multiple sites.

***Once the new waste management organization is established it should:***

- ***Develop a set of basic initial siting criteria*** – These criteria will ensure that time is not wasted investigating sites that are clearly unsuitable or inappropriate.

- ***Encourage expressions of interest from a large variety of communities that have potentially suitable sites*** – As these communities become engaged in the process, the implementing organization must be flexible enough not to force the issue of consent while also being fully prepared to take advantage of promising opportunities when they arise.
- ***Establish initial program milestones*** – Milestones should be laid out in a mission plan to allow for review by Congress, the Administration, and stakeholders, and to provide verifiable indicators for oversight of the organization's performance.

provide the flexibility needed to develop repository capacity in a more gradual and stepwise manner. The need for buffer capacity is addressed by the Commission's recommendation concerning the expeditious development of one or more consolidated storage facilities for SNF, as discussed in chapter 5 of this report.

## 6.4 SPECIFIC STEPS IN AN ADAPTIVE, STAGED FACILITY SITING AND DEVELOPMENT PROCESS

Experience in other countries and from the WIPP facility in the United States suggests that an adaptive, phased, and ultimately consent-based process should start by encouraging expressions of interest from a large variety of communities that can offer a potentially suitable environment for the type of facility under consideration. The waste management organization should also be able to approach communities that it believes can meet the siting requirements. As communities engage the process, the implementing organization must be flexible enough not to force the issue of consent while also being fully prepared to take advantage of promising opportunities when they arise. Throughout, meaningful consultation with stakeholders to inform them of the status of the siting process and make needed adjustments (much as was done by the NWMO in Canada) will be critical to building credibility and confidence in the implementing organization.

Prior to launching a consent-based siting process, the implementing organization should develop a set of basic, initial siting criteria designed to ensure that time and resources are not wasted to investigate sites that are clearly unsafe, unsuitable or inappropriate for waste facility development. At the same time, it will be important to communicate with local communities and stakeholders about the nature of the risks involved in hosting a facility and about options for addressing and managing those risks. As the siting process continues and as various candidate sites pass initial screening criteria, additional sets of criteria should be applied to eliminate all but the most suitable sites for further characterization. These additional criteria might include geologic features, anticipated socioeconomic effects, transportation access and impacts, costs, and other important considerations. Obviously, as a candidate site is characterized in greater and greater detail it will be necessary to demonstrate not only that the preliminary criteria are satisfied, but that all applicable environmental, health and safety, and other requirements set forth by the responsible regulatory authorities can be met.

The Commission takes the view that any future site, provided it has met all regulatory requirements and has been selected with local- and state-level consent should require no additional approval, including congressional approval.<sup>133</sup> Likewise, after a disposal facility enters operation, any modification or expansion of the facility's mission should be consent-based. This approach is consistent with an overall framework that gives the new implementing organization authority—subject to congressional oversight—to make binding agreements with regard to developing key parts of the nuclear waste management system. As with other details of establishing a new management approach and a new implementing organization, the specific requirements for moving forward with a particular site would have to be set forth in new legislation.

The Commission also recommends that pilot, test, and demonstration facilities (including an *in situ* research and demonstration laboratory) be co-located with new waste management facilities, as appropriate, wherever feasible. This will make it possible to conduct tests aimed at improving operational efficiency and safety and signal a continuing commitment to R&D to reduce residual uncertainties.<sup>134</sup> These facilities have also been used as excellent public communication tools in Sweden and France, for example, to explain to the interested public exactly how a repository operates.

The National Academies' 2003 *One Step at a Time* report identified seven key attributes of adaptive staging:

1. **Commitment to systematic learning.** Project managers intentionally seek, are open to, and learn from new knowledge and stakeholder input. Stages are designed specifically to increase available scientific, technical, societal, institutional, and operational knowledge.
2. **Flexibility.** Project managers are able and willing to reevaluate earlier decisions and redesign or change course when new information warrants.
3. **Reversibility.** Project managers are able to abandon an earlier path and reverse the course of action to a previous stage if new information warrants.
4. **Transparency.** The decision-making process and the basis for decisions are documented and accessible in real-time and plain language to all stakeholders.
5. **Auditability.** Documentation for the basis of decisions is complete and made available to all interested parties for review purposes.
6. **Integrity.** Technical results are accurately and objectively reported and all uncertainties, assumptions, and indeterminacies are identified and labeled.



**7. Responsiveness.** Project managers seek and act on new information in a timely fashion.

Finally, the Commission recognizes that reasonable milestones for major phases of program development and implementation are important to keep the program focused and ensure that it is moving forward. The Finnish waste management program demonstrates the usefulness of milestones as a mechanism to help sustain steady and meaningful progress. Since an adaptive phased approach requires both clear programmatic planning and flexibility, we recommend that the implementing organization establish reasonable time horizons for the major stages of the program. As one example, the implementing organization might contemplate a range of, say, 15 to 20 years to accomplish site identification and characterization and to conduct the licensing process. A notional timeframe for siting and developing a consolidated storage facility would presumably be shorter, perhaps on the order of 5 to 10 years. The implementing organization will be responsible for setting overall and intermediate milestones for each stage of the process. Of course, there will be unforeseen developments that could cause siting to take a longer or shorter period of time. This is why the program requires flexibility. Program milestones should be laid out in a regularly updated mission plan (as discussed in chapter 7) to allow for review by Congress, the Administration, and stakeholders, and to provide verifiable indicators for external oversight of the organization's performance. Any needed changes would be presented in mission plan revisions for review as appropriate.<sup>135</sup>

## 6.5 SUPPORT FOR PARTICIPATION

A noteworthy feature of the Swedish repository program is that funds from the nuclear waste management organization are set aside to be awarded to NGOs involved in the siting and repository development process. These funds are used by the NGOs to investigate technical and other aspects of the nuclear waste management program.

In the course of the Commission's deliberations, many participants emphasized the importance of citizen participation. For example, a letter from the South Carolina Governor's Nuclear Advisory Council and others pointed out that "citizen participation results in better and quicker decisions that are accepted by the larger public."<sup>136</sup>

For a complicated and technically-involved issue like the development of a nuclear waste repository, the inability of citizens and citizen groups to access the necessary technical expertise can be a major barrier to participation (see further discussion of this issue in section 6.6). In a large country like the United States, sheer distance can also be an issue; important meetings, conferences, and other events are

regularly held in far-flung locations, and travel and lodging expenses can be beyond the means of individuals and groups who would otherwise wish to participate.<sup>137</sup> Perhaps even more important, states, tribes, and affected communities—in order to gain trust and confidence in the decisions taken by the waste management organization—must be empowered to meaningfully participate in the decision-making process. This means being in a position to evaluate options and provide substantive input on technical and operational matters of direct relevance to their concerns and interests.<sup>138</sup>

In sum, the Commission believes that a new U.S. waste management organization should adopt the Swedish practice and set aside funding for participation by citizens, citizen groups, and other NGOs. The availability of funding should be widely announced and reasonable criteria should be established against which to evaluate applications for financial support.

## FEATURES OF ADAPTIVE STAGING

Every first-of-a-kind, long-term, and complex project develops in stages. With time, stages and schedules are inevitably revised in light of experience and knowledge gathered along the way. However, many national repository programs, including the U.S. program, have run afoul of rigid milestones for commencing full-scale waste emplacement.

By contrast, adaptive staging entails a flexible approach where the overall direction to be taken and its end points are outlined at the beginning and all parties, including stakeholders, acknowledge that the program can be revised as it progresses. Adaptive staging is less "error-prone" than a rigid approach and it allows the current generation to manage waste using the best available knowledge without foreclosing options if future generations decide to take a different approach.

It is important to emphasize that these elements should not be implemented in a way that causes continual delay. Certainly, an adaptive staged approach may result in higher initial costs and a slower pace of waste emplacement in the beginning. But the point is to implement a process that is ultimately more efficient—both in terms of cost and time—because it corrects potential problems before they become expensive and time consuming. Finally, an adaptive staged approach implies continued investment in new learning, including support for science and technology development that can improve the performance of the whole waste management system.

## 6.6 THE ROLE OF STATES, TRIBES, AND COMMUNITIES IN AN ADAPTIVE, CONSENT-BASED SITING PROCESS

It has long been accepted that host states, tribes, and local governments should play an important role in siting nuclear waste management and disposal facilities.<sup>139</sup> As one early study put it: “If the federal government is to make progress toward a permanent solution of the radioactive waste problem, it cannot go it alone—citizens will insist on assurances (other than federal assurances) that proposed actions will not involve undue risks to the host states.”<sup>140</sup>

In the debates leading up to the original NWPA of 1982, Congress considered a wide range of options for formalizing the host states’ role in repository siting—from merely providing for consultation to giving host states a complete veto over proposed projects within their borders. Ultimately, the formula adopted in the NWPA included provisions for “consultation and cooperation,” combined with some state oversight rights and the ability to veto a proposed site. The state veto, however, was subject to congressional override—an option that was exercised when Congress overrode Nevada’s veto of the Yucca Mountain site in 2002.<sup>141</sup>

As we noted in our brief review of lessons learned from the U.S. experience so far, states have generally resisted—in some cases very strongly—efforts to site HLW and spent fuel disposal and away-from-reactor storage sites within their borders.<sup>142</sup> By contrast, some local governments and tribes have viewed these facilities more positively—and in some cases have supported them strongly—primarily on the basis of anticipated job creation and economic development benefits. Indeed, some of the most supportive communities have been those with a long history of hosting nuclear facilities. Tribal and local support, however, has not usually been sufficient to overcome state-level opposition. This suggests that to be successful, a new waste management organization must find ways to address state concerns while at the same time capitalizing on local support for proposed facilities.

What those concerns might be and how the tensions inherent in the federal–state and federal–tribe relationship might be successfully navigated in different siting contexts is impossible to anticipate in advance. Clearly, locating and constructing facilities for the management and disposal of SNF and HLW will require complex and possibly lengthy negotiations between the federal government and other relevant units of government. In these negotiations, it will be important to define the roles, responsibilities, and authorities of host state, tribal, and local governments both throughout the siting and licensing process and once a facility is

operational.<sup>143</sup> In addition, host jurisdictions should have the option to enter into partnership arrangements or other legally-binding, court-enforceable agreements with the implementing organization to ensure that all commitments concerning the development and subsequent operation of waste management facilities are upheld. A similarly consent-based approach should be used in the future in deciding whether modifications to the scope or mission of an existing facility are appropriate and acceptable.

Beyond engaging in substantive negotiations and binding agreements with other units of government as part of the facility siting and development process, the Commission believes that states and tribes should retain—or where appropriate, be delegated—direct authority over aspects of regulation, permitting, and operations where oversight below the federal level can be exercised effectively and in a way that is helpful in protecting the interests and gaining the confidence of affected communities and citizens. Such authorities could be included in legally-enforceable agreements or partnerships if such arrangements are negotiated between the implementing organization and states, tribes, and/or local communities that agree to host a waste management facility. We recognize that defining a meaningful and appropriate role for states, tribes, and local governments under current law is far from straightforward, given that the Atomic Energy Act of 1954 provides for exclusive federal jurisdiction over many radioactive waste management issues.<sup>144</sup> Nevertheless, we believe it will be essential to affirm a role for states, tribes, and local governments that is at once positive, proactive, and substantively meaningful and thereby reduces rather than increases the potential for conflict, confusion, and delay. At the same time, host state, local, and tribal governments have responsibilities to work productively with the federal government to help advance the national interest.

Several commenters have expressed a desire to see the Commission explicitly define the point at which potential host state, tribal and local governments could no longer unconditionally (that is, without cause) “opt out” of a facility siting process. These commenters correctly note that the level of state, tribal and community acceptance of a proposed waste management facility can and likely will fluctuate over time. The Commission believes that defining the point at which the right to unconditionally opt out expires must be part of the negotiation between affected units of government and the waste management organization. In our view, however, the right to opt out without cause should expire no later than the time when a license application for a proposed facility is submitted.

We believe this approach makes sense given that, under the process we have recommended, the potential host community, tribe, and state would have had to consent to be considered for a waste site, with full knowledge of the relevant safety standards and siting criteria. Further, the host state and affected tribal and local governments would have had to agree to the terms of site study and what was to be built prior to the submission of a license application. When studies were complete, a license application would be prepared, and the Commission believes the host state and affected tribal and local governments should be given the opportunity to sign off on it before submittal. After that time, the state and other units of government would only be allowed to opt out “for cause”—such as bad faith on the part of the facility operator. Formal agreements, of the type we have recommended elsewhere, would be in place to cover this situation.

It is worth noting that in the context of the fundamentally consent-based facility siting and development process we are recommending, negotiations with host states, tribes, and local governments would obviate the need for a state-level veto, just as the veto/override provisions of the NWPA would not have applied to a repository or MRS facility sited through the voluntary Nuclear Waste Negotiator process established in the 1987 NWPA amendments. Meanwhile, legislation to establish a new waste management organization and associated funding reforms (discussed in detail in the next two chapters)

## CONSENT

Another question highlighted in numerous comments to the BRC is the question of how to define “consent.” Some stakeholders, for example, have suggested that consent within a state could be measured by a state-wide referendum or ballot question. On the other hand, the WIPP facility was sited, opened, and has been operated without the state’s elected leaders employing such consent-measuring mechanisms. The Commission takes the view that the question of how to determine consent ultimately has to be answered by a potential host jurisdiction, using whatever means and timing it sees fit. We believe that a good gauge of consent would be the willingness of the host state (and other affected units of government, as appropriate) to enter into legally binding agreements with the facility operator, where these agreements enable states, tribes, or communities to have confidence that they can protect the interests of their citizens.<sup>145</sup>

must make it clear that the organization has the responsibility, authority, and resources to negotiate and comply with enforceable commitments.

Here, as in other aspects of facility siting, it is instructive to look again to the WIPP experience, since that project was controversial at the state level for many years despite strong local support from the Carlsbad business community. After years of delay and state–federal disagreements, an important development came when Congress required EPA (not DOE) to certify that the facility met applicable standards for waste disposal, including requirements under the Resource Conservation and Recovery Act (RCRA) for the disposal of mixed hazardous and radioactive waste.<sup>146</sup> This meant that the State of New Mexico retained authority to regulate mixed waste at WIPP and that the New Mexico Environment Department had to issue a Hazardous Waste Facility Permit for the repository. Even though the state did not have direct regulatory authority over the radioactive components of the waste being brought to the facility,<sup>147</sup> this development was very important in terms of giving state officials and residents beyond the local community confidence that the facility was safe. Similarly, DOE’s decision to work cooperatively with Carlsbad and the Western Governors’ Association to develop a safe transportation program for WIPP was extremely helpful in addressing transportation-related concerns. The resulting Western Governors’ Association WIPP Transportation Safety Program Implementation Guide includes many procedures that would otherwise be considered “extra-regulatory” and could not be mandated by the states without federal consent. And finally, the establishment of the federally-funded, university-housed Environmental Evaluation Group was important for gaining the trust of state officials and the local community because it provided an independent and credible source for technical information and review of the WIPP project.<sup>148</sup>

Trust, in fact, is often the core issue whenever different parties are involved in a complex adjudicatory process—and it can be especially difficult to sustain when much of the power or control is viewed as being concentrated on one side. In a recent news article, former Governor Michael Sullivan of Wyoming pointed to a lack of trust as one of the central issues that led him to veto a proposed monitored retrievable storage facility in Wyoming in 1992.<sup>149</sup> The WIPP example suggests that having some degree of direct state- or local-level control (in the WIPP case, this was possible through RCRA) can be helpful in instances where faith in federal agencies is lacking. In some cases, states have pursued formal agreements with the federal government that can be enforced in the courts, if necessary. In 1995, for

example, the State of Idaho entered into an agreement with DOE and the U.S. Navy that allows DOE to ship a limited quantity of spent fuel (primarily from research reactors and from the Navy's nuclear-powered fleet) to INL for storage over a 40-year period. The agreement also obligates DOE to move all spent fuel into dry storage by 2023 and to remove all naval spent fuel from Idaho by no later than 2035. If DOE fails to meet any of the agreement milestones at any point, DOE is subject to fines of \$60,000 per day and the State of Idaho may ask the U.S. District Court to halt any further spent fuel shipments to INL. The State of Washington recently entered into a similar agreement with DOE concerning the storage of wastes at Hanford.

The same issues of trust, consultation, and control arise in the context of the federal government's interactions with Indian tribes, another important stakeholder group in the context of nuclear waste management decisions.<sup>150</sup> In fact, because many existing and proposed nuclear sites are either on or near tribal lands, tribal governments have been involved in nuclear technology and nuclear waste issues for decades. The 1982 NWSA requires consultation with states and affected Indian tribes and specifically addresses the participation of tribes in repository siting decisions. In the wake of the 1987 NWSA amendments, several tribes expressed interest in exploring the possibility of hosting nuclear waste facilities on at least an interim basis. As was the case with local communities, however, these expressions of interest generally met with opposition at the state level.

Intergovernmental relationships will require careful attention as the U.S. nuclear waste management program is revived. Experience shows that an unwilling state government can successfully stand in the way of tribal efforts to site nuclear waste management facilities and the Commission believes it would be unrealistic to attempt to locate a facility on tribal land in the face of determined state-level opposition. Yet unlike local communities or state governments, tribes have a unique "government-to-government" relationship with the United States.<sup>151</sup> Their right to make their own laws and be governed by them is limited only by their status as dependent domestic nations and by federal law. Therefore, the federal organization tasked with managing the waste problem will be required to work with federally-recognized tribes on a government-to-government basis.

Legally, states have a very limited role in Indian affairs. They do not have the power to regulate Indian tribes or tribal lands unless such powers are delegated to them by the federal government. Since 1975, moreover, federal policy has supported tribal self-determination. This means that

meaningful consultation with tribal governments is required in the development of federal policies and practices that may impact tribal lands, people, or resources.<sup>152</sup> The existing State and Tribal Government Working Group (STGWWG) provides an example of one mechanism for facilitating regular consultation between states and tribes and the federal government. Established in 1989 at the request of 10 state governors, the group grew to include 15 states and 10 tribes who would meet with DOE to discuss the federal government's cleanup activities at facilities that have been or are still part of the nation's nuclear weapons complex. STGWWG now meets twice annually. As with states, some precedent also exists for giving tribes a degree of regulatory control over specific facilities or operations in the nuclear waste management system. In 1991, the Shoshone-Bannock Tribe attempted to stop the shipment of commercial spent fuel across its reservation in Idaho. A lawsuit resulted and while the courts concluded that federal law (in this case, the Hazardous Materials Transportation Act) did not allow the tribes to ban spent fuel shipments from crossing their land, it did allow them to develop regulations for those shipments.

In sum, whatever the specific authorities and resources of a given community, state, or Indian tribe, experience shows that determined opposition at any level of government can at a minimum significantly complicate and delay, and in many cases defeat, best efforts to site a facility. In this context, it is difficult to overstate the importance of support for a facility or site at the state, tribe, and local level (obviously, public acceptance is not the only criterion; to be considered, any site must also meet safety and technical criteria and other requirements). Support from Congress—for the new waste management organization and its activities as well as for participating states, tribes, and communities—is obviously also important. In the case of WIPP, Congress engaged with the siting process over a period of many years and at several critical junctures congressional intervention, far from undermining the process, helped build trust, resolve issues and ultimately achieve success.

## 6.7 BENEFITS TO HOST STATES, TRIBES, AND COMMUNITIES

In addition to conducting a process that is consent-based, transparent, and responsive to tribal, state, and local governments' need for meaningful input and control, it will be important to demonstrate that the decision to host a facility can deliver real benefits (economic and otherwise) to the tribe, state, and local community.<sup>153</sup> Affected states, tribes, and communities will reasonably expect incentives for helping to address the

important national issue of nuclear waste management. To be most effective, such incentives must be provided in ways that are generous, creative, and attentive to their symbolic content.

Besides financial incentives, benefits could include local preferences in hiring and in the purchase of goods and services by the waste management facility, infrastructure investments (such as new roads or rail lines<sup>154</sup>), as well as the opportunity to host co-located research and demonstration facilities or other activities that would generate new employment opportunities and make a positive contribution to the local and regional economy.<sup>155</sup> For example, Spain's effort to find a volunteer host for a storage facility for spent fuel and a small amount of HLW included a technological research laboratory to deal with waste processing, waste forms, disposal of HLW as well as spent fuel, etc. as an integral part of the facility. Eight volunteer communities for the integrated storage/research facility were identified and a final site was selected in December 2011 (see section 6.2).

As noted in section 7.4.1, we recommend that the responsibilities of the new waste management organization include promoting the social and economic well-being of communities affected by waste management facilities. The Commission also recommends that the benefits provided by the current NWPA<sup>156</sup> be modified and expanded to give the waste management organization greater flexibility to promote economic development. Specifically, the Commission believes that the level of benefits currently specified in Section 171 of the NWPA is inadequate. Accordingly we recommend that the NWPA be amended to authorize a new federal corporation (described in the next chapter) to negotiate substantial benefits—potentially well above the amounts currently contemplated in Section 171—to state and local governments, communities, tribes, or other organizations as appropriate. The specific uses of these funds and the metrics that would determine their amounts should be an element of negotiation between the federal government and local communities and governments interested in hosting facilities, but we envision that benefit payments could be used for a wide range of uses, including for economic development purposes. All such payments should be subjected to external, independent auditing.

In addition to locating waste management-related activities in the affected state and community, these states and communities could also be given preference in the siting of other federal projects (provided they are otherwise suitable to host those projects). Section 174 of the NWPA, titled “Other Benefits—Considerations in Siting Facilities,” already specifies that the Secretary of Energy “in siting Federal research projects, shall give special consideration to proposals from states where a repository is located.” This approach can provide additional benefits to host communities and states without requiring new appropriations or increasing the cost of already planned programs or projects. The Commission recommends that this provision be expanded to include states that host any waste management facilities sited by the new waste management organization and to clarify that the special consideration applies to research, development, and demonstration facilities (not research contracts) that receive federal funding, including any federal matching funds.

In addition to incentives and benefits, neighbors and others impacted by nuclear waste management facilities need assurance of reasonable compensation for real costs. The Commission believes that the framework for evaluating and providing compensation for direct impacts in the current NWPA is workable and should be left alone.<sup>157</sup>

Experiences in Sweden, Finland, and elsewhere have shown that it may not be possible or even advisable to specify incentives and compensation up front; rather, in keeping with an adaptive approach, these determinations are best left to the discretion of the implementing organization and potential host governments—including communities surrounding the host community. These stakeholders will be in the best position to determine what incentives are both appropriate and in their best interests.

Finally, it is important to recognize that Congress may ultimately have a role in providing or approving benefits and compensation for hosting nationally-needed nuclear waste facilities, particularly since some benefits—such as transfers of federal land to host states, tribes, or communities to compensate for land withdrawn for waste facilities—may be beyond the waste management organization's authority and could require legislation.