Community Involvement in Finding a Pathway for Disposal of High-Level Nuclear Waste - 11051

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ABSTRACT

Oak Ridge was the birthplace of nuclear research, and nuclear-reactor and fuel-cycle research are historical missions at Oak Ridge National Laboratory (ORNL). The region is also home to the Tennessee Valley Authority (TVA), owner of six nuclear power plant units that generate 30% of the region's electricity. Consequently, residents and local governments have a significant interest in the disposal of high-level radioactive waste (HLW) and spent nuclear fuel (SNF). The Oak Ridge Reservation (ORR) Local Oversight Committee (LOC) represents the concerns of local governments with respect to Department of Energy (DOE) environmental issues, including national policies such as disposal of DOE's most dangerous wastes. ORNL has sent SNF to other DOE sites, and is shipping its transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP). The LOC and its Citizens' Advisory Panel (CAP) supported the permitting of WIPP for disposal of TRU waste and the proposed use of Yucca Mountain for disposal of defense HLW and SNF. Success in siting a disposal site depends not only on the desire of the local community for the economic development it will bring, but also assurance that all technical, safety and environmental concerns will be addressed. This was illustrated by the positive experience of the Oak Ridge community during siting discussions for a Monitored Retrievable Storage (MRS) facility in 1985, a process that was ended by state of Tennessee opposition. A key lesson is that the host state must be included in negotiations that address its concerns, allow it a degree of control and oversight over the facility, and offer economic incentives. This approach proved successful for the siting of WIPP, but DOE was unable to successfully engage the state of Nevada to gain its support for the use of Yucca Mountain for disposal of defense HLW and commercial SNF.

INTRODUCTION

Residents of Oak Ridge, Tennessee, and nearby communities are among the most nuclear-savvy in the country. Oak Ridge was the initial Manhattan Project site for research, development, and production which ultimately led to the atomic bomb. The major DOE facilities at Oak Ridge now include ORNL, the Y-12 National Security Complex, and East Tennessee Technology Park, formerly known as the K-25 Gaseous Diffusion Plant.

ORNL, originally code-named X-10, was the pilot plant for production and separation of plutonium. Since its start in 1943, ORNL has transitioned from weapons-related science to being the premier general science lab in the DOE system. ORNL has built or operated 13 reactors and has undertaken research and development in all aspects of the nuclear fuel cycle. The laboratory sends its SNF off to other DOE facilities for storage and management.

In addition to the facilities on the ORR, the region is served by the TVA, the primary function of which is to produce electricity. TVA was created in 1933 by President Franklin Roosevelt. Its ability to produce large quantities of electricity and the large supply of clean river water for cooling were two important attributes for locating the Manhattan Project facilities in what is now Oak Ridge, Tennessee. Since then, TVA and the plants in Oak Ridge, especially ORNL, have had an ongoing nexus centered on nuclear energy. TVA now has six operating nuclear power reactors and is actively working on completing others. The agency stores its SNF onsite in cooling pools and dry casks.

These factors combine to make siting of a geological repository—likely preceded by a variety of waste management facilities for treatment and storage of SNF and HLW—an important issue for Oak Ridge and other Tennessee communities.

Citizens of the greater Oak Ridge area are generally supportive of nuclear energy due to the presence of these large regional employers. The host and surrounding communities for the ORR and the TVA nuclear power plants have years of experience with nuclear issues. They routinely communicate with the DOE, TVA, Congress and state and federal regulators regarding missions critical to the United States' defense and energy security.

The ORR LOC was created to provide local government input into DOE environmental decisions on the ORR. However, local actions are influenced by national policies. The LOC and its CAP have weighed in with their support for the need for the WIPP disposal site for TRU waste stored at ORNL. Although the DOE in Oak Ridge does not generate any defense HLW, the LOC and its CAP have supported DOE's ability to properly disposition all wastes across the DOE complex. The LOC recognizes that the availability of Yucca Mountain or other geological repository benefits all DOE host communities, as well as ensuring that nuclear waste generated in Tennessee has a safe disposition pathway. It is also essential to the United States' strategies for energy independence, nonproliferation, and climate-change mitigation.

Engagement of local governments, which have jurisdiction over land use, is key to siting a disposal or other waste management site. This proved to be an important factor to the siting of WIPP. State governments also must be provided with incentives to accept such a site and can kill a project if not included in the decision-making process. Oak Ridge's 1985 experience with a proposed MRS site on the ORR illustrates the successes of properly engaging local authorities as well as the need to have state buy-in for project completion.

NUCLEAR ENERGY RESEARCH AND WASTE DISPOSAL ISSUES IN OAK RIDGE

Nuclear Reactors at ORNL

On November 4, 1943 the X-10 Pile—later known as the Graphite Reactor—went critical, becoming the first continuously operating reactor in the world (1, 2). This reactor was instrumental in the lab's original mission as a pilot plant for production and separation of plutonium in the Manhattan Project effort to develop an atomic bomb during World War II (3). After the war, Manhattan Project scientists successfully lobbied Congress for civilian control of nuclear power, but the lab's mission became uncertain. Initial successes centered on research and production of isotopes for medical and other uses. In the 1950s, ORNL established itself as a player in the field of reactor development (4).

Over the 67 years of ORNL's history, a significant part of its mission has been research on reactors. Oak Ridge School of Reactor Technology operated from 1950 to 1965, and many of its 976 graduates contributed to new and improved reactor designs (5). Pioneering reactor designs by ORNL nuclear engineers led to the plutonium-production reactors built at Hanford, as well as creating the foundation for later research reactors, naval reactors, and nuclear power plants (6).

ORNL has built and/or operated over a dozen reactors (7). The research reactors housed at ORNL include the Graphite Reactor, Low Intensity Test Reactor, two Homogeneous Reactor, Bulk Shielding Reactor, Aircraft Reactor Experiment, two Tower Shielding Reactors, Molten Salt Reactor Experiment (MSRE), Oak Ridge Research Reactor, Health Physics Research Reactor, and High Flux Isotope Reactor (HFIR) (6, 4). ORNL also developed two portable reactors: the Geneva Conference Reactor that it operated at the 1955 first International Conference on Peaceful Uses of Atomic Energy in Geneva, Switzerland, and in the mid-1950s the lab designed the Package Power Reactor for use by the United States Army (4).

In 1956 the Congressional Joint Committee on Atomic Energy directed the Atomic Energy Commission (AEC), the precursor agency to DOE, to build a gas-cooled reactor; this effort was then assigned to Oak Ridge Operations. The project was undertaken jointly with ORNL providing technical support and TVA the designated operator of the Experimental Gas-Cooled Reactor. Ten years after the project was initiated, the reactor was on the verge of operation when the AEC canceled the project (7). The structure still stands on the shore of Melton Hill Lake.

In 1987 DOE shut down many reactors across its complex, including all ORNL reactors, due to concerns about reactor safety management triggered by the Chernobyl disaster. This led to upgrades and improvements, allowing Tower Shielding Reactor II and HFIR to restart (7).

HFIR is the only reactor that is currently operational, having undergone a number of upgrades over the years. It is used in the production of numerous medical, research and strategic isotopes and is the pioneering reactor in the field of neutron research (4).

Fuel Cycle Research at ORNL

Initial experiments with nuclear fuel commenced at ORNL in 1944 (6). Since then, the lab has undertaken research and development in all aspects of the nuclear fuel cycle. Beginning in the 1950s, ORNL developed processes to extract uranium from ores for commercial nuclear fuel, leading to the standard methods still in use (3).

Following World War II, researchers at ORNL refined the oxidation-reduction or REDOX solvent extraction process for extracting uranium and plutonium from nuclear waste, and helped develop the Plutonium/Uranium Extraction (PUREX) process, which remains the preferred reprocessing method for recovery of uranium and plutonium from spent nuclear reactor fuel. Continuing research made ORNL the leader in the design of PUREX plants, leading to the massive Cold War reprocessing facilities at Idaho Falls, Hanford, and Savannah River (3, 4).

ORNL continued to develop more efficient, effective and safer nuclear fuel reprocessing methods during the late 1970s and 1980s. Although these advanced techniques did not find application in the United States, they contributed to reprocessing technology currently used in Europe and Japan (3). ORNL also hosted the Consolidated Fuel Reprocessing Program which was a collaborative effort with the Japanese Power Reactor and Nuclear Fuel Development Corporation. Under this program ORNL's experts in this field supported Japan's effort to develop the capability to reprocess nuclear fuel (5).

In 2007 ORNL began a demonstration project for recycling commercial nuclear fuel as part of the Bush Administration's Global Nuclear Energy Partnership (GNEP). The first phase, undertaken in cooperation with other DOE national labs, was considered successful (8). Despite the cancellation of the GNEP initiative, the demonstration project continued into 2010.

Spent Fuel Disposal at ORNL

All of the SNF on the ORR was housed at ORNL. By the end of 2006, nearly the entire backlog of stored SNF, with the exception of HFIR SNF, had been shipped offsite (9). The Tower Shielding Reactor used aluminum-clad fuel which was shipped to Savannah River Site in South Carolina, with the completion of the campaign occurring in 2004 (10).

In the early 2000's, all non-aluminum-clad SNF was repackaged into duel-purpose shipping/storage casks for shipment to Idaho National Laboratory (then Idaho National Engineering and Environmental

Laboratory) near Idaho Falls. This campaign comprised five shipments and was completed by the end of 2003 (10).

Because HFIR remains an operational facility, its fuel is kept in storage racks behind the reactor pool until the short-lived radionuclides have decayed sufficiently to enable it to be safely shipped. As with the fuel from the Tower Shielding Reactor, this SNF is periodically shipped to Savannah River Site for surveillance and maintenance until a final disposal option is available.

The most troublesome SNF is that of the MSRE. Removal of the uranium-233 fluoride fuel salts was difficult due to the high radiation fields and had significant criticality concerns. The uranium-233 has been added to larger stocks of uranium-233 oxide held by ORNL and designated for downblending and disposal; however the project has run into serious technical difficulties and is behind schedule.

Transuranic Waste

The research programs at ORNL resulted in the generation of large quantities of wastes and debris containing fission products and elements with atomic numbers greater than 92, that of uranium; these latter wastes are termed TRU. Oak Ridge is home to large quantities of TRU waste stored in tanks, drums, and casks in ORNL's Melton Valley waste management area. There are approximately 1500 cubic meters of contact-handled (CH) TRU waste and 600 cubic meters of dangerously radioactive remote-handled (RH) TRU waste at that are slated for disposal at the WIPP a geologic repository near Carlsbad, New Mexico (11). In fact, ORNL has the largest inventory by curie activity of RH TRU waste, 89% of the total in the DOE complex (12). The Transuranic Waste Processing Center was built in 2003, and it sent the first shipment of CH TRU waste to WIPP in September 2008 and the first shipment of RH TRU waste in February 2009 (11).

TENNESSEE VALLEY AUTHORITY AND NUCLEAR ENERGY

TVA was created in 1933 with the passage of the TVA Act by Congress. The government corporation had a broad mandate to improve living conditions in the Tennessee Valley with missions that included power production, navigation, flood control, malaria prevention, reforestation, erosion control, and soil improvement (13). The presence of TVA's flagship hydroelectric dam on the Clinch River at Norris, Tennessee, and the agency's capability of expanding its power production was an important reason for the Army Corps of Engineers to locate the Manhattan Project site nearby, which would eventually become Oak Ridge. A massive amount of power was needed for the various processes of isolating uranium-235, and large quantities of water were needed for cooling the production plants (14).

The industrial demands of World War II provided the impetus for increasing electricity production in support of arms and materials manufacturing. TVA undertook one of the largest dam-building efforts in the United States to develop the region's potential for hydroelectric power. This undertaking peaked in 1942 with 12 hydroelectric projects and a coal-fired steam plant under construction at the same time (13).

After the war, electricity demand continued to grow, in part due to the demands of the uranium enrichment facilities in Oak Ridge as material was churned out to support the Cold War arms race. TVA embarked on a program of building additional coal-fired steam plants to meet the growing demand. In the 1960s, in expectation of continued growth in demand for electric power, TVA began a nuclear-plant construction campaign. However, a decade later energy demand dropped, in part due to shut down of the gaseous diffusion facilities in Oak Ridge, and TVA canceled its nuclear effort in 1985 (13).

TVA ultimately revived several of the nuclear plants, and they currently contribute about 6,600 megawatts of electric power to the regional supply; this represents about 30% of TVA's production (15). The agency's nuclear portfolio includes the following:

- Browns Ferry Nuclear Plant is located on an 840-acre tract on Wheeler Reservoir, which is on the Tennessee River near Athens, Alabama. All three units began operation in the 1970s, but were shut down in 1985. Units 2 and 3 were restarted in the 1990s, and Unit 1 was restarted in 2007, adding 1,150 megawatts of base-load capacity (13, 16).
- Sequoyah Nuclear Plant beside Chickamauga Reservoir is located on 525 acres near Soddy-Daisy, Tennessee. Sequoyah Units 1 and 2 began commercial operations in the early 1980s and together can produce more than 2,320 megawatts of electricity (17).
- Watts Bar Nuclear Plant is located on the Chickamauga Reservoir on 1,700 acres in east Tennessee near Spring City. Unit 1, with a production capacity of 1,170 megawatts, came online in May 1996 (18).

TVA continues to plan for new nuclear units, as the need for carbon-free base-load generation becomes more acute. The construction of Watts Bar Unit 2 will be completed, and the reactor is expected to be operational by 2013, adding 1,180 megawatts of electricity to the grid (18). In addition, the Bellefonte Unit 1 reactor may be completed as early as 2018 (19).

In partnership with ORNL, TVA plans to site two prefabricated modular nuclear plants on the site of the canceled Clinch River Breeder Reactor project, TVA-owned land which adjoins the ORR. Agency officials have notified the NRC that they are evaluating the feasibility of siting two Babcock & Wilcox-designed mPower reactors by 2020. Together these would produce 250 megawatts of electricity (7). The mPower reactiors, if proven practical, will help TVA reach its goal of generating half of its power from non-carbon sources, and it will support ORNL's goal of using only carbon-free energy by 2020 to sustain the massive energy demands of its super-computing and neutron-research missions (19).

TVA helps recycle surplus nuclear weapons-grade uranium by using down-blended highly enriched uranium as fuel through the Blended Low Enriched Uranium project with DOE. Due to the success of this project, TVA is also studying the possible use of mixed oxide fuel at the Browns Ferry or Sequoyah plants. This fuel is sourced from excess Cold War weapons-grade plutonium mixed with uranium. In 2009 TVA entered a letter of intent for the study, although the fuel is not projected to be available until 2016 (20). These projects help advance the United States' nonproliferation interests.

At TVA's nuclear power plants, the fuel rods remain in the reactor for 18 to 24 months. When the fuel is spent the rods are then moved to an on-site cooling pool and, when sufficiently cool, placed in massive lead-and-concrete dry casks (21). As of March 2010, TVA was storing 3,013 metric tons of SNF (22). TVA, like other nuclear utilities around the country, is awaiting an option for final disposal of its SNF.

BACKGROUND ON THE LOCAL OVERSIGHT COMMITTEE

The LOC was formed in 1991 as a non-profit, regional organization when the state of Tennessee signed an oversight agreement with DOE to independently monitor ORR environmental restoration and waste management activities. The LOC represents the interests of local governments and their citizens with respect to DOE's environmental decisions, including waste management, on the ORR. Other issues of concern are migration of contamination off-site, emergency planning and regional mutual aid agreements, historic preservation decisions triggered by decommissioning of Manhattan Project and Cold War era structures, and reindustrialization of remediated sites and decontaminated facilities.

The LOC's Board of Directors is made up of elected and appointed officials from the City of Oak Ridge and the seven surrounding and downstream counties. The LOC's purpose is to ensure, in a manner consistent with prudent and effective use of public funds, that the best interests of those local communities adjacent to and downstream of the DOE's ORR are protected to the maximum extent possible during the cleanup and continued operation of the ORR facilities and associated off-site areas. These interests include human health, the environment, and the local economic and social well being.

The LOC is supported by a CAP which is composed of up to 20 citizens from the greater ORR region with diverse backgrounds. The CAP studies DOE's technical and policy issues, presenting its recommendations to the LOC Board and state and federal officials. Initiatives undertaken by the CAP include promotion of planning and funding for long-term stewardship on the ORR, examining options for disposal of legacy and cleanup wastes, outreach on emergency planning and response, working with federal and state agencies regarding contamination by mercury and polychlorinated biphenyls downstream of ORR, promotion of Manhattan Project-related heritage tourism, evaluating new environmental remediation technologies, supporting beneficial reuse of industrial assets, and studying environmental health issues in the community.

LOC's objectives and activities relative to DOE's activities and decisions on the ORR are as follows:

- Promote maximum local public awareness and involvement
- Provide an effective avenue for disseminating accurate information
- Issue news releases and press briefings, and conduct other activities designed to inform the public
- Evaluate, comment, and make recommendations on DOE's ongoing actions, reports, and findings
- Represent local concerns to the DOE, EPA, and the Tennessee Department of Environment and Conservation in the review of all projects of greatest interest to the local communities
- Promote the acceleration of those activities identified by the LOC as providing increased local benefit when expedited
- Participate in the annual budget and prioritization process for DOE's Environmental Management program
- Communicate local concerns and interests to the DOE, EPA, Congress, and the State of Tennessee
- Take positions on national issues that affect ORR's progress on environment cleanup and waste management
- Prepare special studies, assessments, surveys, and related efforts to further public information
- Act as a liaison with LOC-member county and city governments with respect to activities requiring government action or participation

LOC POSITIONS ON OFF-SITE NUCLEAR WASTE DISPOSAL

Waste Isolation Pilot Plant

The LOC has been a strong supporter of safe and timely disposition of Oak Ridge's TRU waste, taking opportunities to comment on the draft Environmental Impact Statement (EIS), permits, and decision documents in favor of opening WIPP. The ORR is a particularly unsuitable site for storage of these wastes due to the high rainfall (approximately 55 inches per year), near-surface groundwater, and local population density. The LOC believes that it is much safer and far more responsible to manage TRU waste at WIPP than to store it indefinitely at DOE sites such as the ORR around the country.

In 2006 the LOC approved a position statement on TRU waste disposition:

> LOC supports the Waste Isolation Pilot Project, a geological repository in New Mexico that is designated to receive all TRU waste from the DOE complex. WIPP is already permitted to receive contact-handled TRU waste from the ORR. In addition, there are approximately 2,500 m^3 of remote-handled TRU waste at ORR that is designated to be sent to WIPP under the revised permit. LOC supports the following:
>
> - That the New Mexico Environment Department-issued permit should allow disposal of all remote-handled TRU waste in Oak Ridge's current inventory.
> - Acceptance by WIPP of any new TRU waste streams discovered on the ORR.
> - The timely processing and shipping of TRU waste from the ORR.
> - Use of Oak Ridge's TRU Waste Treatment Facility to consolidate and characterize TRU waste shipments from other sites, provided that there is a documented final disposition path and compensation of host communities for the burden of increased shipments.
> - Continued funding by DOE's Oak Ridge Office at levels sufficient to maintain steady progress in TRU waste recovery and disposition efforts.
>
> The LOC opposes continuation of long-term storage of TRU waste, processed or unprocessed, on the ORR (23).

Yucca Mountain

Although the need for a geologic repository for SNF and HLW is not directly an issue that affects the DOE facilities at Oak Ridge, the LOC and its CAP recognize that one is necessary to other sites in the DOE complex—including those who have accepted spent fuel from ONRL reactors—as well as the health of the nuclear power industry. If reprocessing waste becomes a viable option, a geologic repository will still be necessary for disposal of waste streams. A sometimes-neglected aspect of Yucca Mountain's role is its support of the United States' nonproliferation interests, an active mission of both ORNL and the Y-12 National Security Complex.

The CAP wrote a letter dated February 9, 2000, commenting on decision documents on the Yucca Mountain project and endorsing the preferred alternative laid out in the *Draft EIS for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada.* The group noted "The mitigation measure to delay repository closure up to 300 years…should be seriously considered by DOE. This would leave the option for retrieval and waste recycling or destruction using future technologies as a viable alternative (24)."

At its meeting of March 30, 2000, the LOC voted to support opening the proposed repository for SNF and HLW at Yucca Mountain, Nevada. This was followed up in a letter dated April 3, 2000, sent to the region's congressional delegation and the White House. The LOC pointed out that appropriate disposal (or recycling) of SNF is a necessary component of the nuclear industry fuel life cycle and that disposition of surplus weapons-grade materials relies on their conversion into reactor fuel with ultimate disposition as SNF at the end of their life cycle (25).

In a letter dated October 1, 2001, the LOC responded to a questionnaire from DOE and summarized its position on the proposed repository.

> Members of the LOC have closely followed and provided comment on previous documents concerning the disposition of surplus weapons-grade materials, including highly enriched

> uranium and plutonium. The Records of Decision for both of these included conversion and fabrication into reactor fuel with subsequent disposition as SNF. Availability of Yucca Mountain for ultimate disposal of this material is a fundamental element of our nation's nonproliferation strategy.
>
> In addition to DOE's needs, appropriate disposal (or recycling) of SNF is a necessary component of the nuclear industry fuel life cycle. Nuclear power is a key means of reducing the United States' carbon dioxide and other emissions and lessening the potential for global warming. Additionally, nuclear energy is a key component of the President's energy policy, and opening Yucca Mountain to receive SNF is a necessary action to implement this policy.
>
> The Yucca Mountain Preliminary Site Suitability Evaluation and other scientific documents produced by the Department provide an adequate basis for finding that the Yucca Mountain site is suitable for development of a repository. Based on this, the Secretary of Energy should proceed to recommend the site to the President at this time (26).

NEED FOR ENGAGEMENT WITH LOCAL AND STATE GOVERNMENTS

Two of LOC's member jurisdictions, the City of Oak Ridge and Anderson County, are also members of Energy Communities Alliance (ECA). ECA represents the interests of DOE host communities nationwide on environmental cleanup issues and related concerns. The LOC agrees with ECA's position on the *Local Government Role in DOE Decision-Making*, which states in part:

> Local governments are responsible for the health and safety of communities affected by past, current or proposed DOE actions and must be consulted on a pre-decisional basis. Early involvement of these elected and appointed officials is critical for establishing trust among communities, regulators, DOE, and other citizens. Such input includes the full range of technical, socio-economic, and risk-based issues that impact the health, safety and welfare of the affected communities….
>
> Because local officials represent the first line of communication with the citizens and are held accountable to their constituency, DOE should turn first and foremost to local governments for consultation. Public participation should play an important role in DOE decision-making, but public meetings, DOE created advisory boards, and community reuse organizations are not a substitute for direct communication and interaction with affected local governments. Local governments should be engaged in decision-making by DOE as official representatives of their communities (27).

In its comments on the *Draft EIS for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*, the CAP made the following statement:

> Based on the LOC's experience in Oak Ridge with National Environmental Policy Act (NEPA) mitigation plans for local DOE environmental decisions, the CAP strongly recommends that local and tribal governments be consulted during mitigation planning and implementation. Although this is not required by NEPA, it would add an important element of public acceptance to the highly charged political environment surrounding this issue (24).

An additional factor that contributes to the success of siting waste disposal facilities is compensation to the host community and/or state government. This was exemplified by the successful siting of WIPP in Carlsbad, New Mexico. Carlsbad had its concerns about technical aspects and risk to its citizens

addressed, understanding that WIPP also represented a windfall for economic development. The state had different priorities, and was able to negotiate transportation upgrades and $300 million in unrestricted federal funds. In addition, New Mexico regulators were given control over the origin and hazardous characteristics of the TRU received for disposal. The DOE's guarantees regarding WIPP are codified in federal law and judicially enforceable (28).

In its April 3, 2000, letter the LOC strongly urged "that the federal government provide sufficient funds to Nye County and other Nevada counties impacted by waste transport to Yucca Mountain for the purpose of ensuring adequate local capabilities for emergency preparedness, communications, and response (25)."

Despite the support by DOE host communities and locations with nuclear power plants for the geological repository, as well as acceptance by Nye County, Nevada, the Obama Administration ended consideration of Yucca Mountain as a repository for SNF and HLW in early 2009 due to pressure from the state of Nevada. The consequences of this decision for DOE sites storing such wastes, as well as the nuclear power industry, have been extensively examined. However, host governments now are left with a great deal of uncertainty regarding the long-term fate of dangerous DOE wastes stored in and near their communities.

ECA has addressed the issue of the cancellation of the Yucca Mountain repository. In a letter to Energy Secretary Steven Chu dated December 17, 2009, ECA states: "DOE should formally engage local communities and governments in a dialogue at the national level on the future of SNF and HLW in their communities" noting that many of the communities accepted these wastes from other states and sites (including ORNL).

This letter goes on to state:

> Of the current options for consideration – interim storage, reprocessing/recycling, permanent geologic disposal - all will impact local governments and all will ultimately need support from local communities at both sender and receiver sites to be fully and successfully pursued. Two key factors contributing to the successful siting and operation of WIPP were the local community's early support for hosting the repository, and DOE's engagement with affected communities through a process that heavily involved local communities and governments around the country (and ECA) (29).

The organization followed up with a February 25, 2010, letter that stated: "In order to address the potential risk to communities, ECA believes DOE should begin to analyze the safety and the impact on the environment in communities forced to store HLW and spent fuel as a result of the decision to terminate Yucca Mountain. DOE should provide local governments with funds to acquire third party technical assistance to analyze the impacts and monitor the storage of HLW and spent fuel in our communities (30)."

Despite the gloom surrounding cancellation of Yucca Mountain, a New Mexico legislator, John Heaton, noted in a presentation at the 2010 Intergovernmental Meeting that there may be communities that would accept a geological repository for SNF and HLW. Engaging and educating community leaders and citizens regarding the possibility of siting a facility combined with appropriate financial incentives might meet with success. The siting of WIPP is a good example, and there is some interest in amending the Land Withdrawal Act to allow disposal of SNF and HLW at that facility.

The now-acute need for a SNF disposal site presents an opportunity for a national conversation about the potential benefits of reprocessing, which would reduce the quantities and half-life of waste for permanent disposal. ORNL is well-positioned to contribute its technical expertise on the subject. GNEP proved to be

a short-lived initiative that was meant to move the United States towards a policy of recycling nuclear fuel. This proposal had significant support in the Oak Ridge community.

With or without reprocessing, the country will likely need sites for secure interim storage to relieve pressure on nuclear power plants which have limited storage space in cooling pools and dry-cask storage yards. Here, Oak Ridge has had experience with the siting process as well.

In 1985 Oak Ridge created a citizens task force to address the possibility of siting a MRS facility proposed by DOE as part of the national radioactive waste management and disposal system under the Nuclear Waste Policy Act of 1982 (NWPA). The MRS task force identified numerous conditions that DOE would need to meet in order to site such a facility in the Oak Ridge area; these included and went well beyond the socioeconomic mitigations in the NWPA. DOE proved to be responsive to the task force's concerns and agreed to tax equivalency payments and committed to addressing community concerns about safety, operations, upgrades of transportation routes, impacts to property values, and other questions that arose during discussions. The process was ended prematurely in January 1986 when the state of Tennessee sued DOE to prevent it from presenting the MRS proposal to Congress until DOE's siting process was reviewed (31).

CONCLUSIONS

Oak Ridge, indeed the entire Tennessee Valley region, has a stake in the creation of a geological repository for SNF and defense HLW. ORNL, as a leader in reactor technology, has produced spent fuel that was sent to other DOE facilities for long-term management. Spent fuel from the operating HFIR initially is stored onsite in the reactor pool; ultimately it is shipped to the Savannah River Site for long-term management. TVA reactors store spent fuel onsite; as with other nuclear utilities across the United States, this agency will need a disposal pathway for this waste. This concentration of nuclear expertise helps make the region more accepting of technical solutions for waste disposition.

Oak Ridge's primary experience with use of a geologic repository involves sending TRU waste to WIPP. As the process unfolded with the release of NEPA documents and permit applications, this initiative was strongly supported by the LOC, its CAP, and other members of the community. The LOC and its CAP also backed the proposed use of Yucca Mountain for the disposal of defense HLW and commercial SNF.

ECA, an organization representing DOE host communities, staunchly supported opening Yucca Mountain, regarding it as a necessary facility for completing cleanup of the DOE complex. When the decision was made to end consideration of the site for HLW disposal, ECA sent strongly worded statements explaining the concerns of its member communities that host dangerous DOE defense HLW and SNF and requesting analyses of the safety and environmental risks of long-term storage of such wastes at those sites.

WIPP succeeded because not only did the Carlsbad community want the project and its economic benefits, but the federal government was also able to persuade the state of New Mexico to accept WIPP, in part through use of economic incentives, including upgrading of state highways, and also by allowing state regulators significant control over what could be disposed in the facility. There was also strong support for WIPP by other DOE communities, especially those with significant stores of TRU waste as in Oak Ridge, with the LOC and other stakeholder groups encouraging permitting of the facility. Yucca Mountain failed despite complex-wide support due to the inability of DOE to secure state acceptance of the program, even though the Nye County government supported the repository due to the economic incentives and development opportunities.

As with Carlsbad and Nye County, Oak Ridge's experience with an initiative to site a MRS demonstrated that potential host communities could be successfully wooed with economic incentives, as long as citizen input regarding technical, safety, and environmental issues was sought and addressed. However, the state of Tennessee was not included in negotiations, and its opposition proved the death of that proposal. The experiences of these communities can provide a model for local government and citizen engagement to show how a negotiation process combined with incentives can create possibilities for waste management, storage, or disposal facilities. This is especially important now that DOE no longer has an option for addressing its defense HLW and the nation's commercial SNF.

A lesson learned is that not only to local acceptance is needed, but the state must also be included as a major party in negotiations and ultimately agree to such a facility. This proved to be one of the keys to siting WIPP, but unfortunately state of Nevada opposition led to the demise of the Yucca Mountain project.

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