

Comprehensive Fuel Cycle Research Study

Presented to the Savannah River Site Community Reuse
Organization

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The content of this Study reflects the independent views of Dickstein Shapiro LLP, based on information available from a variety of sources. The Study is not intended to reflect the views of the Savannah River Site Community Reuse Organization.

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I. Executive Summary

The purpose of this report is to provide the five-county region (“Region”) represented by the Savannah River Site Community Reuse Organization (“SRSCRO”) with the information necessary to determine how and/or what resources the Region has available to offer a national solution to the management of the back-end of the nuclear fuel cycle and what new fuel cycle facilities might be needed.

A. The Region

The Region is comprised of Aiken, Allendale and Barnwell counties in South Carolina and Richmond and Columbia counties in Georgia. The SRSCRO is a non-profit organization representing the Region. The mission of the SRSCRO is to facilitate economic development opportunities in the Region by taking advantage of the technology, capabilities and missions at the Department of Energy (“DOE”) Savannah River Site (“SRS”) and seeking to expand upon them.

President Obama’s Blue Ribbon Commission on America’s Nuclear Future (“Commission”) recommended a new strategy for siting facilities associated with the back-end of the nuclear fuel cycle that centers on a “new consent-based approach.” In June 2012, SRSCRO, on behalf of the Region, commissioned this comprehensive Study to inform the five-county region around SRS on the potential benefits of establishing new fuel cycle facilities.

B. Past Siting Efforts

There have been several successful and unsuccessful efforts to site a disposal facility for nuclear waste. These efforts were carefully considered by the Commission in the preparation of its Final Report.

In the United States, the Waste Isolation Pilot Plant (“WIPP”) located in southeast New Mexico is a success story and a potential model to be followed. WIPP benefited from an increasingly supportive host community, and a state that was willing to participate in discussions with the host community and DOE. Internationally, Sweden and Finland represent the best examples of successful siting efforts for nuclear waste facilities. Both efforts had the benefit of supportive host communities.

The Yucca Mountain project stands in stark contrast to the successful efforts of the WIPP, Finland and Sweden. While there was and still are willing and supportive host communities in Nevada for a nuclear waste repository at Yucca Mountain, key state leaders and the Nevada Congressional delegation are vehemently opposed to the repository at Yucca Mountain. In late 2009, the

Obama Administration withdrew the license application from the Nuclear Regulatory Commission (“NRC”) and terminated the project (a decision still under review in the federal courts).

Community support is vital to the success of any effort to develop and establish fuel cycle facilities. All elements in the community must be assured that they will be involved and their voices heard. Community involvement should be focused on addressing the risks, both perceived real, associated with fuel cycle activities – including the risks of transportation, radioactive material release, and possible acts of terrorism. Conversely, the community needs to fully evaluate and understand the substantial benefits that the community will realize, primarily in the form of new skilled jobs and incremental economic revenues. Some of the communities in the Region have the advantage of having engaged in prior advocacy efforts successfully.

C. Research, Development and Demonstration (“RD&D”)

The ability, and desire, of the Region to contribute to nuclear RD&D and to the advancement of the nuclear industry is undisputed.

The continued use and operation of H-Canyon at the SRS are keys to fuel cycle RD&D program. H-Canyon has a unique niche in the United States and should be maintained and utilized as a viable facility.

Post-irradiation examination of “aged” spent nuclear fuel (“SNF”)¹ is a logical component of fuel cycle RD&D. As highlighted by many, including the Commission, there is a need to research the effects of very long term storage on SNF to ensure that it can be safely stored and subsequently safely transported. This research could be done in a small hot-cell facility located at a consolidated storage site.

H-Canyon has the capability to demonstrate many different and alternative separations processes. The ability to verify/demonstrate flowsheets² for advanced separation processes is beneficial to the nuclear industry.

Additional areas of R&D are contained in the DOE’s Office of Nuclear Energy R&D Roadmap from April 2010. Of the areas identified in the Roadmap, there

¹ SNF, which is principally generated by civilian nuclear power, is sometime referred to as “used nuclear fuel”

² A flowsheet graphically represents the processes, variables and equipment used in a particular advanced separations scheme and includes material balances where appropriate.

are several that the Region has an existing workforce and infrastructure to support as part of a broader RD&D program. These areas include: 1) develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors; (2) develop improvements in the affordability of new reactors to enable nuclear energy to help meet energy security and climate change goals; (3) develop sustainable nuclear fuel cycles; and (4) better understand and minimize the risks of nuclear proliferation and terrorism.

D. Storage

This Study assumes that bringing fuel cycle facilities and RD&D to the Region would include consolidated storage as an initial step.

Consolidated storage would start with the SNF currently in South Carolina and Georgia and, if successful, could expand to include the remainder of the 20,000 MT of SNF in the southeastern U.S. Subsequent phases – if pursued – would broaden the effort to include Virginia and the northeastern states, which together have slightly more than 20,000 MT of SNF. There could also be opportunities to work with DOE to meet its needs for dry storage of various fuels and vitrified defense high-level waste currently in storage at the SRS.

There are several potential locations for fuel cycle facilities – including RD&D facilities and consolidated storage facilities – in the Region. When selecting a site or sites for consolidated storage, the regulatory requirements associated with dry cask must be considered, as well as available infrastructure such as utilities and transportation.

E. Reprocessing

Given the SRS's long history with and involvement in reprocessing, establishing a reprocessing capability in the Region should be well accepted by the local communities. Clearly – as this Study's economic model shows – there are substantial economic benefits – jobs, tax revenues and additional compensation -- to siting a reprocessing facility in the Region.

However, there are hurdles that will need to be overcome in order to establish a SNF reprocessing facility. It is generally acknowledged that the use of the PUREX (plutonium-uranium extraction) process to reprocess spent nuclear fuel in the United States would not be acceptable. PUREX is considered by many non-proliferation proponents to be a substantial proliferation risk because it separates pure plutonium from the uranium and fission products. There are several other

separation processes that could be used that address that concern by not separating pure plutonium.

Most of the waste from reprocessing SNF would be vitrified – turned into glass logs – very similar to the glass logs currently being produced by SRS.

F. Regulatory/Licensing

The licensing and regulation of the construction and operations of fuel cycle facilities would be the responsibility of the NRC. However, it is expected that the South Carolina Department of Health and Environmental Control – representing the host state – would have considerable involvement in monitoring and oversight of the fuel cycle program.

There are three key phases in the licensing and construction timeline for any fuel cycle facility. The “Pre-license Application Phase,” the “License Application Review Phase,” and the “Construction and Pre-operations Phase.” As an example, for a consolidated storage facility, it is anticipated that from the pre-license phase to the end of the construction and operations phase would take approximately six years.

As required by law, NRC provides ongoing oversight and regulation of nuclear facilities once they are constructed and placed into service.

G. Community Support for Fuel Cycle Facilities

The development of local community support for fuel cycle facilities – like consolidated storage or reprocessing—involves several key aspects that must be carefully considered. Important to a local community consensus is access to trustworthy information regarding the risks and benefits of potential activities. The entire local community must be given the opportunity to be involved in reaching consensus regarding the establishment of fuel cycle facilities. Community support and the process of consensus building must begin with elected community officials who are well versed in the subject matter and can authoritatively and meaningfully discuss all aspects of the plan. Getting the community involved in the preliminary planning stages of any effort to establish fuel cycle facilities is important. If the local community concludes that the risk/reward ratio is acceptable, the local elected officials must capture that conclusion, and ensure that the appropriate state agencies and officials understand the local community’s decision. As noted before, some communities in the Region have demonstrated a good grasp of these advocacy skills in prior circumstances.

H. Engagement with State, Local Governments, State Regulatory Agencies and Regulatory Utility Commissions

The state government would likely make the final decision regarding siting fuel cycle facilities based not only on the recommendation of local government, but also input from the state's economic, environmental and nuclear regulatory agencies.

Involvement and participation of state, local governments and regulatory agencies is vital to the success of this consensus building effort. The proposed strategy builds on local support, working up to local elected officials and community leaders, and finally engaging the support of state elected officials in both South Carolina and Georgia.

Regulatory agencies in South Carolina and Georgia should be consulted throughout the consensus-building process. It is also important to build a consensus among state regulatory utility commissions, and the National Association of Regulatory Utility Commissioners is the ideal vehicle for that effort.

I. Federal Legislation

Comprehensive legislation is required to implement the recommendations of the Commission. This federal legislation would create an independent corporation with assured access to adequate funding (principally by redirection of the existing 1 mil/ kWh nuclear waste fee), and specify a process by which potential host communities would apply to the independent corporation to be considered to host fuel cycle facilities, consolidated storage and/or disposal facilities. The independent corporation would also have the authority to reprocess SNF if it was determined to be beneficial to managing the back-end of the fuel cycle.

J. Economic Opportunities

The economic model used in the preparation of this Study allows for the modeling of any number of scenarios. The Study looks at economic impacts for three levels of consolidated storage, each with and without reprocessing. There are economic benefits associated with consolidated storage on a standalone basis, but the economic benefits of incorporating reprocessing into the equation are dramatically more significant, and are independent of the size of the consolidated storage. The model conservatively estimates that a small reprocessing facility (800 MT/year) with a small consolidated storage facility (20,000 MT) would provide the following benefits to the local economy (after construction and commencement of operations): incremental local employment of 1,698 jobs;

incremental local economic output of \$239M; and incremental state and local tax revenue of \$12M. Direct compensation to a state or local community for hosting fuel cycle facilities would be an additional economic benefit.

K. Recommendations/Next Steps for the Region

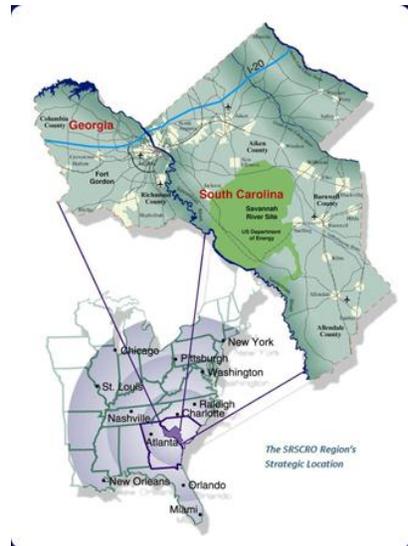
Given the substantial projected benefits to the Region from siting, constructing, and operating fuel cycle facilities, the Region should move forward in establishing fuel cycle facilities in the Region. The Region should develop a local comprehensive proposal for managing the back-end of the fuel cycle and prepare it for submittal. Initial efforts should be focused in several areas. These areas include, but are not limited to:

- 1) Identify the roles and responsibilities of the participating organizations within the Region.
- 2) Develop a draft detailed plan and timeline to implement the Region's decision regarding fuel cycle facilities.
- 3) Begin broad community discussion and gain broad community support. Efforts in this area should begin as soon as possible to ensure sufficient time is available to discuss plans and involve the communities.
- 4) Begin engaging with State and Regional officials. Engagement of key officials in Georgia and South Carolina and local elected officials is essential to inform them of the Region's plans and, as appropriate, involved them in the planning.
- 5) Support the preparation of a comprehensive legislative proposal to implement key recommendations of the Commission, and solicit the support of state delegations for the legislation.
- 6) Establish a working group within the Region to address siting of fuel cycle facilities.
- 7) Develop relationships with strategic industrial partners.
- 8) Work with the Savannah River National Laboratory ("SRNL") to (a) identify and prioritize needed research and development activities and (b) identify workforce needs that can be part of a Region led initiative.

II. Introduction

A. SRSCRO

SRSCRO is a non-profit organization representing a five-county region in Georgia and South Carolina. The stated mission of the SRSCRO is to: "...facilitate economic development opportunities associated with Savannah River Site technology, capabilities and missions and to serve as an informed, unified community voice for the five-county, two-state region [and] . . . serve as a knowledgeable, united central voice of the region when it comes to new missions and matters related to economic development and job creation associated with the Savannah River Site."



The SRSCRO was selected by the Region as the logical entity to commission the comprehensive study of potential national solutions to management of the back-end of the fuel cycle and the potential of new fuel cycle facilities in the Region. The solutions being evaluated include expanded RD&D, consolidated storage facility (together with ancillary support facilities, manufacturing, etc.) followed in the future by a reprocessing facility to recover valuable resources from SNF which is generated principally by the civilian nuclear power sector.³ Fuel cycle facilities would be required for these solutions.

B. Blue Ribbon Commission on America's Nuclear Future

The President requested that the Secretary of Energy⁴ establish the Commission. The Commission was chartered in March 2010 "to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle, including all alternatives for the storage, processing, and disposal of civilian and defense used nuclear fuel, high-level waste, and materials derived from nuclear

³ As noted below, timely development of one of more permanent geologic repositories is essential to the solution, so that consolidated storage facilities do not become permanent repositories by default.

⁴ <http://www.whitehouse.gov/the-press-office/presidential-memorandum-blue-ribbon-commission-americas-nuclear-future>

activities.”⁵ The Commission’s Final Report⁶ (cited herein as “Commission Final Report”) was delivered to the Secretary on January 26, 2012 and contains eight specific recommendations to implement the strategy proposed in the report. Those recommendations are:

- 1) A new, consent-based approach to siting future nuclear waste management facilities;
- 2) A new organization dedicated solely to implementing the waste management program and empowered with the authority and resources to succeed;
- 3) Access to the funds nuclear utility ratepayers are providing for the purpose of nuclear waste management;
- 4) Prompt efforts to develop one or more geologic disposal facilities;
- 5) Prompt efforts to develop one or more consolidated storage facilities;
- 6) Prompt efforts to prepare for the eventual large-scale transport of spent nuclear fuel and high-level waste to consolidated storage and disposal facilities when such facilities become available;
- 7) Support for continued U.S. innovation in nuclear energy technology and for workforce development; and,
- 8) Active U.S. leadership in international efforts to address safety, waste management, non-proliferation, and security concerns.

While the Commission also identified several near-term actions⁷ that could be taken by the President – under existing authority – to begin implementing the new strategy, the fact is that the strategy advanced by the Commission can only be implemented through the passage of comprehensive federal legislation, a primary purpose of which would be to implement the Commission’s key recommendations. Indeed, without such new legislation, a workable resolution to

⁵<http://cybercemetery.unt.edu/archive/brc/20120620215336/http://brc.gov/index.php?q=page/character>

⁶http://cybercemetery.unt.edu/archive/brc/20120620220235/http://brc.gov/sites/default/files/documents/brc_finalreport_jan2012.pdf

⁷ Commission Final Report section 13, page 117

the nuclear waste issues which have plagued the United States for decades will not be possible.

III. Relevant Commission Recommendations

The SRSCRO and significant officials and organizations in the Region endorse a number of the Commission’s recommendations, which makes the Commission Final Report a useful foundation for developing workable solutions⁸. There are several recommendations that are directly relevant to the potential efforts of the Region. These are the “consent-based approach,” the creation of an independent nuclear waste management entity (“U.S. Nuclear Waste Management Corporation” or “NWMC”) funded from the existing nuclear waste fee; the “prompt efforts to develop one or more consolidated storage facilities,” and “continued U.S. innovation in nuclear energy technology and for workforce development.”⁹

A. Consent-based Approach

Clearly the consent-based approach to the siting of fuel cycle facilities is one of the most relevant recommendations for the SRSCRO. This recommendation addresses a fundamental problem experienced by the United States over the last four decades, namely trying to force an unwilling state to accept a federal government-mandated solution to the back-end of the nuclear fuel cycle – specifically the disposal of civilian and defense related SNF and defense high-level waste. That problem is epitomized by the deeply troubled Yucca Mountain project and the attendant failure of the DOE to carry out the mandates of the Nuclear Waste Policy Act of 1982, as amended (“NWPA”)¹⁰.

The consent-based approach recommended by the Commission is intended to be staged, flexible and adaptive in nature, and intended to encourage communities and states to volunteer to host fuel cycle, consolidated storage and/or disposal facilities.¹¹ Part and parcel of the consent-based approach is the availability of an incentive program, with significant incentives that can be tailored to specific

⁸ Of course, not everyone endorses every recommendation of the Commission Final Report, and many fault the Report for not addressing more directly the status of the Yucca Mountain project. The Commission’s charter, however, precluded any direct treatment of the Yucca Mountain project but, as noted below, many feel that Yucca Mountain remains a viable and relevant component of any national plan for addressing the back end of the fuel cycle.

⁹ Commission Final Report Sections 5, 6, 7, 8 and 11

¹⁰ 40 U.S.C. 10101 et seq.

¹¹ Commission Final Report at pp. 52-55

states, communities, or regions by negotiation with the federal government, and/or by way of the procedures to be established by the newly-created entity recommended by the Commission (*viz.*, NWMC).

The Region is well-positioned to take advantage of the consent-based program and to advocate the legislative actions necessary to implement the Commission's recommendations. Indeed, without the involvement and support of organizations like the SRSCRO (and the comparable organizations existing in other key states), passage of the necessary federal legislation in the foreseeable future is not likely.

B. A New Organization to Implement the Waste Management Program (NWMC)

A new organization focused on the single task of managing the back-end of the nuclear fuel cycle is needed for a variety of reasons. Those reasons are to: 1) provide stability and longer-term leadership on the nuclear waste issues; 2) focus on a single subject – the back-end of the fuel cycle; and 3) establish credibility and trust that have long been absent with DOE. The Commission believed that this could best be accomplished by establishing an independent entity (*viz.*, NWMC) and not an agency of the federal government.

For the nuclear waste management program in the United States to effectively move forward, NWMC would need to be insulated from politics and the changing control of the White House and Congress, and must have an assured source of funding that is not subject to the complex and politically-driven Congressional appropriations process.

C. Access to Utility Waste Disposal Fees for their Intended Purpose

Waste fees being collected from the utilities using nuclear power to generate electricity should be used for their intended purpose (i.e., management of civilian SNF).¹² Currently these waste fees, which are collected at a rate of 1 mil/kWh of nuclear generation and total about \$750M/year, are going directly into the U.S. Treasury. Once in the Treasury, they must be appropriated by Congress for specific purposes, which make them subject to the dictates of Congressional members. The appropriations process has been used in the past to hinder efforts to move the nuclear waste program forward, with the result that only a small

¹² Funds collected from utility ratepayers should not be used for the management of non-civilian SNF, *i.e.*, defense high level waste and government-owned SNF. Thus, despite the desire to avoid the Congressional appropriations process to the maximum extent possible, Congress would have to appropriate the funds for storage and disposal of non-civilian SNF.

portion of the waste funds have been devoted to the intended purposes (with most of the appropriated funds going to the now stymied Yucca Mountain project).

As a near-term action, the Commission stated that the Secretary of Energy, under existing authority, should change the way the fees are collected. In short, the Commission recommended that a third-party trust be established into which the utilities would pay their waste fee. The trust would hold the fees until such a time that Congress restructured the nuclear waste management program through new comprehensive legislation. At that time, the trust would either pay to the intended recipients the amount that was authorized for them or would direct those funds to the new independent corporation upon its creation. This concept of a third-party trust fund has, of course, not been implemented, either by the Secretary or by separate action of the Congress. Thus, the nuclear waste fees continue to be paid directly into the U.S. Treasury and remain available for whatever purpose Congress chooses, irrespective of their intended purpose.

D. Prompt Efforts to Develop One or More Consolidated Storage Facilities

First and foremost, since the DOE has not met its obligation to take title to SNF, nearly 68,000 MT of SNF remains at operating reactor sites and at decommissioned reactor sites and is being stored safely and securely in facilities licensed and regulated by the NRC.



The ability to move SNF to a consolidated storage facility would give the federal government or NWMC the flexibility to manage the transfer of the fuel to safe and secure storage independent of the availability of the disposal facility. Currently the NWPA does not allow for consolidated storage in advance of a permanent disposal facility (designated in an amendment to the NWPA as the Yucca Mountain project) reaching very specific milestones. The Commission believed that the restriction on consolidated storage in the NWPA was not helpful to the overall management of SNF.

A reported 2,827 MT of SNF are currently “stranded” at decommissioned reactors sites in nine states. Prompt development of consolidated storage facilities and the prioritization of this “stranded” fuel would enable these decommissioned sites to be reused and potentially reduce the federal government’s financial liability associated with the continued storage of the fuel. This same reduction in liability

would also be applicable the movement of SNF from operating reactor sites to the consolidated storage.

E. Support for Continued U.S. Innovation in Nuclear Energy Technology and for Workforce Development

The Commission felt strongly that continued research, development, and demonstration in the area of nuclear technology was important to the continued advancement of nuclear energy in the United States and abroad.¹³ The members of the Reactor and Fuel Cycle Technology Subcommittee were particularly interested in the potential benefits from the advancing fuel cycle research, including fast reactor research. Generally, the Commission supported the DOE Office of Nuclear Energy's research and development roadmap¹⁴. The roadmap offers the Office of Nuclear Energy's view on the research, development and demonstration activities necessary for the continued viability of nuclear energy in the U.S.

The Commission also recommended the development of a skilled workforce to support waste management activities and the nuclear industry in general by increasing funding for science, engineering, technology, and mathematics in federal government and university programs.¹⁵

The SRSCRO and the Region are leading the nation in support for continued innovation in nuclear energy and nuclear workforce development. Well in advance of the Commission's recommendation, the SRSCRO – working with the Region's academic institutions – established the Nuclear Workforce Initiative (NWI®) to ensure that a highly-skilled and trained workforce is readily available in the Region.

F. Commingling of Civilian and Defense Wastes

While not one of the key recommendation, the Commission did advise the Administration to review the decision made by President Reagan in the early 1980s to commingle civilian and defense waste. The issue to be considered is whether or not the defense waste should remain the responsibility of the DOE, or should be included within the purview of NWMC. See footnote 12 above regarding funding for management of non-civilian SNF.

¹³ Commission Final Report, Section 11

¹⁴ http://www.ne.doe.gov/pdfFiles/NuclearEnergy_Roadmap_Final.pdf

¹⁵ Commission Final Report at p. 108.

IV. Past Siting Efforts

There have been several efforts, successful and otherwise, to site a disposal facility for nuclear waste in the United States and internationally. These efforts were carefully considered by the Commission in the preparation of its Final Report.¹⁶

A. Successful Efforts

Both in the United States and internationally, successful siting efforts have resulted from essentially the same basic critical element – an informed, supportive and participative host community and state. The host community and state must be well informed and have the ongoing resources and commitment to participate in siting, licensing and regulating the facility, and to provide and facilitate oversight of facility operations.

In the United States, the WIPP located in southeast New Mexico is a success story and a potential model to be followed. WIPP is the only operating deep geologic repository in the world and has been disposing of defense-related transuranic waste safely for over a decade. WIPP directly benefited from an increasingly supportive host community and a state that was willing to work cooperatively with the host community and DOE. A unique factor that aided the efforts was the participation and support of Senator Pete Domenici (R-NM). While still a member of the Senate, Senator Domenici (who was a member of the Commission) used his position in the Senate to gather broad Congressional support and funding for WIPP. Currently, the community and state are supportive of WIPP expanding its mission to include the disposal of Greater-Than-Class C wastes.

Internationally, Sweden and Finland are the best examples of successful siting efforts. Both efforts had the benefit of supportive host communities. In the case of Finland, after a country-wide, years-long screening process, the Finnish Parliament ratified and endorsed the government's decision to locate Finland's repository in the selected host community (the municipality of Eurajoki).

Sweden took a somewhat different approach. Having identified 3 potential communities that were geographically acceptable to host the repository for Sweden's SNF and high-level waste, the municipal councils of those communities voted on whether to consent to further investigation. Two of the municipalities did consent and one declined. The two municipalities that consented competed

¹⁶ Commission Final Report, Section 6.2 at pp. 49-54.

with each other to host the repository. The two competing municipalities were rewarded with substantial incentives.

B. Failed Efforts

The effort in the United States to develop, license and operate a permanent repository – the Yucca Mountain project -- stands in sharp contrast to the successful siting (and operation) of WIPP and the siting efforts in Finland and Sweden. While there was and still are willing and supportive host communities – notably Nye, Esmeralda, and Lincoln Counties in Nevada – for Yucca Mountain, key state leaders and the Nevada Congressional delegation are vehemently opposed to the repository at Yucca Mountain. The lack of state support has led to



continued regulatory and legal actions intended to delay and/or defeat the Yucca Mountain project. The Nevada Congressional delegation was successful in limiting funding to the program and endorsed the Obama Administration’s decision to withdraw the license application from the NRC and cancel the project (a decision still under review in the federal courts).

The issues surrounding the Yucca Mountain project originated with the 1987 amendment to the NWPAA. The 1987 amendment eliminated the then-ongoing studies of other potential disposal sites and directed that only Yucca Mountain be studied further. This amendment was passed by Congress in the face of significant and strong opposition from the state of Nevada and a majority of its residents. Clearly, this was not a consent-based process or approach and immediately was perceived by many to be a determination based on political expediency rather than sound scientific and technical reasoning.¹⁷

¹⁷ As noted below, there continues to be very strong support among many quarters (including within the Congress) for proceeding with the Yucca Mountain project. Comprehensive federal legislation to implement recommendations of the BRC and to advance the consent based solution to SNF management must be carefully crafted so as not to preclude continued debate on the fate of the Yucca Mountain project.

V. RD&D

The ability, and desire, of the Region to contribute to nuclear RD&D and advance the nuclear industry is undisputed. The Region has an existing, qualified workforce and infrastructure to support broad RD&D efforts.

Demonstration of advanced technologies is important in moving the advanced technologies towards commercial implementation. This demonstration could be as a result of SRNL R&D as well as the demonstration of R&D and advanced nuclear systems (fuel cycle or reactors) from elsewhere. Below are some opportunities for RD&D within the capabilities of the SRS site.

A. Potential Use of H-Canyon

The potential and capabilities of H-Canyon on the SRS are well known. H-Canyon is a unique capability of DOE and, in fact, the only available large-scale separations facility in the United States.



H-Canyon has the capability to demonstrate many different separations processes. The processes, variables and equipment are captured in “flowsheets.” H-Canyon can demonstrate various flowsheets on a scale that is significantly larger than bench scale. The ability to verify/demonstrate flowsheets for advanced separation processes is beneficial to the nuclear industry.

If not demonstrating flowsheets, H-Canyon could be used to develop methodologies to support larger scale reprocessing. This could include the capture of certain gases that have been identified as a potential problem for a large scale (> 800 MT) reprocessing plant in the United States.

The presence of H-Canyon within SRS is a key advantage for the Region.

B. Post-Irradiation Examination (PIE) on “Aged Fuel” from Long-term Dry Cask Storage.

As highlighted by others, including the Commission’s Final Report, there is an ongoing need to do research on the effects of very long-term storage on SNF to ensure that it can be safely stored on an extended basis, and safely transported.

Of particular interest is research on the degradation of the SNF in long-term dry storage to ensure that the radioactive materials remain inside the fuel cladding. Changes in the degradation mechanisms and the time it takes to degrade could affect the ability of the radioactive material in the fuel should it be exposed to the environment.

The hot-cell facility located at the storage site would perform PIE and surveillance on aged fuel and actively engage in the research and characterization of the aged fuel.

C. Savannah River National Laboratory Cooperation and Opportunities

Close cooperation with the Savannah River National Laboratory (SRNL) is important and presents opportunities for the Region. The SRNL is one of the premier fuel cycle R&D laboratories in the U.S. and as such is able to lend additional credibility to the efforts of the SRSCRO and the Region.



SRNL and SRSCRO could work together to demonstrate the application of SRNL R&D and help SRNL market that application to the private sector.

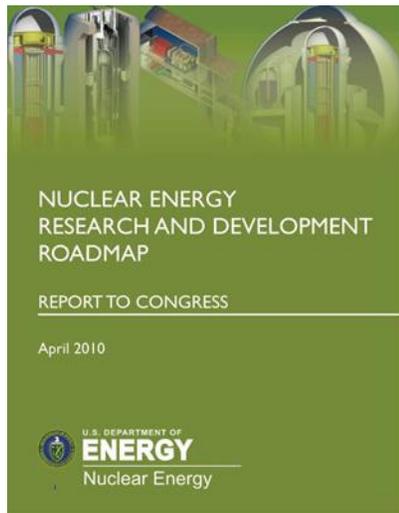
Also, the Region should work with SRNL to identify and develop RD&D capabilities and resources required to support the impact on the Region on the nuclear fuel cycle. This could include new state-of-the-art facilities and a highly skilled and trained workforce.

D. Nuclear Energy's R&D Plan

The DOE's Office of Nuclear Energy identified several areas of focused research in their April 2010 R&D Roadmap. Of the areas identified there are several areas that provide some opportunities for the Region.

The Office of Nuclear Energy broke down their objectives into four high-level R&D objectives¹⁸. They are: 1) develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors; (2) develop improvements in the affordability of new reactors to enable nuclear energy to help meet energy security and climate change goals; (3) develop

¹⁸ Nuclear Energy Research and Development Roadmap, Report to Congress, April 2010



sustainable nuclear fuel cycles; and (4) better understand and minimize the risks of nuclear proliferation and terrorism.

The Region, working with SRNL, could play a role in several of these areas. The Office of Nuclear Energy includes in R&D Objective #2 identification and removal of barriers to the deployment of small modular reactors (SMRs) and high-temperature reactors (HTRs). SRSCRO’s participation in the effort to bring a SMR to the Region establishes a straightforward connectivity to evaluate the barriers and investigate approaches to remove them. Also, SRSCRO’s longstanding and constructive

relationship with the nuclear industry will assist in facilitating this process.

SRSCRO, with Regional support and involvement of SRNL, could also do high-level systems studies for the use of HTRs -- the Region’s businesses which require large amounts of process heat.

Probably the objective in which SRSCRO could best play a lead role is in the development of sustainable nuclear fuel cycles. Given the expertise that exists in the Region and SRNL, and the facilities at the SRS, the SRSCRO could play a key role in the coordination of work and the interface between SRS, SRNL and industry. There is also the possibility that new facilities – nuclear or not – could be built in cooperation with the SRSCRO and leased back to DOE.

VI. Storage

A comprehensive and feasible technical plan begins with clear assumptions as to what can and cannot be done.

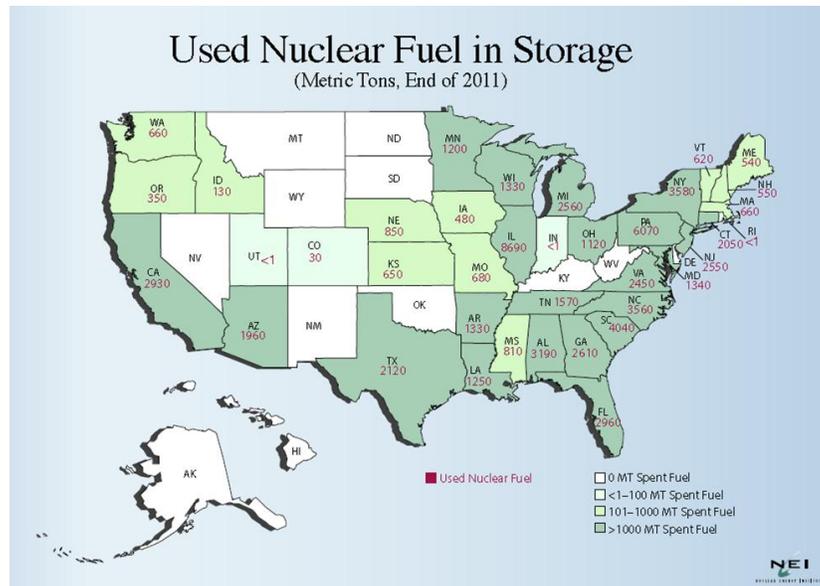
A. Assumptions

- 1) The consolidated storage facility will provide storage for 20,000 MT of SNF in dry casks.
- 2) The consolidated storage facility will allow additional storage to be added in the future as required, but not to exceed 60,000 MT.
- 3) The consolidated storage facility will have the ability to unload and load shipping containers and load and unload dry casks for storage.

- 4) The consolidated storage facility will include a medium-sized hot cell facility with the ability to repackage spent fuel assemblies as necessary and perform post-irradiation examination (PIE) and related R&D on aged SNF.
- 5) The facility must be located with ready rail access and close to the SRS.

B. Civilian SNF

It is clear that there are adequate quantities of SNF to support an economically-viable consolidated storage facility not only here in the Region but also at other locations across the United States. The figure below indicates where SNF, or used nuclear fuel, is stored across the United States.



As part of a Regional effort, a top priority should be the consolidation of civilian SNF from the seven operating nuclear generating plants in South Carolina and Georgia – approximately 6,650 MT – based on their needs.

In the southeastern United States (South Carolina, North Carolina, Georgia, Alabama, Mississippi, Tennessee, and Florida) there are about 20,000 MT of SNF (including the 6,650 MT noted above).

Broadening the circle to include Virginia, and the northeastern States (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; New Jersey, New York and Pennsylvania.) would add another slightly more than 20,000 MT of SNF. This figure includes approximately 1081MT of civilian SNF from the decommissioned nuclear generating facilities in Connecticut, Maine and

Massachusetts. This so-called “orphaned fuel” should be a second priority after consolidation of the civilian SNF at operating nuclear plants in South Carolina and Georgia.

C. DOE SNF Dry Storage

There is an opportunity to include DOE SNF that can be safely stored in dry casks. There is approximately 29 MT of DOE SNF in storage at SRS in L-basin. The DOE SNF is comprised of ~9 MT of aluminum fuel and ~20 MT of non-aluminum SNF.

The Environmental Impact Statement for SRS SNF Management (DOE/EIS-0279) identified some DOE SNF that is not suitable for extended wet storage. The Record of Decision (ROD) for DOE/EIS-0279 specified that fuels be removed from the SRS basins by 2019 and identified some actions to accomplish that end and they are listed below:



- 1) Expeditious operations of the H-Canyon;
- 2) Transfer of ~20 MT non-aluminum fuels that are not compatible with H-Canyon operations to the Idaho National Laboratory (“INL”);
- 3) Designating, isolating, and preparing a portion of the L-basin to resize fuels to allow load out from the L-basins, and make the fuels compatible at the designated INL facility;
- 4) Successful development of a repackaging process for repackaging fuels stored in cans that are incompatible with the dissolution process; and
- 5) Identification of a new location to receive and store aluminum fuels after 2019.

Of particular note is the planned closure of the L-basin in 2019; a new location is needed to receive and store non-aluminum fuels after 2019. The magnitude of these receipt and storage requirements is not yet clear, but the fuel could readily be incorporated into the consolidated storage facility.

The dry storage for these fuels would be incremental to the civilian SNF cask and would be located in essentially the same area inside the security perimeter.

It is expected that funding for this activity would come from DOE funds appropriated by Congress.

D. Defense Vitrified HLW Dry Storage

DOE’s Office of Environmental Management (“EM”) is evaluating the movement of older vitrified defense high-level waste, which has reduced thermal loads, to dry cask storage.

The opportunity exists to include the storage of the vitrified HLW in the plans for the consolidated storage facility. This would be incremental storage, much like the DOE SNF mentioned above.



The storage of vitrified HLW in dry casks has already been endorsed by DOE. NAC International (“NAC”) has been selected by DOE to provide dry cask storage for vitrified HLW at the West Valley site. NAC has developed a canister that will be loaded with vitrified HLW for dry cask storage. The canisters can be readily loaded into a NAC transportation cask for shipment.

It is expected that funding for this activity would come from DOE funds appropriated by Congress.

E. Location

There are several potential locations for consolidated storage facilities – and other nuclear facilities – in the Region.

Barnwell County has been host to a NRC-approved reprocessing facility built by Allied-General Nuclear Services. In addition, the Region has two sites that were thoroughly vetted and approved as part of the Global Nuclear Energy Partnership (GNEP) facility siting process. GNEP was formed in 2006 in part to close the nuclear fuel cycle with advanced reprocessing and fast reactors.

When selecting a site or sites for consolidated storage, the requirements of the NRC certificate of compliance for the particular dry storage system play a significant role. Dry storage systems have a number of requirements for siting

and site characteristics. These includes: 1) soil; 2) tornado driven missiles; 3) potential earthquake magnitude, 4) cask transfers; and 5) potential off-site dose¹⁹.

Other considerations that are important include: 1) access to required utilities; 2) transportation (ready access to rail service); and 3) SRS resource.

F. Regulatory/Licensing

The licensing and regulation of consolidated storage facility sites would be the responsibility of the NRC. The NRC would work in conjunction with the NWMC under a formal arrangement between the two entities. What follows in this section assumes that a NWMC would be created with the authority to administer an applications process for “consent based” facilities, with the NWMC process focused principally on establishing the elements of consent and the applicable incentives necessary to make the proposed consolidated storage site viable²⁰. The NRC would conduct its licensing process under the umbrella of the NWMC application process²¹.

1) State of South Carolina

Federal legislation to implement a consent-based consolidated storage program must include a well-defined role for state agencies. The logical South Carolina state agency for both involvement in crafting the consolidated storage program and ultimately providing oversight and monitoring (either pursuant to direct state legislative authority or authority derived from new federal legislation, or both) is the South Carolina Department of Health and Environmental Control (DHEC). Currently, DHEC regulates the low-level waste disposal at Barnwell.

2) License Application(s) for Consolidated Storage Facilities

¹⁹ 10 CFR 72.212 Evaluations

²⁰ It is assumed that NWMC would also have the authority to develop certain nuclear facilities on its own, in which case NWMC would itself be the applicant for a license from the NRC. Activities engaged in directly by NWMC would be distinct from the activities authorized by NWMC pursuant to the consent based applications process.

²¹ There are multiple instances of infrastructure facilities being authorized and regulated by multiple agencies (*e.g.*, pipeline facilities authorized and regulated by the Federal Energy Regulatory Commission (“FERC”) and the U.S. Army Corps of Engineers; LNG export facilities authorized and regulated by the FERC and DOE; etc.). In these instances, a premium is placed on formal coordination among the jurisdictional agencies.

The process for licensing consent-based consolidated storage facilities would be specified in the new comprehensive federal legislation. Assuming creation of NWMC, the new entity would be charged with developing a detailed application process for “consent based” siting, as well as a time-regulated process for approving (or disapproving) completed applications. As noted above, NWMC would work in conjunction with the NRC and the license application would take into account the dual jurisdictions. Specifically, it is anticipated that all license applications must be complete and must include all elements supporting an NRC-issued construction and operating license for all aspects of the consolidated storage site. This includes the construction of the independent spent fuel storage installation (ISFSI), the packaging/repackaging facility, and the R&D facility

As envisioned, funding for the development of an application would be provided from the nuclear waste fees (either on a real time basis or by reimbursement).

The NRC-regulated operating plan for and operations of the facilities at the site would be included in the license application. These operations would include: 1) receipt of SNF or HLW; 2) loading/unloading of the transportation casks; 3) repackaging as necessary; 4) loading/unloading the dry casks; 5) post irradiation and examination process; 6) long-term dry cask storage; and 7) routine radiological and environmental monitoring.

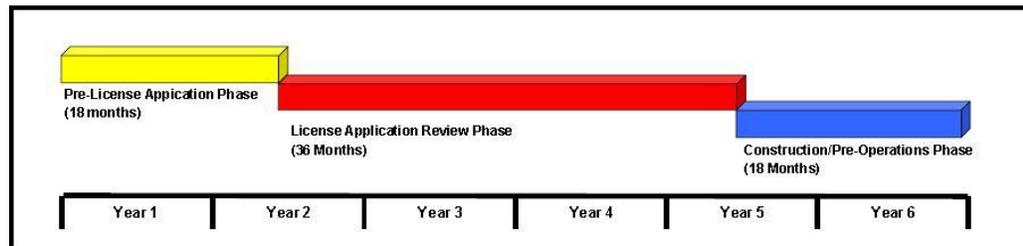
Applicable NRC regulations are set forth in Chapter I of Title 10, "Energy," of the Code of Federal Regulations. The regulations that apply to independent spent fuel storage installations are:

- Part 20 - Standards for protection against radiation
- Part 50 - Domestic licensing of production and utilization facilities
- Part 51 - Environmental protection regulations for domestic licensing and related regulatory functions
- Part 72 - Licensing requirements for the independent storage of SNF, high-level radioactive waste, and reactor-related greater than class C.

G. Licensing and Construction Timelines

Based on a study by the Electric Power Research Institute (“EPRI”)²², the complete licensing process should take about four and a half years. Assuming new federal legislation creating the NWMC, it is anticipated that NWMC and NRC will work cooperatively and that the time frame set forth below will not be extended.

EPRI identified several phases of the licensing process as indicated in their figure below.



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The “Pre-license Application Phase” would include siting activities such as adequately characterizing the proposed site and completing a preliminary design for the licensed facilities and needed infrastructure. An Environmental Report would be developed along with a Safety Analysis Report. The License Application (“LA”) would be submitted at the end of this phase.

The “License Application Review Phase” would begin with the submission of the LA to the NRC. During this phase the NRC would review the LA and prepare a Safety Evaluation Report and an Environmental Impact Statement to assess the environmental impacts of the consolidated storage facility site. The final detailed designs for the facilities at the site would be completed during this phase. This phase would end with the issuance of a license to construct and operate by NRC.

The “Construction/Pre-Operations Phase” would begin when the license was granted. It includes the construction of all requisite facilities required and the development of the staffing necessary to perform facility operations.

²² Cost Estimate for an Away-From-Reactor Generic Interim Storage Facility for Spent Nuclear Fuel, EPRI, May 2009

²³ Cost Estimate for an Away-From-Reactor Generic Interim Storage Facility for Spent Nuclear Fuel, EPRI, May 2009, page 1-4

H. Operations

All operations at the consolidated storage site will comply with the operating plans contained in the LA and subsequently in the license issued by the NRC.

The operations would require procedures and the application of conduct of operations at the highest level to ensure compliance with the requirements in order to maintain the safety of the public, the environment and the workers.

The operations covered would include the: 1) receipt of SNF or HLW; 2) loading/unloading the transportation cask; 3) repackaging as necessary; 4) loading/unloading the dry cask storage; 5) post irradiation and examination; 6) long-term dry cask storage; and 7) routine radiological and environmental monitoring.

Effective oversight and monitoring programs will be implemented during operations, and include assurance to host communities that operations are conducted in accordance with “hosting agreements.”

It is anticipated that compensation for operation of consolidated storage facilities, and for related activities, will be provided by the NWMC from the funds collected via the nuclear waste fee.

VII. Reprocessing

Given the Region’s long history with and involvement in reprocessing, establishing a reprocessing capability in the Region should be generally accepted by the local communities.

Reprocessing in the region would not only generate good paying and highly-skilled jobs, but also increase the tax revenue of the local communities. This will be discussed in the economic model results section.

It is generally acknowledged that the use of the PUREX process to reprocess spent nuclear fuel in the United States would not be acceptable. PUREX was developed in the United States during the Manhattan Project to recover pure plutonium from the nuclear fuel for use in atomic weapons. Essentially all of the plutonium used in the United States nuclear weapons stockpile was recovered using the PUREX separations process. As such, PUREX is considered by many non-proliferation proponents to be a substantial proliferation risk because it separates pure plutonium from the uranium and fission products.

There are, however, other advanced separation processes that do not separate plutonium alone. COEX™ is a French process that extracts plutonium and uranium together – no plutonium is ever separated from the uranium. The French have demonstrated the COEX™ process at their La Hague facility on a bench scale.

A reasonable size for a reprocessing plant in the United States is a capacity of 800 to 1,000 metric tons per year. To put that capacity in context, the U.S. currently has 104 operating reactors, and a reprocessing plant of 1000 metric tons per year would service about half of those. The plant could be designed to allow for modular expansion of capacity in the future as required.

To the extent it is possible; the reprocessing plant should be pursued with private funding rather than federal government funding. In particular, there is likely no support in the federal government for building and operating a reprocessing plant in the United States. If federal funding was available, it would likely come with restrictions resulting in significant control by the government. Several large companies in the United States have made a business case for reprocessing SNF. However, their business case is built on long-term contracts to reprocess the SNF with the owners of the fuel. The long-term contracts would allow these companies to arrange project financing and build the requisite facilities. With the development of consolidated storage sites and the creation of an independent NWMC which would hold title to the SNF, this business model – privately funded based on long-term contracts – could be viable.

Even assuming that capital for reprocessing facilities will come from the private sector, communities hosting reprocessing facilities should also pursue additional compensation from NWMC for the risks and opportunity costs associated with hosting large scale nuclear facilities.

A. Regulatory/Licensing

The timelines associated with reprocessing are significantly longer than consolidated storage. There are several factors that contribute to the longer timeline:

- 1) The NRC has identified a number of gaps in their current regulatory structure that would require new rulemaking. There will be little enthusiasm for spending significant funding on design of a reprocessing facility until the regulatory requirements are clearly known. According to the NRC, and absent acceleration, the new rulemaking would not occur until 2019²⁴.

²⁴ <http://pbadupws.nrc.gov/docs/ML1132/ML113210386.pdf>

- 2) Once NWMC is fully functional, and before the NWMC would seriously consider reprocessing, the NWMC would have to do an assessment of the benefits of reprocessing in their overall back-end management plan.
- 3) It is not likely that a business case could be made by any company without a long-term contract and a fixed \$/kg of SNF reprocessed. Until NWMC assesses and makes a positive decision in favor of reprocessing, there would be no contract.

Of course with the three items above, it appears the final rulemaking and the regulatory framework would be the last item completed. Assuming that legislation enacting the Commission's recommendations and establishing the NWMC occurs in 2013, it will require three years to start up, and with the NWMC assessment of reprocessing taking an additional 2 years, it is feasible that the decision to move forward on reprocessing could be made in 2018. The question will be how much work a contractor would be willing to undertake in advance of a final reprocessing determination and NRC rulemaking. The answer would depend on the availability of development funding from the new NWMC.

1) State of South Carolina

DHEC would provide oversight and monitoring (either pursuant to direct state legislative authority or authority derived from new federal legislation, or both) for South Carolina.

2) License Application for a Reprocessing Facility

As envisioned, funding for the development of an application would be provided from the nuclear waste fees (either on a real time basis or by reimbursement) via NWMC. The NRC-regulated operating plan for and operations of the facilities at the site would be included in the license application.

B. Location

As with consolidated storage, there are several potential locations for reprocessing facilities in the Region. As mentioned before, Barnwell County has actually been host to a NRC-approved reprocessing facility built by Allied-General Nuclear Services. Also, GNEP, which focused heavily on advanced reprocessing, vetted two sites in the Region to participate in advanced reprocessing and fast reactor part of the partnership.

Since NRC is still developing its regulations for reprocessing, it is more difficult to select a site. But the non-regulatory considerations are the same as for the Consolidated Storage Facility, which include: 1) access to required utilities; 2) transportation (ready access to rail service); and 3) SRS resource. In addition there are obvious advantages of collocating the Consolidated Storage Facility and the Reprocessing Facility.

C. Licensing and Construction Timelines

It is estimated that a reprocessing plant will take 19 years to complete licensing, construction commissioned for operations; considerably longer than a consolidated storage facility.

The “Pre-license Application Phase,” the “License Application Review Phase” and the “Construction/Pre-Operations Phase” discussed earlier can be applied to a reprocessing plant. It is estimated that these phase will take 7 years, 5 years, and 7 years respectively.

D. Operations

All operations at a reprocessing facility would comply with the operating plans contained in the LA and in the license issued by the NRC.

Effective oversight and monitoring programs will be implemented during operations and include assurance to host communities that operations are conducted in accordance with “hosting agreements.”

VIII. Transportation

Transportation is a key area of concern to the general public. Historically, transportation presented a very small degree of risk. Over the last 30 years, there have been a substantial number of shipments of SNF, over both short and long distances, by rail, truck and barge -- all without any release of radioactive material to the environment.

A. Available Infrastructure

Movement by rail is considered the safest method for the transportation of SNF. In some cases the shipping package is so massive that it can only be shipped by rail.

The area to the south of the SRS has ready rail access. CSX maintains a main track that travels up the southeast side of the SRS loosely following SC-125. A rail spur from this line services the SRS and other private operations along the

public property to the edge of the site. The existence of both the main line and the spur are primary elements adding to the viability of this site. Other sites may also be viable if incremental rail infrastructure can be put in place on an economically viable basis.²⁵

B. Cask Maintenance

Inherent in the transportation of SNF is the need to perform routine cask maintenance and periodic recertification. This activity would be included in the packaging facility mentioned previously.

These inspections would consist of helium leak checking, weld inspection, and other related inspections.

C. Storage

A storage facility for the transportation casks would also be required. This would essentially be a large warehouse type facility.

IX. Manufacturing

With the advent of fuel cycle facilities in the Region, there is the potential of significant increases in manufacturing jobs. These manufacturing jobs would be associated with the extensive supply chain for the fuel cycle facilities. Additionally, the requirements for components and parts used in the nuclear industry are significantly more stringent than in normal commercial manufacturing.

X. Training

New fuel cycle facilities will create a need for additional highly-skilled and trained workers. These workers would be developed using programs established SRSCRO with support from the Region, as well as academia in the Region.

Of particular note is the Nuclear Workforce Initiative (NWI®) that was established to be proactive and ensure that an adequate, highly-skilled and trained workforce is readily available to support nuclear activities in the Region.

A review/survey of new fuel cycle facility needs should be done so that the NWI® could appropriately address and satisfy the projected needs.

²⁵ Clearly, the issue of transporting SNF from its current location to a consolidated storage facility must also be considered, and should be a significant subject for the new federal legislation. See Commission Final Report, Section 9.

XI. Community Support for Fuel Cycle Facilities

The development of community support and the process of consensus building for fuel cycle facilities – such as consolidated storage – involves several key aspects that must be carefully considered. Community support must begin with elected community officials who are well versed in the subject matter and can authoritatively discuss all aspects of the plan.

A. The Crucial Need for Community Acceptance

First, and perhaps foremost, is getting the community involved in the preliminary planning stages of any effort to establish fuel cycle facilities. It is vital to ensure that the voices of the community have been heard, that they feel they have been heard, and that their views are reflected in the plan. It must be recognized that the terms “community” and “affected community” are very broad and that every “community” has strata. The leaders of the effort to develop the objectives of this Study must prioritize the approach to these various community elements. Ultimately, as noted below, the stratification of the “affected communities” goes beyond the local communities, and includes both regional and state components.

Critical to involvement of the community is the need to provide a significant amount of reliable information with the intent and purpose of helping the community to understand the risks and benefits of the plan. The community must then decide if the risk/reward ratio is acceptable.

With the obvious need for new comprehensive federal legislation, involving community leaders in the development of such legislation provides an important opportunity for meaningful local input. Indeed, one of the most critical elements of new legislation will be the “consent-based” process, and the “consent” aspect must clearly be drafted to include the consent of affected local communities and regional and state levels stakeholders.

1) Risks – Transportation, Storage, Release, Terrorism

A comprehensive public information program must be established so that the public and communities have a good understanding of the potential risks associated with fuel cycle facilities, as well as the relative magnitude of those risks when compared to other risks associated with everyday life and other activities. In evaluating such risks, the various means of risk management must be addressed, including safety programs, quality assurance programs, and security programs that support the physical protection of facilities and/or special nuclear material, including during

transportation and material control and accounting for special nuclear material.

Risks (a product of probability and consequence) and risk management must be adequately addressed and explained to the communities. The risks that we routinely hear about from communities, and which seem to be of most concern, are related to transportation, storage, accidents and terrorism. Among other things, a series of risk workshops should be held, first with the elected officials, and subsequently in open sessions with the general public in the community.

2) Benefits

Another key element of acceptance by any community is the ability to credibly demonstrate the benefits which will accrue to the community – answering the “what is in it for us?” question. There must be a tangible net benefit to the community and Region,

These benefits must be carefully laid out and effectively communicated. The benefits of primary importance to a community would most likely be job creation and incremental local revenues – directly (from compensation for operating the storage and related facilities) or indirectly (from increased tax revenues and infrastructure development).

3) Enforceable Agreements

Enforceable agreements with both governmental authorities, as well as third-party contractors, will be vital to community consent to hosting a consolidated storage facility. In the context of the nuclear utilities’ litigation against DOE for its failure to perform its SNF “take away” obligations under the NWPA, the issue of contract enforceability has been paramount, and the utilities’ efforts to hold DOE accountable for breach of the “Standard Contract,” as well as for breach of other efforts to advance the Yucca Mountain project, have met stiff resistance from the federal government. This unfortunate history must be overcome in order to instill confidence in a consent-based consolidated storage program. Issues of legal enforceability must be addressed as part of the new comprehensive enabling legislation.

Key components of enforceability include a workable non-judicial dispute resolution mechanism, especially in government and NWMC agreements and authorizations; access to federal courts on an expedited basis if non-judicial mechanisms do not work; and streamlined processes to enforce

non-judicial resolutions or judicial judgments (including, in the case of monetary judgments against the federal government, access to the U.S. Judgment Fund).

4) Availability of Permanent Geologic Repository(ies)

Community support for fuel cycle facilities will depend on an enforceable commitment by the federal government and/or NWMC to proceed with timely development of one or more permanent geologic repositories. The Region does not lend itself to a permanent repository, but other potential sites are available. It is important that the Region coordinate its program with the entities in other states that are moving forward with proposals for consent-based permanent repositories.²⁶

XII. Engagement with State and Local Governments, State Regulatory Agencies and Regulatory Utility Commissions

A. Strategy for Engagement

Engagement with state and local governments is vital and should be done early and often once the Region decides to pursue new fuel cycle facilities, be they for RD&D, storage, or reprocessing. The strategy would be to engage local elected officials and community leaders from communities in both South Carolina and Georgia and then broaden the engagement to include state elected officials and state departments.

The first step is to garner support from local elected officials and community leaders in interested South Carolina and Georgia communities. Mentioned earlier in this Study are workshops for specific aspects related to building support for the SRSCRO effort in the local communities. Those workshops would continue and focus on informing the local elected officials and community leaders.

The workshops would then be expanded to include state level elected officials from both South Carolina and Georgia.

At the outset, SRSCRO should develop a comprehensive list of elected officials and community leaders whose involvement will be solicited.

²⁶ As noted in several places in this Study, the Yucca Mountain project remains a very sensitive subject. The process of developing comprehensive federal legislation must navigate the territory between those who support Yucca Mountain and those who oppose it.

It is also important to build consensus among state regulatory utility commissioners in South Carolina and Georgia – and ultimately other relevant states whose support (especially for comprehensive federal legislation) will be important. The National Association of Regulatory Utility Commissioners is the ideal vehicle for developing a broad consensus.

B. State Involvement

The fuel cycle facilities would be licensed and regulated by the NRC. Thus, the involvement by South Carolina would not be in a regulatory capacity for the fuel cycle facilities, but rather oversight and consultation. Nonetheless, it is anticipated that the new federal legislation will make state consent a principal element of the “consent-based” process.

1) Define Role for Oversight

As noted above, the likely South Carolina agency to provide oversight would be the Department of Health and Environmental Control (DHEC). This oversight would be much like the oversight provided by DHEC of the SRS. An Agreement in Principle would be established between DHEC and the new fuel cycle facilities for environmental monitoring and emergency preparedness. DHEC could establish an independent environmental monitoring program to verify that the safety and health of the public and protection of the environment is being maintained.

2) Define Involvement in Implementation

DHEC would be consulted during the planning process and the implementation of any plan to establish a consolidated storage facility site. DHEC would add significant value up front and provide credibility to the planning process and implementation. Funding for DHEC’s participation could be from the funds identified for the fuel cycle facilities.

C. Local Governments and Communities

As with state-level involvement, the new federal legislation is anticipated to make local community involvement an essential element of the “consent-based” process.

At an early stage, an advisory board should be established comprised of local elected officials, local community leaders, and the general public.

The ultimate goal would be to have this advisory board provide valuable input on the development of the plans for and implementation of the fuel cycle facilities. If established early enough, the advisory board could provide guidance throughout the process of enacting the new federal legislation.

The advisory board would be provided funding to hire independent expert consultants. These consultants would give the advisory board input on all aspects of the consolidated storage facility site project.

XIII. Plan for Legislative Action

A. Overview of the federal legislative process

1) General

Legislation as comprehensive as that proposed in this Study must transit a broad array of Congressional Committees, in both the U.S. House and the Senate. The proposed legislation must at the outset have sponsors – one or more Representatives in the House and one or more Senators in the Senate. There is no limit to the number of co-sponsors, and the more co-sponsors there are, the more credibility the proposed legislation will have. Bi-partisan co-sponsorship is, of course, better than one-party co-sponsorship. Once bills are introduced, they are referred to the jurisdictional committee or committees, and within the committees, they are referred to the appropriate subcommittees. These assignments are determined by the leadership in each of the House and Senate. Upon referral of a proposed bill to a committee (and in most cases a subcommittee), the management of the bill is determined in the first instance by the staff of the body, and almost always by the staff representing the majority party. Assuming the initial work and the initial hearings are conducted at the subcommittee level, the bill advances first to the full committee and then is reported out to the full House or Senate. Typically, one house will assume the lead role and the other house may or may not take action before the bill is reported to the full body.

2) House of Representatives

In this case, it is likely that the lead Congressional body will be the House of Representatives. A bill of this nature naturally falls within the jurisdiction of the House Energy and Commerce, and will likely be referred by Committee leadership to the Subcommittee on Environment and the Economy. The House Energy and Commerce Committee is chaired by Congressman Fred Upton (R. MI). The Subcommittee on

Environment and the Economy is chaired by Congressman John Shimkus (R. IL). Both chairmen, and both committee and subcommittee staffs, are well versed in the nuclear waste issue, and are fully familiar with the Commission's Final Report. There is a decided bias at the leadership and staff levels in favor of the Yucca Mountain project, and it is important at the outset that any proposed legislation not be seen as damaging the possibility of reviving the Yucca Mountain project or limiting the role of the Yucca Mountain project in the ultimate program.

3) Senate

In this case, it is likely that the Senate will be the "following" body of Congress. When the Senate decides to move on the proposed legislation, the primary jurisdiction will be in the Energy and Natural Resources Committee, and the bill will likely be referred to the Subcommittee on Energy. The current chairman of the Committee on Energy and Natural Resources is Senator Ron Wyden (D. OR). The Chairwoman of the Subcommittee on Energy is Senator Maria Cantwell (D. WA). As is well-known, the Senate Majority Leader, Harry Reid (D. NV), is vehemently opposed to the Yucca Mountain project. Any proposed legislation which is seen in any way as potentially pro-Yucca Mountain will be stymied by Senator Reid (who, as Majority Leader, can determine whether a bill moves through the Senate, or not). In short, the ultimate fate of any comprehensive legislation, such as that proposed in this Study, is likely to be determined in the Senate.

B. Currently pending legislative proposals in terms of impacts on the Region's objectives.

1) Feinstein Bill

The Feinstein bill, sponsored by Senator Diane Feinstein (D. CA) who is Chairwoman of the Appropriations Subcommittee on Energy and Water Development, is one of two bills which have been floated in an effort to "put down a marker" for implementation of the Commission Final Report. The Feinstein bill is embedded in the FY13 Energy and Water Development Appropriations Bill. Section 312 of the bill authorizes the Secretary of Energy to conduct a pilot program with one or more private partners to license, construct, and operate one or more privately or government owned consolidated storage facilities. It further states the Secretary shall within 120 days of enactment of the bill request proposals for cooperative agreements to obtain a license from the NRC, to

demonstrate transportation of SNF and high-level waste, and to demonstrate safe storage at the consolidated storage site.

Section 312 also outlines a “Consent-Based Approval” process. The bill identifies “Consent-Based Approval” as the basis for the Secretary entering into an agreement to host the consolidated storage facility with: 1) the Governor of the State; 2) each unit of local government in the jurisdiction; and 3) each affected Indian tribe. Congress would then approve the terms of the agreement and authorize appropriation of funds from the Nuclear Waste Fund to implement the agreement.

2) Bingaman Bill

In the last Congress, the Nuclear Waste Administration Act of 2012 was offered by Senator Jeff Bingaman (D. NM) in August 2012. The bill attempted to implement many of the recommendations of the Commission. The act proposed to: 1) establish a new nuclear waste management organization within the federal government; 2) transferred the siting, licensing, construction, and operation functions of nuclear waste management facilities from the Secretary to the new government agency; 3) established a new consent-based process for siting; 4) provided centralized storage for a specific quantity of nuclear waste pending the completion of a repository; and 5) assured that funds collected from nuclear waste generators are used for the purpose intended. One controversial provision of the Bingaman bill was the proposed linkage between consolidated storage sites and a repository (with minor exceptions, consolidated storage not being able to proceed unless a repository proceeded in tandem).

This bill would have allowed the development and implementation of consolidated storage sites as envisioned in this Study.

As with the Feinstein bill, the Bingaman bill was put down as a marker and no action was taken on the bill in the prior Congress.

C. Legislative Proposal and Process

- 1) The legislation would implement the provisions of the Commission’s Final Report in a manner which is deemed most appropriate from the perspective of the communities which would be on the “consent” side of a consent-based process.

- 2) It is clear that no new comprehensive legislation will be enacted without the broad support of the communities (broadly defined to include state and local level interests) which would benefit from the legislation, either by being on the “consent” side of the consent-based project or by being able to move nuclear waste currently stored within that community to one or more consolidated storage sites. Every effort should be made to develop broad-based support for the proposed legislation, first from the communities interested in hosting a consolidated storage site (and also communities interested in hosting a repository site) and then from the array of communities who would have the opportunity to move nuclear waste to a consolidated storage site or repository. A tertiary goal would be to enlist the support of industry and industry associations (including the utility industry) whose interests would be positively affected by the proposed legislation. It goes without saying that the broader the base of support for the comprehensive legislation, the more likely its passage in a workable form.

- 3) The process of advancing the proposed legislation through the Congress will likely require significant additional effort and resources. However, one possible source of funding (either on a current basis or by subsequent reimbursement) is the nuclear waste fees being collected currently from the ratepayers of nuclear generators. The Commission Final Report advances the notion that, rather than those fees being paid directly into the U.S. Treasury, they should be paid in a third-party escrow account (enabled by the Secretary of Energy) so that they can be applied at the appropriate time to the objectives for which the fees are intended. It should be a goal of the SRSCRO and the other supporters of the proposed legislation to seek payment or reimbursement of those monies to support the broad-based community effort to enact new comprehensive legislation. Alternatively, the proposed legislation should contain a provision allowing for eventual reimbursement of such costs once NWMC is established and the nuclear waste fees are transferred from any escrow or the fees are paid directly to NWMC. Note that the legislation also proposes that the nuclear waste fees be used to fund the development of consent-based consolidated storage and repository proposals.

XIV. Economic Opportunities and Risks

A. Summary Discussion of Output of Economic Model

The economic and financial model was run for the following six scenarios:

- 1) 20,000 MT storage without and with 800 MT/year reprocessing plant;

- 2) 40,000 MT storage without and with 800 MT/year reprocessing plant; and
- 3) 60,000 MT storage without and with 800 MT/year reprocessing plant.

Table 1 is a summary table of results for the scenarios listed above. The direct employment is comprised of those employees that would be working at the consolidated storage facility site. The Total Incremental Local Employment, Total Incremental Local Economic Output, and Total Incremental State and Local Tax Revenue are calculated using economic multipliers and the direct costs associated with the consolidated storage facility and, if applicable to the scenario, the reprocessing facility. The incremental results are for steady state operations of the facility.

The following is a brief explanation of economic multipliers adapted from an earlier SRSCRO-commissioned economic impact study²⁷. The economic multipliers were used to project the local and state economic impacts. The descriptions below apply generally to both the economic output and employment multipliers.

- 1) The total economic impact of expected project spending is calculated as the sum of the direct, indirect, and induced effects of such spending as reflected in multipliers.
- 2) The direct effects include the project expenditures spent with suppliers in the State and local economy, wages paid to local workers, and the number of jobs associated with those local workers. An example of this would be the value of building materials purchased from local vendors to construct a consolidated storage facility or reprocessing facility represents a direct economic impact.
- 3) Indirect effects represent the relationship between different firms that provide inputs to the goods and services purchased directly in connection with the selected activities. For example, the economic value of inputs to the local production of equipment sold to a consolidated storage facility or reprocessing facility represents an indirect economic impact.
- 4) Induced Effects are economic impacts that arise from the spending of household income earned by workers employed as part of the selected

²⁷ The Economic Impact of the Savannah River Site on Five Adjacent Counties in South Carolina and Georgia, May 2011, pp. 25-26

activities. Workers involved with these activities could potentially spend their income at retail, service, and other types of local establishments. Businesses affected by this spending will hire additional workers who will also spend a portion of their income in the local economy.

Scenarios	Direct Employment		Total Incremental Local Employment	Total Incremental Local Economic Output	Total Incremental State and Local Tax Revenue
	Construction	Operations			
20,000 MT	121	62	129	\$14M	\$743M
40,000 MT	128	85	173	\$21.166M	\$1.119M
60,000 MT	134	107	217	\$28.282M	\$1.495M
Reprocessing (storage independent)	3273	803	1698	\$239M	\$12M

Table 1 Summary Results from Economic/Financial Model

As mentioned earlier in this report and as evident in Table 1, combining consolidated storage with reprocessing leads to a substantial increase in the positive economic to the Region.

B. Risks

While it is not clear that there are or would be actual impacts on other economic development opportunities, care should be given to address this potential.

Rather than trying to quantify the likelihood that a company might be affected by the storage or reprocessing of SNF in the Region, the Study attempts to mitigate the concern a company might have.

Perceived risks by a company considering locating in the Region with consolidated storage or reprocessing may include:

1) Transportation of SNF

There is generally considerable public concern regarding the transportation of SNF – or any nuclear material for that matter. A company that might consider locating in the Region would be concerned about the impacts of a transportation accident or incident that might hamper the receipt of raw materials and/or the delivery of goods and services to their customers

This concern could be mitigated by highlighting the outstanding safety record of nuclear related shipments in the U.S. The fact that the shipping packages are NRC licensed and regulated would also increase the acceptance of a reluctant company.

2) Release of radioactive material

The risk of releasing radioactive material is very, very low, but is still a risk that could be perceived as great by various companies. The impacts to the company could be the potential of lost assets or assets that are contaminated with radioactive material and no usable.

This concern could also be mitigated by demonstrating that the regulation and oversight by the NRC significantly reduces the potential for a release of radioactive material.

3) Terrorism

Terrorism associated with SNF and nuclear facilities is always a public concern. As with the other potential concerns above, this concern would be mitigated by the maintenance of an appropriate security force that complies with NRC regulations.

XV. Opportunities for Development Funding

A. Federal Grants

Considering that it will most likely require more than a decade to put in place the comprehensive legislation, staff the NWMC so it can become operational, conduct the NWMC/NRC approval processes, and construct and commission facilities, a significant amount of funding will be required by those who are moving forward with specific proposals for consolidated storage and/or permanent disposal. During this period, and perhaps even before the legislation is enacted (see prior references to the concept of a DOE-administered escrow fund for the Nuclear Waste Fee), the federal government will continue to collect the Nuclear Waste Fees at a rate of approximately \$750 million per year. An appropriate use of these funds is to support the development of proposals which will form the backbone of the comprehensive national plan, and support the communities hosting facilities while they wait a decade or more for revenue and other economic benefits to start flowing from facility operations.

B. Strategic Industry Partners

Strategic industry partners could provide development funding or services in kind to support the ongoing efforts of the Region. These industry partners would likely require some commitment in exchange for their participation in the siting, construction and operation of fuel cycle facilities. A careful selection of these partners would be required.

XVI. Compensation and Incentives

The Commission recognized that compensation and incentives that are generous and not prescribed up front can very positively impact the willingness of a community and state to volunteer to host a consolidated storage and/or disposal facility. The siting effort in Finland and Sweden supports this approach. The stakeholders in the local municipalities – working with the waste management authority – were able to craft meaningful incentive and compensation packages.

To that end, the proposed federal legislation would include general guidelines for compensation and incentives for a host community that sites, constructs, and operates a consolidated storage facility while also allowing for maximum flexibility so that details could be guided by the host communities. It cannot be overemphasized that creating meaningful compensation and other incentives will be the difference between success and failure of a consent-based process.

A. Potential Incentives

There is an extensive list of incentives that could be proposed by the SRSCRO, the local communities and the states of South Carolina and Georgia. Below is a listing of some of the incentives that have been discussed that are specific to SRSCRO.

- 1) NWMC would commit to adopt reprocessing in the management of the back-end of the fuel cycle if technically and economically advantageous. Special consideration would be given to the role of the Region and SRNL in establishing the reprocessing capability.
- 2) DOE Office of Nuclear Energy would commit to fund RD&D of alternatives fuel cycle including the construction and operation of RD&D facilities.
- 3) DOE Office of Environmental Management would relocate its transportation program to SRS.

- 4) DOE would commit to establish additional waste management R&D facilities in the SRSCRO Region.
- 5) DOE would commit to maintain and operate H-Canyon for the processing of the research reactor fuel
- 6) DOE would commit to make H-Canyon available –on a non-interference basis – to perform RD&D activities.
- 7) DOE would commit to giving the Region preference in siting other federal projects and programs – including federal nuclear R&D.
- 8) NWMC would – to the extent possible – require the use of local and regional suppliers and vendors to support construction and operation of fuel cycle facilities.
- 9) NWMC and the Region would agree to a “curies in vs. curies out” approach to determining the rate at which SNF could be shipped in commensurate with the amount of defense HLW that is shipped out.
- 10) DOE Office of Environmental Management would work with the SRSCRO to develop areas of cooperation and mutual benefit.
- 11) DOE/NWMC would reimburse the SRSCRO for expenses incurred to date that are associated with their efforts to establish a consolidated storage facility.
- 12) Incentives would be provided to encourage private industry to relocate or expand existing operations in the Region.

B. Potential Compensation

Compensation could be provided to the state, county, and local community (city) in the form of cash payments, sourced at least in part from NWMC’s collection of nuclear waste fees. It is assumed that this compensation is above and beyond any incentives received by SRSCRO and the Region. This additional compensation (over and above the economic benefit of increased tax revenues) would be risk-based and intended to compensate for the risks and opportunity costs associated with large scale nuclear operations.

A phased cash payment of \$50M per year would split between the state and the local communities each year from the initiation of the consent-based process until

the receipt of the first SNF at the consolidated site. The state and the local communities would determine how the payment would be allocated.

After the consolidated storage is operational and the first SNF received, the yearly payment would be increased to \$100M per year and payable until the SNF is shipped for final disposal.

XVII. Recommendations/Actions/Path Forward for the Region

Given the substantial projected benefits to the Region from siting, constructing, and operating fuel cycle facilities, the Region should move forward in establishing fuel cycle facilities in the Region. The Region should develop a local comprehensive proposal for managing the back-end of the fuel cycle and prepare it for submittal. Initial efforts should be focused in several areas. These areas include, but are not limited to:

- 1) Identify the roles and responsibilities of the participating organizations within the Region.
- 2) Develop a draft detailed plan and timeline to implement the Region's decision regarding fuel cycle facilities.
- 3) Begin broad community discussion and gain broad community support. Efforts in this area should begin as soon as possible to ensure sufficient time is available to discuss plans and involve the communities.
- 4) Begin engaging with State and Regional officials. Engagement of key officials in Georgia and South Carolina and local elected officials is essential to inform them of the Region's plans and, as appropriate, involved them in the planning.
- 5) Support the preparation of a comprehensive legislative proposal to implement key recommendations of the Commission, and solicit the support of state delegations for the legislation.
- 6) Establish a working group within the Region to address siting of fuel cycle facilities.
- 7) Develop relationships with strategic industrial partners.
- 8) Work with the Savannah River National Laboratory ("SRNL") to (a) identify and prioritize needed research and development activities and (b) identify workforce needs that can be part of a Region led initiative