Updated Strategic Assessment of the U.S. NRC Low-Level Radioactive Waste (LLW) Program and the new WCS Commercial Disposal Facility for LLW

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1. Introduction

The United States faces a significant increase in low level radioactive waste (LLW) from nuclear power plant decommissioning in the future, a fact which was noted by the NRC in its 2007 Strategic Assessment of the U.S Nuclear Regulatory Commission's Low-Level Radioactive Waste Regulatory Program [1]. More recently in 2014, the NRC revised and updated this strategy and published the proposed changes in the Federal Register [2].

The purpose of this paper is to review the updated NRC low level radioactive waste regulatory strategy and also present an update on a significant change in the LLW disposal landscape in the U.S., the opening of a new commercial disposal facility, the Texas Compact Waste Facility (CWF) in Andrews, Texas [3].

Operational since spring of 2012, the CWF is owned and licensed by the state of Texas and operated by Waste Control Specialists LLC (WCS) [3]. The WCS facility in western Andrews County is the only commercial facility in the United States licensed to dispose of Class A, B and C LLW in the U.S. in the past 40 years. In this paper we will look at the factors that permitted this facility to open whereas other attempts to open a new LLW facility have failed.

It is well known that the largest volumes of waste from the decommissioning and dismantling of nuclear power plants will be Very Low Level Nuclear Waste and LLW. The NRC has recognized that the regulatory strategy must accommodate significant increases in LLW waste that will result from the increase in decommissioning wastes. [1, 2].

2. U.S. Low Level Waste Radioactive Waste Disposal Options

Commercial low-level radioactive waste must be disposed at commercially operated low-level waste disposal facilities. Facilities that manage or dispose of LLW are licensed and regulated by either the NRC or one of the 37 agreement states that have made arrangements with the NRC to regulate LLW. To qualify as an agreement state, it is necessary to set standards at least as stringent as the NRC's and have the technical expertise to regulate effectively.

The Low Level Radioactive Waste Policy Amendments Act of 1985 gave the individual states responsibility for the disposal of the low-level radioactive waste produced within the state. The act encouraged states to join together into regional groups, termed compacts, to provide regional solutions to LLW disposal. States responded by developing what ultimately turned out to be 10 compacts.

The problem that has caused concern for the ability to manage increased quantities of LLW from decommissioning, is that although the compacts were formed, no new disposal facilities were built for commercial LLW. Until 2012, there were just three LLW disposal facilities operating in the U.S. at Barnwell SC; Richland, WA; and Clive, UT. In fact, the options for LLW disposal diminished even further when Barnwell stopped accepting wastes from out of compact states in 2008 [4].

This changed with the opening of the Waste Control Specialists LLC Facility in the Andrews, Texas in 2012. Four disposal facilities now accept low-level radioactive waste [5]:

- Barnwell, SC. Barnwell is licensed by South Carolina to receive wastes in Classes A, B and C. The facility accepts waste from Connecticut, New Jersey and South Carolina.
- Richland, WA. The facility is licensed by the state of Washington to receive wastes in Classes A, B and C. It accepts waste from states that belong to the Northwest Compact (Washington, Alaska, Hawaii, Idaho, Montana, Oregon and Wyoming) and the Rocky Mountain Compact (Colorado, Nevada, and New Mexico).
- Clive, UT. Clive is licensed by the state of Utah to accept Class A waste only. The facility accepts waste from all regions of the United States.
- Andrews County, TX. WCS is licensed by the Texas Commission on Environmental Quality, the facility opened in 2012. It accepts Classes A, B, and C low-level radioactive waste from Texas and Vermont; and 34 states that do not have operating compact facilities and the federal government.

It is important for LLW disposal in the U.S. that under the State of Texas operating permit, WCS is able to accept waste from states other than Texas and Vermont,

the two compact states [3]. While this is not unique, it is significant that the facility has accepted waste out-of-compact waste from 34 states with no path forward for LLW disposal.

It is also important to note that WCS has recently disposed of intact large-component low-level radioactive waste materials when four intact 200-ton steam generators were buried at WCS in August, 2014 [3].

3. U.S. NRC Strategic Assessment

In 2007, due to developments in the national program for Low-Level Radioactive Waste (LLRW) disposal, as well as, changes in the regulatory environment, the NRC's LLRW program faced new challenges and issues. New technical issues related to protection of public health and the environment and security emerged [1].

These challenges and issues included 1) the need for greater flexibility and reliability in LLRW disposal options; 2) increased storage of Class B and Class C LLW because of the limited access of the Barnwell, South Carolina disposal facility to out-of compact waste generators; 3) the potential need to dispose of large quantities of power plant decommissioning waste, as well as depleted uranium from enrichment facilities; 4) increased safety concerns; 5) need for greater LLW program resources than were available; 6) increased security concerns related to storing LLW in general and sealed radioactive sources in particular; and 7) potential for generation of new waste streams (for example, by the next generation of nuclear reactors and the potential reemergence of nuclear fuel reprocessing in the United States) [1].

In response to these challenges and issues the NRC published the "Strategic Assessment of the Low-Level Radioactive Waste Regulatory Program" in 2007. This assessment identified and prioritized 20 specific activities to respond to the needs [1].

The NRC has completed two of the high priority activities identified in the 2007 Strategic Assessment, including updating guidance for LLW storage and evaluating the disposal of depleted uranium and the measures needed to ensure its safe disposal.

The NRC staff analyzed the impacts of near-surface disposal of large quantities of depleted uranium on the performance objectives of 10 CFR Part 61 and is proceeding with a rulemaking to specify a requirement for a site-specific analysis for the disposal of large quantities of depleted uranium. A proposed rule is expected to be published in 2015 [2].

The NRC published a Federal Register notice in June, 2014 soliciting public comment on a new proposed Strategic Assessment of Low-Level Radioactive Waste Regulatory Program [2]. The comment period on that proposed change closed in September 2014 and the rulemaking is still pending as of March, 2015.

In order to inform the strategy for regulating LLW disposal the NRC has developed three possible future scenarios for LLW disposal. These are identified as the optimistic, realistic, and pessimistic scenarios and are considered to bound the possible near future developments in LLW disposal. These three scenarios are summarized (with some editing) as follows:

The Optimistic Scenario Assumptions: All aspects for management of waste from the back end of the fuel cycle are continuously available, including uninterrupted commercial disposal capacity for all Class A, B, and C LLW and from all waste generators. Some limited competition results in disposal costs that are considered reasonable for most waste generators. Greater-than-class-C LLRW disposal is available at a U.S. Department of Energy (DOE) facility licensed by the NRC. There is a regulatory framework and process in place for low-activity waste that enables safe disposal in an efficient manner. A variety of low activity waste disposal options keeps the average cost of disposal low for this type of waste. There is little need for extended storage of LLRW or for new innovations regarding treatment of LLRW, including volume reduction or use of nonradioactive surrogates.

The Realistic Scenario Assumptions: Class A, B, and C LLW have clear paths forward for disposal. Small quantities of relatively high activity LLW are stored at industrial, medical, and research facilities and at nuclear Power Plants (NPP's). A small percentage of GTCC—mainly sealed sources— continues to be moved out of the commercial sector into DOE storage, but a disposal facility for GTCC waste is still many years away. Orphan waste is identified in an ad hoc fashion, and a path forward for disposition/disposal becomes more limited. Disposal options for low-activity waste are few, and approvals continue to be on a case-by-case basis that takes significant time to obtain approval. The LLRW regulatory framework is relatively stable, but necessarily reactive to certain circumstances, such as development of new technology, external events and innovations in waste processing, stabilization, and storage technology.

The Pessimistic Scenario Assumptions: Disposal capacity for all types of LLW is severely constrained and costs of disposal are prohibitively high for many generators. Consequently, there are significant increases in both the volume and activity of LLRW held in long-term storage. Disposal options for low-activity waste are severely constrained, and there are no prospects for development of a GTCC disposal facility in the near-to-medium term. Beneficial uses of radioactive material in research, medical care and

industrial applications decrease because of escalating uncertainties in disposal options and costs.
Escalating costs become the driver for significant innovations in processing and storage technology. The public becomes concerned about potential safety impacts of LLW storage as it becomes increasingly aware of its widespread use by licensees.
Decommissioning of some NPP's is postponed, or different decommissioning strategies are used due to high disposal costs, uncertain disposal availability and conflicting public and/or political pressures.

While the NRC proposes three scenarios for possible future scenarios for the disposal of LLW, based on the experience of the last four decades it would seem prudent to use the a combination of the realistic and pessimistic scenario as a planning basis for LLW disposal options in the near future.

4. The WCS LLW Disposal Facility

In January 2015 the authors received an on-site briefing on the operations at the WCS Andrews Texas LLW disposal site. Our focus was to understand the factors that allowed this site to successfully open.

These factors identified are those that are well known to those who have been involved in nuclear waste disposal and nuclear facility siting studies. They include:

- Public Acceptance. WCS enjoys widespread support from the people of Andrews County and the entire Permian Basin.
- Low population density in the surrounding area.
- Suitable site geology. Located within a 600-ft. thick relatively impermeable red-bed clay formation.
- Arid environment.
- No drinking water aquifer below the site.
- Good access by truck and rail transportation.
- A favorable state political environment in Texas.

5. Conclusion

Based on the observation that other suitable sites have been identified such as the Clive, Utah site that meet (almost) all of these criteria it would appear that the first and last factors in our list are the most problematic and it will require a change in the public acceptance and the political posture of states to help solve the national issue of safe and cost-effective LLW disposal. The NRC poses this issue another way in the pessimistic scenario, "the public becomes concerned about potential safety impacts of LLW storage as it becomes increasingly aware of its widespread use by licensees," implying that this could create a tipping point in public opinion and acceptance of a safer solution for managing LLW.

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REFERENCES

[1] US Nuclear Regulatory Commission, *Strategic Assessment of the U.S nuclear Regulatory Commission's Low-Level Radioactive Waste Regulatory Program*, SECY-07-0180, Washington DC 2007.
[2] Federal Register, *Low-Level Radioactive Waste Regulatory Program; Strategic assessment update; Request for comment; Notice of proposed rulemaking*, 10 CFR Part 61, May 2014, pp. 27772 - 27774.
[3] Waste Control Specialists LLC, Available from: http://www.wcstexas.com, March, 2015.
[4] M.T. Ryan, M.P. Lee, and H.J. Larson, *History and Framework of Commercial Low-Level Radioactive Waste Management in the United States: ACNW White Paper*, NUREG-1853, Washington DC January, 2007.
[5] Nuclear Energy Institute Fact Sheet, *Disposal of Commercial Low Level Radioactive Waste*, Available at: http://www.nei.org/Master-Document-Folder/Backgrounders/Fact-Sheets/Disposal-Of-Commercial-Low-Level-Radioactive-Waste.