Radioactive Waste Management: What Does the Public Need to Know?

William R. Roy

Anti-nuclear activists claim that the United States should abandon nuclear energy because we do not know how to safely manage radioactive wastes, and those previous attempts to manage even low-level wastes have been environmental disasters. Unfortunately this biased and distorted depiction is believed by many people, and has spread paranoia and an irrational fear and public distrust about anything radioactive. This fear has done little to persuade Federal and State governments to make legislative decisions that are based on the recommendations of scientists and engineers with regard to managing radioactive wastes. Instead, the decisions are based on politics, and the all-too-familiar of approach of “kicking the can down the road.” We must do better in providing the public and policy makers with factual and unbiased information.

Understanding radioactive waste management begins with understanding the wastes themselves. Low-level radioactive waste is a broad category of solids, liquids and gases that can contain a number of different radionuclides that are by-products from several sources. Nuclear power plants generate the majority of low-level wastes in the United States [1]. In terms of energy production, these by-products result from the routine operation of nuclear power plants, the decommissioning and demolition of former power plants and research reactors, and nuclear fuel fabrication and reprocessing facilities. The prevalent method for disposing low-level wastes has been shallow land burial. Activists are correct in pointing out that previous attempts to manage low-level wastes were indeed problematic. What the public needs to know is that these early land disposal sites were analogous to our nation’s first attempts to place satellites into orbit; some of the rockets failed to reach orbit and crashed. Today, people regard satellites in orbit around the earth as a routine accomplishment. The early disposal sites were also designed and operated without much experience or a regulatory framework to serve as a guide.

In 1962, the Beatty disposal facility became the first commercially operated facility for low-level wastes to be licensed by the U.S. Atomic Energy Commission in Nevada. The site closed in 1992, because it had a history of facility management and waste transportation mistakes which resulted in poor public relations [2]. In 1963, the Maxey Flats Low-level radioactive waste disposal site opened in Kentucky. As was the practice at the time, neither waste minimization nor volume reduction was required prior to shallow land disposal. The waste packages buried at Maxey Flats were believed to be a mixture of easily degradable cardboard and fiberboard boxes mixed with wooden boxes and 55-gallon drums. Also the waste containers were not compacted prior to placement. Because of the random placement of the containers after burial, there were initially void spaces between the containers. As the waste containers decomposed, the backfill soil settled to fill the void spaces, resulting in the subsidence and eventually failure of the trench covers to isolate the wastes from the environment. In 1977, the Commonwealth of Kentucky ordered the site closed [2].

The West Valley disposal site opened as a commercial facility in 1963 in New York. Like Maxey Flats, West Valley was plagued by the “bathtub effect;” two trenches became filled with leachate, and seeped through covers. The disposal facility was then closed. The Sheffield Low-Level Radioactive Waste Disposal Facility opened in 1968 in Illinois. Tritium was detected in on-site monitoring wells. It appeared that the tritium had migrated more rapidly than expected, based on the initial site characterization. Follow-up site investigations revealed that there were continuous, water-permeable sand layers that would allow leachate to migrate from the disposal trenches. Because of this discovery, the waste facility was by default “full” and ceased accepting any more waste 1978 [2].

What the public needs to know is that there are currently three low-level waste disposal facilities that have been in operation for years without resulting in major environmental problems, and they are still available today. The U.S. Ecology Richland, Washington Facility has been in operation since 1965 as a commercial business. The Barnwell Waste Management Facility in South Carolina began disposing low-level wastes in 1971. The EnergySolutions Clive Facility in Utah is the largest commercial low-level waste disposal site in the United States. In 2011, the Texas Compact Disposal Facility opened. Sited and designed based on the experience of past facilities, it is located in northwest Texas. This new facility is the first one established in decades, and had the potential to safely dispose of low-level wastes for decades to come. Clearly, the satellite named “Low-Level Waste Management” is in permanent orbit.

Spent nuclear fuel is a type of radioactive waste and it contains a wide variety of activation and fission products that requires long-term management [3]. Again, anti-nuclear activists assert that we should abandon nuclear energy because we have no clear national policy for the management of the spent fuel. What the public needs to know is that the solution has been known for decades: a geological repository. A geological repository is an excavation within solid rock used for the long-term containment and isolation of radioactive waste. There is a strong consensus among all major counties that a deep geological repository is the best option available for managing radioactive wastes [4,5]. The purpose of a geological repository is to provide passive protection from the release of radioactive material to future generations far into the future. Internationally, geological repositories that currently contain wastes or are planned in the future for low-level radioactive wastes, transuranic wastes, spent nuclear fuel, and high-level reprocessing wastes vary in terms of capacity, depth, design, and type of host rock. The type of host rock is influenced by...
the geological history of the area chosen for the repository. The host rock for most planned geological repositories is either "hard rocks" such as granite, sedimentary formations such as argillite (claystone), evaporates (mainly halite), and consolidated volcanic ash [5].

The public needs to know that Sweden and Norway are leading the way. Sweden began locating a potential repository for the final disposal of spent nuclear fuel in 1993. In 2009, a site near the Formsmark Power Plant in Oathammar was selected on the basis of having the best geological conditions, and the application for construction was sent to the Swedish Radiation Safety Authority and the Land and Environmental Court in Stockholm in 2011. The application is currently under review. The repository may be operational by about 2023 [6]. A geological repository for spent nuclear fuel in Finland is under construction at Olkiluto. Site selection began in 1983. The facility, named "Onkalo," is being built in four phases, the first two being focused on downward excavation and bedrock characterization. The last two phases will focus on the actual repository excavation such that disposal can begin in 2020 [7] making it the first geological repository for spent nuclear fuel in the world. France, Canada, and the United Kingdom are all at various stages of siting a geological repository for spent nuclear fuel. But what about the United States? The Yucca Mountain Nuclear Waste Repository in Nevada was to be the first geological repository in the United States for commercial spent nuclear fuel, legacy high-level waste from the Department of Energy (DOE), and Naval spent nuclear fuel. The site was studied for decades, and billions of tax dollars were spent in hopes of building a national repository. Some scientists devoted their entire careers to Yucca Mountain. In 2006, a U.S. Committee (Environmental and Public Works) issued a white paper calling Yucca Mountain "The Most Studied Real Estate on the Planet" [8]. In 2008, DOE submitted a license application to the Nuclear Regulatory Commission, seeking authorization to construct the repository with the goal of being available to receive wastes in 2017. However, because of strong political opposition from legislators in Nevada, the Obama administration eliminated all funding for the Yucca Mountain program. Since that time, the long-term future of the proposed geological repository remains unclear because of on-going litigation. What the public needs to know is that politics is attempting to derail Yucca Mountain, and not inadequacies in the amount of science and engineering that have been applied to siting and designing a safe repository. The Obama Administration formed a Blue Ribbon Commission to make recommendations about managing spent nuclear fuel. Not surprisingly, they recommended a geological repository [9]. DOE has since issued a new plan [10] advocating a geological repository, but chose to kick to proverbial can down the road to the year 2048 before it is operational.

References
6. Svensk Kärnbränslehantering AB.

Author Affiliations

Department of Nuclear, Plasma, and Radiological Engineering, University of Illinois at Urbana-Champaign, USA

Submit your next manuscript and get advantages of SciTechnol submissions

- 50 Journals
- 21 Day rapid review process
- 1000 Editorial team
- 2 Million readers
- More than 5000 Reviewers
- Publication immediately after acceptance
- Quality and quick editorial, review processing

Submit your next manuscript at www.scitechnol.com/submission