LWVNM Nuclear Issues Study
Task 2 Report

Deterrents to Nuclear Energy Expansion and Effective Remedies

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Task 2: Identify deterrents to nuclear energy expansion and effective remedies (consider the LWVNM Spent Nuclear Fuel Storage Safety Position adopted in 2021)

There are several deterrents to using nuclear fuel to produce electricity. These include the dangers associated with uranium mining, the potential for accidents involving radioactivity, linkages to nuclear weapons, disposal of radioactive waste, and issues of environmental justice and transparency. Nevertheless, the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development argues for inclusion of nuclear power in the electricity mix saying that "Including all options in the analysis is required because there is no silver bullet in addressing the climate crisis and because we need to understand the complex trade-offs between options." Similarly, Richard Meserve, former chair of the Nuclear Regulatory Commission, speaking about advanced nuclear reactors, has described climate change as a huge challenge and has indicated that there is no tool that we should exclude in addressing the situation. (1)

Assessing the trade-offs is especially challenging when the general public has difficulty identifying trusted sources of information and in understanding the levels of uncertainty surrounding various options.

Uranium as a fuel source

Nuclear power plants are fueled by uranium, an element which is found in the earth's crust (as commonly as tin, tungsten, and molybdenum), as well as in seawater. Uranium is mined by underground or open-pit methods, or *in situ* (which is less dangerous to workers and the environment). It is then processed into fuel pellets, and ultimately placed in fuel rods for nuclear reactors. (2)

Countries that are major sources of uranium are Australia, Kazakhstan, Canada, Namibia, and Russia. The US has only about 1% of the world's resources but, within the US, New Mexico ranks second in reserves and accounted for over 30% of US production between 1948 and 2002. A press release from First American Uranium recently noted the potential for the Grants area of New Mexico to again become a significant source of production. (3) Worldwide there are sufficient uranium resources to support significant growth in nuclear power. (4)

Natural uranium is converted into hexafluoride and then enriched to the denser U-235 isotope, the preferred isotope for most nuclear reactors. As of the beginning of this decade, however, Russia accounted for nearly 40% of the world's conversion capacity and close to half of the world's enrichment capacity. (5) To reduce dependence on Russian sources, five of the G7 countries, including the US, have recently announced their intention to create new supply chains for uranium fuel. (The only operating commercial uranium enrichment facility in North America is located in southeastern New Mexico.)

At least in New Mexico, especially for the Navajo Nation, there is a history of damage to the environment and to people associated with uranium mining. (6) In addition, the largest release of radioactive material in US history occurred on July 16, 1979, when a tailings disposal pond breached its dam, releasing 94 million gallons of uranium waste into the Rio Puerco, a water source for nearby Navajo communities. *NM Political Report* indicates that the spill and mine and mill sites in the area remain unremediated over forty years after the event. (7)

Damage from mining has been significantly reduced using leaching to extract uranium *in situ*. A solution containing water mixed with oxygen and or/hydrogen peroxide and sodium carbonate or carbon dioxide is pumped into the ground to dissolve the uranium. Then the solution is pumped to the surface where further processing occurs. There is no mining in the traditional sense and no mill is required. That is, extraction of uranium is environmentally cleaner but there remains a legacy of distrust because of the history of the industry.

Costs of new construction

The Nuclear Energy Agency of OECD (the Organisation for Economic Co-operation and Development) argues that rapid build out of new nuclear plants is possible, noting that construction in China and Korea is accomplished in 5-6 years and that there has been rapid deployment of nuclear facilities in France, Sweden, Ontario, and the UAE. However, the history in the US suggests that construction would be a more lengthy process. According to Gregory Jaczko, former chair of the Nuclear Regulatory Commission (NRC), much has been done to improve the licensing process, but nuclear power will not be viable for meeting climate goals in 2030 or 2035. He sees it as "a monumental task" for nuclear to be a major contributor in the climate fight, but says that perhaps it could be a minor contributor. Mark Jacobson, Stanford University, notes that nuclear plants are just too expensive to build and operate and that the long lead time to build plants would be accompanied by on-going emissions of GHG. (8) Some nuclear plants have been shut down because of relatively high operating costs compared with electricity from other sources.

Aside from economic issues, there are concerns about the industry as a result of the Three Mile Island, Fukushima, and Chernobyl accidents and the potential for war-related damage like that at Zaporizhzhia in Ukraine.

Extending the operating lives of existing nuclear facilities

Considering these issues, does it make sense to achieve somewhat greater reliance on nuclear power by extending the life of existing nuclear reactors where it is feasible to do so safely? The Nuclear Regulatory Commission initially licenses facilities for 40 years. In some cases those licenses have been extended to a total of 60 years and, in a few cases to 80 years of operation.

With this approach the construction phase for new plants is avoided, but additional uranium supplies are still needed, and spent nuclear fuel continues to accumulate. (9)

Decommissioning nuclear facilities

Licensees for nuclear power plants are required to ensure that they have sufficient funds to cover the decommissioning of the facility (at a cost generally of $300-$400 million) at the end of its operational life. "Most plans involve release of the site to the public for unrestricted use, meaning any residual radiation would be below NRC's limits of 25 millirem annual exposure and there would be no further regulatory controls by the NRC." Under one approach to decommissioning, there is immediate dismantling of the facility with removal or decontamination of radioactive contaminants. Under the other approach, the facility is maintained and monitored in a condition that allows radioactivity to decay until the plant is dismantled and the property decontaminated. Of the 11 sites where decommissioning was complete in October 2022, only three had no fuel left on the site. (10)

Environmental Justice Issues

There are environmental justice issues to consider as we look at decarbonizing our energy systems to mitigate climate change, adapt to the changes we're already experiencing, and consider expanding nuclear power. What are the trade-offs we are willing to accept? Will the decision-making process about nuclear energy involve both those who will benefit and those who bear the costs of producing the electricity? (11) This is particularly relevant in looking at nuclear injustice in American Indian communities, where uranium mining has polluted the land. (12) Also of concern are procedural justice issues that pertain to nuclear plant siting, license renewal decision-making, and emergency preparedness. (13) Jaczsko notes growing constraints in public participation in nuclear decision-making by the NRC, which appear to reinforce a tradition of "secrecy, denial, and misinformation" that has long been part of the nuclear industrial complex. (14) In addition, is it fair to future generations for the present population to deplete the finite quantities of high-grade uranium ore? (15) Or to relegate to those yet to be born the storing of high-level nuclear waste? Living in proximity to nuclear power plants is not without risk, both in terms of catastrophic failures and day-to-day operations; these risks extend to unequal distribution of ethnic and socio-economic groups within a fifty-mile radius of a power plant, and damage to and scarcity of water resources. (16)

Stanford Professor Jacobson points out that emissions of carbon dioxide from new nuclear are 78 to 178 g-CO_2/kWh compared with 4.8-8.6 for onshore wind. Of this total, 64 to 102 g-CO_2/kWh are associated with the longer planning-to-operation time lag (10-19 years) for nuclear as opposed to 2 to 5 years for wind or solar. That is, during these planning periods, GHG continues to be emitted from other fuel sources. In addition, all nuclear plants emit 4.4 g-CO_2e/kWh from the water vapor and heat they release.

Most spent fuel rods are stored at the same site as the reactor that consumed them. This has given rise to hundreds of radioactive waste sites in many countries that must be maintained and funded for at least 200,000 years, far beyond the lifetimes of any nuclear power plant. The more nuclear waste that accumulates, the greater the risk of radioactive leaks, which can damage water supply, crops, animals, and humans. (17) This waste will accumulate at 2,000 metric tons per year. (18) Are towns through which spent fuel is transported prepared to handle a nuclear emergency? Can we predict how extensive, or the time of clean-up, or who will handle the costs? (19)

If indeed an emergency exists, consider the delay associated with nuclear reactors requiring 10-19 years between planning and operation; given current deaths by air pollution from carbon emissions, some might find this delay both unnecessary and unconscionable with alternative renewable, clean energy sources close at hand. “Emergency” may include not only global warming, but nuclear accidents. The costs of managing and restoring land after catastrophic nuclear accidents are not limited to the present generation; cost overruns in the designing and implementation of nuclear power plants thwart the investment in safer, less environmentally harmful sources of power (20). In sum, that barriers to and risks associated with an increasing use of nuclear energy include operational risks and the associated safety concerns, uranium mining risks, financial and regulatory risks, unresolved waste management issues, nuclear weapons proliferation concerns, and adverse public opinion is amply supported in the charts/graphs accompanying the presentations of Jacobson, Jaczko, and Ramana. (21)

Storage of Spent Nuclear Fuel

Spent nuclear fuel (SNF) often resides at nuclear power plants for some time and may continue at those locations after the plants are decommissioned. In 1987, in the Nuclear Waste Policy Act, Yucca Mountain, Nevada, was designated as a permanent nuclear waste repository. The Department of Energy (DOE) began seeking a license to construct the facility in 2008 but funding for the project was discontinued by Congress in 2011. According to the General Accountability Office, in discontinuing the project, the DOE did not cite either technical or safety issues but said that Yucca Mountain was not a workable option. (22) (It is often said that the current lack of a permanent repository is a political issue, rather than a scientific one.)

Public concerns about SNF storage are a deterrent to production of electricity using nuclear fuel since expansion of nuclear power would generate yet more waste. The issue is particularly important in New Mexico since there are two intermediate consolidated storage facilities seeking to operate in southeastern New Mexico and in an adjacent county in Texas. The concern is that these facilities will become permanent in the absence of a designated permanent facility. Other issues in New Mexico involve potential conflict between the nuclear storage activity and the oil and gas sector, which is quite active in the region and which currently accounts for a substantial portion of state revenues. Others raise questions about safety in transporting SNF from its current location to an intermediate or permanent storage location.

In contrast to the US situation, Finland is on the verge of opening the world's first deep geologic nuclear waste repository. (23)

An alternative approach is taken elsewhere in Europe (especially France) and other parts of the world where reprocessing of spent fuel occurs. Reprocessing separates uranium from plutonium and can be used to produce fuel for reactors, thus reducing the amount of waste generated. (3) The economics of reprocessing have been a deterrent as it is often cheaper to buy uranium than to generate fuel from reprocessing (24) and reprocessing raises concerns about nuclear proliferation.

Several years ago LWVNM did a study and adopted a position on SNF storage. The position supports comprehensive measures to provide protection of human health and the environment from any adverse effects of the storage of radioactive materials produced by nuclear energy, including SNF. Public participation in the planning and decision-making process along with adequate funding of such participation is an important element in the position. In general, the League supports

- Policies for the management of SNF/GTCC wastes to protect public health and air, water, and land resources;
- The establishment of processes for effective involvement of state and local government and citizens in siting proposals for storage of radioactive wastes;
- Full environmental review of storage facilities for radioactive wastes;
- Safe transport, storage, and disposal of radioactive wastes;
- Financial guarantees to cover costs of accidents, clean-up and reclamation; and
- Federal ownership and management of storage facilities. (25)

In 2023, the New Mexico legislature enacted a law attempting to block the SNF facility in New Mexico by requiring a federal permanent repository to be in operation before nuclear waste can be stored in the state. (26)

In summary, if renewable energy sources are not able to fill the national and global needs for GHG-free electricity, current technology offers some solutions to past problems with nuclear power. *In situ* mining of uranium is one such example and advanced reactors and more expeditious licensing processes may be others. Unresolved issues from the past and lack of transparency leave some members of the public viewing nuclear power with distrust of the technology and its management.

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