Nuclear Decommissioning Citizens Advisory Panel
DRAFT Advisory Opinion for Discussion at 11.12.15 NDCAP Meeting
Submitted on 10.15.15

Continued Funding for the Radiological Emergency Response Plan

It is the opinion of the Vermont Nuclear Decommissioning Citizens Advisory Panel NDCAP) that the owner of the U.S. Nuclear Regulatory Commission (NRC) License for the Vermont Yankee Nuclear Power Station (VY) continue to fund the VY Radiological Emergency Response Plan (RERP) at a level determined adequate by the Department of Public Safety with advice from the state agencies, towns and other parties potentially affected by, and likely to respond to, radiological releases from VY and other incidents. It is further recommended that this funding be scaled to the varying level of risk over the entire course of the decommissioning of VY until the U.S. NRC license is terminated, currently scheduled for 2072.

The RERP was created and is sustained by Vermont statute which requires funding of the RERP by any entity operating a nuclear reactor or storing nuclear fuel in the state (*Vermont Statutes Annotated Title 20 Internal Security and Public Safety, Part 1 Emergency Management and Military Aid, Chapter 1 Emergency Management, Section 38*). For the operating history of the reactor at Vermont Yankee, funds were provided by the owner of the NRC license based upon budgets submitted by the towns, state agencies and other parties (e.g., the Windham Regional Planning Commission and the American Red Cross). Currently, This funding for offsite response organizations besides that for local fire, police and emergency medical services is destined to cease after June 30, 2016.

The RERP has provided funding for a number of independent offsite emergency response capabilities during plant operations, including:

1. Comprehensive incident management and multiagency coordination;
2. Prompt, reliable and redundant notification capabilities and continuous communications;
3. Mechanisms for evacuation, shelter, reunification, reentry, relocation, and return for members of the public;
4. Radiological environmental sampling and surveillance by trained and qualified technicians;
5. Radiological accident assessment by trained and qualified scientists
6. Radiochemical laboratory analysis of environmental media to quantify radioactive contaminants in the food and water supply;
7. Law enforcement, fire safety, and emergency medical services;
8. Public information sharing;
9. Hazardous materials response and management
10. Health care and other human services;
11. Food and water protection, restrictions, and replacement;
12. Clean-up and waste management; and
13. Economic infrastructure protection, impact assessment, and recovery.

The current NRC license holder has found and current NRC decisions have confirmed that only capability number 7, what is called a comprehensive emergency management plan, is required after April 2016 for radiological emergency response and funding. The basis of this position is the assertion that radiation doses to the public from VY incidents would be less than the Environmental Protection Agency (EPA) Protective Action Guidelines (PAGs). Ignoring for the moment questions as to whether that position is accurate (see the National Academy of Science reference below that contradicts it), the EPA PAGS were not written to determine whether industrial entities that might release radioactive material into the environment should fund appropriate levels of offsite emergency response capability.

According to the EPA, their guidance "does not address or impact site cleanups occurring under other statutory authorities such as the United States Environmental Protection Agency's (EPA) Superfund program, the Nuclear Regulatory Commission's (NRC) decommissioning program, or other federal or state cleanup programs" (*EPA PAG Manual page i*). The EPA PAG Manual describes the purpose of its guidelines: to determine the doses at which people should be evacuated or relocated, whether people should take potassium iodide to prevent thyroid injury, and whether food and water should be restricted from use because of the dose incurred by ingestion (*EPA PAG Manual page 1*). The EPA PAG Manual guidelines and bases may be found at http://www.epa.gov/radiation/docs/er/pag-manual-interim-public-comment-4-2-2013.pdf.

It is important to note that the EPA PAG dose guidelines are well in excess of the Vermont Department of Health (VDH) public dose limits for VY. In particular, the lowest EPA PAG dose guideline is 1000 to 5000 millirem projected over four days, while the VDH public dose limit is no more than 25 millirem in any year. The EPA PAGs are an unacceptable threshold for public dose from a dormant nuclear reactor, despite it being a facility storing very large quantities of radioactive material awaiting final disposal.

It is important to recognize that public radiation doses, including those below the EPA PAGs, are caused by radioactive contamination of the offsite environment. The release offsite may occur with common incidents like transportation accidents, structure fires, and leakage from containers, as well as less common, but potentially more catastrophic incidents like natural disasters and terrorist attacks. These radiation doses and radioactive contamination of the public environment may have adverse effects on public health. One adverse consequence is the possible increased risk of cancer from the radiation dose received by the offsite contamination. Another adverse consequence may result when contamination of the environment affects the socioeconomic status of its residents. Socioeconomic stressors include lost jobs and wages because Vermont products, including maple, dairy and other agricultural products, are not purchased because they are thought to be, or actually are, radioactively contaminated.

It is the opinion of the NDCAP that of the thirteen capabilities listed above, all but number 2 for evacuation, shelter, reunification, reentry, relocation, and return need to be maintained until the structures, systems and components containing radioactive materials at VY are decontaminated, dismantled and disposed of in a licensed radioactive waste facility. These capabilities currently funded by the owner of VY provide the human and technical resources needed to verify that

doses from any incident at VY until its NRC license is terminated and the site can be released for unrestricted use are unlikely to cause adverse public health consequences. Further, it is the opinion of the NDCAP that this funding be adequate to ensure independent evaluation of the consequences of the incident by qualified people like those in the towns around VY and in the agencies of the state who have been doing so since the facility first started using nuclear fuel for energy production and generating radioactive materials as waste that require licensed disposal offsite.

It is recognized that the level of risk from VY is not the same level of risk which existed during reactor operations. In particular, structures, systems and components are, or will be, mostly de-energized, at low temperature, and depressurized. In addition, most radioactive liquids have been, or will be, consolidated from miles of piping connecting thousands of components into one high integrity storage container, what is called the torus, in the bottom of the primary containment, another high integrity container called the drywell.

Nevertheless, all of the drained structures, systems and components across the entire site are contaminated with layers of solid radioactive materials that will remain a source of risk from until final decontamination and dismantling of the facility. There are also unknown quantities of radioactive materials in the soils of the site from past leaks, fallout from plant exhaust stack releases, and contamination which resulted from above ground spills occurring over the facility's more than 42 years of operation. The VY Post Shutdown Decommissioning Activities Report (PSDAR, *Entergy Document BVY 14-078*, 2014) and other records describe some of the extensive contamination from such sources. Experience at other decommissioning sites revealed contamination levels remaining in site soils and available for movement in groundwater can be very high. Experience at Yankee Rowe demonstrated how large tritium volumes can be, and experience at Maine Yankee and Connecticut Yankee revealed how more hazardous radioactive materials like strontium-90 and transuranics (e.g., isotopes of uranium, neptunium, plutonium and americium) exist in the soils around shutdown reactors.

Given this set of conditions, funding of the RERP should be scaled for the relevant risk. There are three periods of decommissioning for VY, and the level of risk varies for each. The first period is that required to prepare the facility for SAFSTOR and to move spent nuclear fuel from wet storage in the spent fuel pool to dry storage in casks on the independent spent fuel storage installation (ISFSI). According to the VY PSDAR submitted to the U.S. NRC, this period should be finished by the end of 2020. The second period is SAFSTOR with dry fuel storage, and the PSDAR identifies this period as 2021 through 2052, though the 2052 date requires the U.S. Department of Energy have an offsite repository for VY Spent nuclear fuel. The third period of dismantling and decontamination is scheduled to start in 2068. It will last until the U.S. NRC license is terminated no later than 2075. This period will include levels of industrial activity with likely no equal in the history of Vermont as the site is razed to below ground.

Throughout each of the three periods there are risks of radioactive material releases into the air and into the groundwater. These releases may be the result of:

- Transportation accidents;

- The combustion of radioactive materials contained in the abandoned plant systems and components that are not decontaminated until after 2068;
- Breaches of containers storing radioactive materials due to natural disasters like earthquakes and flooding or from hostile actions including ground or air attack; and
- Groundwater carriage from the site of radioactive materials left in the soils at VY from well-documented past leaks, plant stack fallout, and surficial spills.

During the first period, there exist additional risks of radioactive material release from operations with and storage of the spent nuclear fuel. This risk arises especially as spent fuel is transferred from the spent fuel pool into dry casks. There is uncertainty about another pathway for release, and this is release due to the loss of spent fuel pool water and cooling followed by overheating of the spent fuel and loss of fuel cladding integrity, including fire that results with the zirconium-water reaction. The NRC states this kind of fire is not possible. The National Academies of Science disagrees (*Safety and Security of Commercial Spent Nuclear Fuel Storage, National Research Council, National Academies Press, Washington, DC, 2006*). This NDCAP advisory opinion errs on the side of uncertainty, and considers these risks require additional offsite emergency preparedness. During the third period or what is called DECON, the dismantling of the plant and decontamination of the site to allow for U.S. NRC License termination, the level of risk for radiological release dramatically increase. This is due to the increased level of industrial activity to decontaminate structures, systems and components containing radioactive materials.

In conclusion, the NDCAP recommends that the owner of the U.S. NRC license for VY provide funds sufficient to support the human and technical resources to carry out the emergency planning, response and recovery capabilities described here, that the amount of funding required be determined adequate by the towns, organizations and agencies of the State of Vermont that have successfully managed these capabilities since 1972 when VY first operated, recognizing VY risks are less than those during full power operations and vary with the kind of work at the facility, and that the funding be provided until VY is fully decommissioned, the U.S. NRC license for VY is terminated, and the VY site is released for unrestricted use.