

Vermont Yankee Nuclear Power Station
320 Governor Hunt Road
Vernon, Vermont 05354



VERNON, VT REPORT

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Executive Summary

This report identifies and investigates certain methods and resources to be used by NorthStar in the decommissioning plan for Vermont Yankee Nuclear Power Station in Vernon, Vt.

This report examines the following issues identified by the Vernon Planning and Economic Development Commission and the Vernon Selectboard: 1) What is concrete rubblization and what does it mean to the town of Vernon, and 2) What are the “Clean-up Standards” identified in the NorthStar documents¹ and what do they mean to Vernon?

Purpose

The purpose of this study is to review the NorthStar¹ proposal for decommissioning the Vermont Yankee Nuclear Power Station and identify processes and standards that NorthStar will be using, specifically the rubblization process and the site release standard. Further, it is to describe in “laymen’s terms” the processes and standards that will be used and the potential impact to the town of Vernon in the long term. This report does not examine non-radiological hazards such as lead, mercury, asbestos or PCBs.

Rubblization

Rubblization of concrete is a process that separates concrete from rebar (reinforcing steel bars) then reduces the size of the concrete chips to the point where it meets the State classification of “clean fill” (this will only be done with non-radioactive concrete). Once it meets this classification, it will be used as clean fill on the site. The goal is to ensure the site is available for unrestricted use at the end of the process.

“Rubblization” involves: (a) removing all equipment from buildings; (b) some decontamination of the building surfaces; (c) surveys to demonstrate compliance with the 10 CFR 20 Subpart E release criterion (25 mrem/yr); (d) demolition of clean structures (e) placing the clean rubble into the below-grade structure; (f) demolishing the above-grade part of the structure into concrete rubble; and (g) covering and landscaping the site surface in accordance with environmental permits.

Turning used clean (non-radioactive) concrete into rubble² and using it for on-site fill is not a new concept. It was developed for road reconstruction and has been a common practice for years. Instead of removing old concrete and bringing in gravel fill for an updated road bed, the used concrete is reduced in size to form the new roadbed. This

¹ State of Vermont Public Service Board, Dkt 8880, SUMMARY OF PREFILED TESTIMONY OF SCOTT E. STATE December 16, 2016

² VERMONT YANKEE DECOMMISSIONING, Use of Concrete Rubble as Fill by Howard Shaffer PE

procedure saves the expense of hauling away the old concrete, disposing of it, and then buying and hauling in suitable gravel.³ In NorthStar's proposed decommissioning, turning building concrete into rubble and using it to fill abandoned foundation holes would be less expensive than removing it and hauling in fill.

As described in prefiled testimony for NorthStar, the plan is to box and ship all radioactively contaminated or potentially contaminated material as radioactive waste. Any material remaining will be surveyed using accepted industry standards to ensure the material can be released for unrestricted use. This is to ensure the 15 mrem/yr goal is not exceeded.

Then it will remove and dispose of all non-radioactive components above 4' below grade. Non-radioactive components below this level will be left in place and any voids (i.e. tanks) will be filled with concrete. The non radioactive concrete structures above this 4' below grade level will be rubblized and used as fill on the site.

If rubblization is not used, the Town of Vernon will experience a significant increase in heavy truck traffic hauling out all the old concrete and hauling in new fill. This has the potential to increase exhaust, wear and tear on roads, and noise. The increase in carbon emissions, noise and road wear could pose a substantial environmental impact in the localized area of the VY site. Additional traffic hazards adjacent to the Vernon Elementary School would be evident.

If Rubblization is used, the truck traffic will be avoided. Rubblization equipment is typically noisy, emits fossil fuel exhaust and comes with dust control challenges. Dust control measures will be required in accordance with VOSHA regulations. The machinery NorthStar is planning to use to rubblize the concrete is of the "shearing" type and not the "hammering" type. Experience indicates that shearing is less noisy than hammering rubblization. The noise should not be a problem at the school.

Rubblization has been used nationwide as a process to economically dispose of waste concrete. It has also been used in the decommissioning of nuclear plants such as Zion in Illinois.⁴

Radiological Clean-up Standards

The regulation that applies to the decommissioning of a nuclear power plant can be found in the "Code of Federal Regulations" under Title 10 (Energy) Part 20.

10 CFR 20 "Standards for Protection Against Radiation"⁵ sets the limit to release a site for unrestricted use at 25 mrem/yr. NorthStar is proposing to use "U.S.NUCLEAR

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⁴ www.zionsolutions.com/faq/

⁵ Code of Federal Regulations, Title 10, Part 20-STANDARDS FOR PROTECTION AGAINST RADIATION, Subpart E-Radiological Criteria for License Termination, Paragraph 20.1402

REGULATORY COMMISSION, NUREG-1757, CONSOLIDATED DECOMMISSIONING GUIDANCE, (Sept. 2006)⁶,” as the guide to ensure the limit is met. The 25 mrem/yr limit can be equated to the difference between living in a wooden house where the above background dose is 0 or a brick house where the above background dose from the brick is about 25 mrem/yr. NorthStar has elected to set a self-imposed goal of 15 mrem and will use NUREG 1575, MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION MANUAL⁷ (MARSSIM), to measure that dose.

The paragraph that applies to the release of the site is 20.1402 ”Radiological Criteria for Unrestricted Use.” This paragraph states;

A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.

To understand this regulation, it must be broken down into its significant parts. First, NorthStar will need to identify “*residual radioactivity that is distinguishable from background*”. Background radiation is the ionizing radiation present in the environment. Background radiation originates from a variety of sources, both natural and artificial. Sources include cosmic radiation and environmental radioactivity from naturally occurring radioactive materials including radon, radium and fallout from nuclear weapons testing and nuclear accidents. The average annual background dose to U.S. residents is about 200 mrem per year from all sources.

The sources of background radiation can be broken down in accordance with the following table:

| <u>Source</u> | <u>Percentage</u> | |
|---------------|-------------------|--------------------------|
| Radon | 55 | In the air we breathe |
| Terrestrial | 8 | From the ground under us |
| Internal | 11 | Rad material inside us |
| Man Made | 18 | Mostly medical x-rays |
| Cosmic | 8 | From the sun |

⁶ NUREG-1757 Vol. 2, Rev. 1 U.S.NUCLEAR REGULATORY COMMISSION, NUREG-1757, CONSOLIDATED DECOMMISSIONING GUIDANCE, (Sept. 2006)

⁷ NUREG 1575 MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION MANUAL (MARSSIM)

NorthStar will need to identify the radioactivity that is there as a direct result of plant operations (i.e. *distinguishable from background*). They have indicated they will use the guidelines in the MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION MANUAL (MARSSIM) manual to identify sample locations on site and off site for the background data.

Next “*TEDE*”, this is an acronym for “Total Effective Dose Equivalent”. This term is used to categorize all forms of radiation dose together. These include, direct radiation dose (i.e. cosmic radiation, X-rays and gamma rays.) and internal radiation dose (ingested or inhaled radioactive material).

NorthStar will have to identify “*average member of the critical group*”. This is not a real individual, but a theoretical person that will be used to calculate the TEDE exposure.

NorthStar has elected to set a TEDE goal of 15 mrem, and will assume that exposure would be to a resident farmer.⁸ A member of such a theoretical farming family would receive the direct exposure in accordance with the time spent on the farm and the internal exposure for inhaling the air over the site and ingesting only food grown on the farm.

NorthStar has not yet developed the Final Status Survey (FSS) plan for evaluating the site at the end of the decommissioning process, but will use the MARSSIM manual as a guideline to make measurements on the site via direct scanning and soil sampling. NorthStar has indicated “some off site” sampling and scanning to develop data to use for “normal background” as outlined in the MARSSIM manual.

Their FSS plan will have to be evaluated by the NRC and the data obtained reviewed by them before the license is terminated and the site released.

Once the NRC has reviewed the data from the FSS plan and the “License Termination Request” and found both adequate, they will terminate the license. When this has occurred, the site is released for unrestricted use as far as the NRC is concerned.

Conclusion

NorthStar will be required to conduct the decommissioning of Vermont Yankee Nuclear Power Station in compliance with Federal and State regulations. It is assumed that the State and Federal agencies with jurisdiction over the various applicable programs will execute their responsibilities appropriately, and the Town has chosen to rely on the expertise of those agencies and their experts.

⁸ State of Vermont Public Service Board, Dkt 8880, SUMMARY OF PREFILED TESTIMONY OF SCOTT E. STATE December 16, 2016

It appears that with proper oversight, at this time, concert rubbleization and on-site placement of uncontaminated material as fill, could have benefits to the Town. For instance, the Town could potentially avoid traffic impacts from truck traffic that would otherwise be required to haul waste material off-site. Other benefits could also be realized.

The end goal of NorthStar's plan is unrestricted use, and the goal of 15mrem/yr would appear to be consistent with applicable regulations allowing such use.