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*Admitted in:* MA, ME

March 17, 2023

**VIA ELECTRONIC MAIL**

Lynn Muzzey, P.E.
Bureau of Air Quality
Maine Department of Environmental Protection
17 State House Station
Augusta, ME 04333

Re: Maine Yankee Atomic Power Company, A-1166-75-A-X, Property Tax Exemption for Air Pollution Control Facility

Dear Ms. Muzzey:

On behalf of Maine Yankee Atomic Power Company, thank you for providing a copy of the Department's draft decision concluding that a portion of the Independent Spent Fuel Storage Installation ("ISFSI") is air pollution control equipment that qualifies for a property tax exemption as a pollution control facility. We agree with the draft decision, as written, and appreciate the Department's attention to this matter thus far.

Although we have no comments on the draft decision, we do want to respond to several items asserted by the Town of Wiscasset in its February 15, 2023, filing to ensure there is a complete record. To that end, we have provided supplemental reports from our experts, Brian Haagensen (Exhibit A) and Steve Nesbit (Exhibit B), that we request be added to the administrative record for this application.

**I. Radionuclides Are Industrial Air Pollutants**

Although the Town apparently agrees that radionuclides are "air pollutants" within the meaning of the property tax exemption statute, it argues that the radionuclides at issue here are somehow not "industrial" in nature, even though they were produced as a direct result of operation of the Maine Yankee nuclear power plant. *See* Town's Additional Comment at 3. The Town's argument on this point appears to be based on the assertion that the legislative history of the property tax exemption statute does not explain what the word "industrial" means and that the timing of the law "is suggestive" that perhaps it does not include facilities regulated by the Nuclear Regulatory Commission ("NRC"). There is no need, however, to stretch quite so far to interpret the meaning of the word "industrial" in the phrase "industrial air pollutant."

The Maine courts have repeatedly explained that "the starting point in interpreting a statute is the statutory language itself," and that "[u]nless the statute itself reveals a contrary legislative intent, the

plain meaning of the language will control its interpretation." *Murphy v. Board of Environmental Protection*, 615 A.2d 255, 258 (Me. 1992). Further, "[t]o that end, the particular words used in the statute must be given their *plain, common and ordinary meaning*." *Id.* (emphasis added).

The plain meaning of the word "industrial" is of something that is related to "industry." That word, in turn, means the sector of the economy that is devoted to the commercial production of various types of goods.[1] Whatever ambiguity might theoretically exist at the margins of the word, the operation of a 900-megawatt nuclear power plant is squarely within the everyday use of the word "industrial."[2] *See* Nesbit at 1 (noting the Town's position "def[ies] plain English and common sense;" *see also* Haagensen at 4. Thus, radionuclides generated by a nuclear power plant are industrial air pollutants within the meaning of the property tax exemption statute.

Further, the Town curiously asserts that no authority has "analyzed" this issue in Maine, but the Board of Environmental Protection could not have been more direct when it concluded that "[r]adionuclides are an industrial air pollutant" in granting a sales and use tax exemption for this exact same facility in 2001. *See In re Maine Yankee Atomic Power Co.*, #A-82-75-K-X, at 4. There is no reason to believe that the phrase means different things in the two nearly identical pollution control tax exemption statutes.

**II. The Potential for Release of Radionuclides Is Not Merely Theoretical.**

The Town also argues that there are no radionuclides left to be released from the ISFSI or that they can otherwise be confined adequately by the spent fuel rod cladding. From this basis, the Town concludes that the primary function of the ISFSI cannot be confinement of radionuclides. *See* Town's Additional Comment at 5. This is an important factual error. *See* Nesbit at 2 (describing international research efforts at Electric Power Research Institute focused on ensuring confinement).

The Town's opposition on this point largely relies on information that it provided in 2004 to oppose Maine Yankee's prior application for a property tax exemption. As a result, its comments do not even attempt to address the new information provided in our initial filing for this application to better explain how and why we know that there are radionuclides inside the ISFSI that must be confined by something other than just cladding.

As Mr. Haagensen explains in his supplemental report, when Maine Yankee initially selected the dry cask storage method in the late 1990s, most in the industry believed that the ISFSI would only have to store the nuclear waste on-site temporarily as the federal government was (and still is) obligated to take title and transport it off-site. With the passage of time, it became apparent that sites like Maine Yankee will have to store the waste for a much longer period. *See* Haagensen at 1-2. With that longer time horizon, there is now greater attention being paid to factors such as internal corrosion that might impair the integrity of the ISFSI's confinement system. This resulted in, among other things, new NRC rules to

[1] For example, the website Dictionary.com provides that the word "industrial" means "of, pertaining to, of the nature of, or resulting from industry." The word "industry" is then defined as "the aggregate of manufacturing or technically productive enterprises in a particular field;" "any general business activity [or] commercial enterprise;" and "trade or manufacture in general." *See* Dictionary.com, accessed on March 7, 2023.

[2] Contrary to the Town's suggestions, neither the fact that the NRC is the primary regulator of nuclear power plants nor that the ISFSI does not require an air emissions license from the Department have anything to do with how to interpret the plain meaning of "industrial air pollutant" under 36 M.R.S. §§ 655 and 656.

require that storage systems function effectively for at least 160 years and that spent fuel be repackaged when storage systems no longer function effectively. *See* Haagensen at 1-2; *see also* Nesbit at 3. Additionally, a study in 2011 by the NRC demonstrates that the cladding is not sufficient on its own to ensure confinement. *See* Haagensen at 2; *see also* Nesbit at 1-2. As Mr. Haagensen states in his supplemental report:

> Today we have a better understanding that, although the cladding may have provided a fairly effective barrier to confine most of the radionuclides when it was first loaded into the canister, the cladding will degrade over time and the SNF will release both fission product gasses (primarily Krypton-85), volatiles and particulates into the canister atmosphere, as documented in NUREG-/CR-7116.

*See* Haagensen at 2; *see also* Nesbit at 3 (cladding provides "defense-in-depth," but the Transportable Storage Casks are the primary barrier).

In addition, as Mr. Nesbit explains, the radioactive decay process relied upon by the Town is misleading. While it is accurate that the radioactive atoms are decaying, and that some isotopes have short half-lives,

> [R]adioactive decay involves the transformation of one radioactive atom into a different radioactive atom, accompanied by the emission of ionizing radiation. The new radioactive atom will transform into yet another and different radioactive atom, and the process continues until the new atom is stable (nonradioactive). The half-lives of the radioisotopes get longer as you proceed through the decay chain toward a stable isotope, but radioisotopes are, by definition, still radioactive, and therefore potentially hazardous. As I point out on p. 2 of my report, spent fuel remains radioactive (due to the presence of the aforementioned radionuclides) for millions of years, which is why U.S. regulations governing the disposal of spent fuel cover the time periods of 10,000 to 1,000,000 years.

*See* Nesbit at 2; *see also* Nesbit at 2 (explaining that Krypton-85, a radioactive gas, has a half-life of 10.5 years and will be present in the ISFSI for decades, while other radionuclides present in the spent nuclear fuel last even longer, such as Iodine-129 with a half-life of approximately 15 million years); Haagensen at 2-3 (inventory of radionuclides that need to be confined will continue to exist for many years).

In short, regardless of what the Town's experts argued in 2004, it is even more clear today that the NRC believes there are meaningful quantities of radionuclides that still must be confined inside the ISFSI for the foreseeable future. Otherwise, it would not be in recent years revising the continued storage rule, testing scenarios that consider potential leaks, or requiring continued reporting from Maine Yankee on the quantity of radionuclides. *See* Haagensen at 1-2.

## III. The Fact That There Are No Emissions Does Not Prove Confinement Is Not the Primary Function.

The Town's incorrect premise – that there are no radionuclides left to confine – leads it to apply the primary function analysis incorrectly. If one believes that the radionuclides have already escaped or do

not need confinement, it is easy to reach the wrong conclusion that the subfunctions performed by the ISFSI, such as preventing criticality, managing decay heat, and providing a convenient option for eventual transportation, do not serve the overriding confinement function. The Town offers no explanation of why these subfunctions are important, but instead seems to suggest that they exist for their own sake. As explained in our initial filing, that is not the case because those features all help to ensure the overriding function of the ISFSI is met, which is to confine radionuclides inside the ISFSI system to prevent dangerous emissions that would likely harm the public.

Relying on data from 1998, the Town asserts that the lack of actual emissions of radionuclides from the now-defunct spent fuel pool somehow proves that the ISFSI is not preventing emissions. *See* Town's Additional Comment at 7. On the contrary, the fact that there have been no actual emissions from the spent fuel pool building or the ISFSI only proves that those systems work as intended by preventing emissions of radionuclides. *See* Nesbit at 3 (explaining that radiological constituents were filtered from the water as part of the spent fuel pool clean-up and filtering operations and that "no significant emissions would be expected"). That the ISFSI prevents emissions does not mean, as the Town would have the Department conclude, that there are no emissions to prevent. *See* Haagensen at 4 ("the absence of evidence is not the evidence of absence").

Further, when disparaging the need for confinement, the Town focuses only on existing operations during what one might characterize as normal conditions. As explained in our initial filing, however, the NRC requires that the ISFSI system be robust enough to maintain confinement even during extreme events, such as tornados, earthquakes, and explosions. *See* Haagensen at 3; *see also* Nesbit at 3. This is why the system costs millions of dollars to install and regular monitoring to maintain, and it makes no sense to believe that the NRC would require that level of protection if confinement were not a very real concern. *See* Haagensen at 3; *see also* Nesbit at 3-4.

Sincerely,

Brian M. Rayback

Enclosures
cc: Mark Margerum, Maine DEP
Dan Laing, Maine Yankee
Sarah McDaniel, Esq., Town of Wiscasset

# Exhibit A
# Brian Haagensen Supplemental Report

**Testimony of Brian Haagensen Responding to the Town of Wiscasset Filing Dated 2/15/2023**

## Introduction

As a recently retired NRC official, I have recognized that a major communications gap has been developing since the year 2000 between the judgment of the technical nuclear experts and the public. The NRC has been primarily focused on removing unnecessary regulatory barriers to allow the industry to become more efficient while the antinuclear activists have vocally expressed outrage over the dangers associated with the removal of these barriers. The public is left confused and concerned because the NRC too often communicates through studies and documents that are technically difficult to understand by the public and do not directly respond to the pointed questions from the antinuclear activists at public meetings. It is easy to see why the public and local town officials may become confused.

A point-by-point rebuttal to the Town of Wiscasset's (the Town's) Opposition would probably just lead to more confusion. While I am ready to provide that detailed rebuttal, I believe it is better to clarify and focus on a few key high-level points in an effort to explain the reasons for differences between the statements in my report and those of the Town. Both sides have smart advocates and both sides are genuinely convinced of the accuracy of their statements. But the regulatory environment has changed since 2005.

## Cladding Is Not Adequate to Confine Radionuclides

One of the Town's primary arguments in its Opposition is that the cladding of the spent fuel rods is sufficient to confine radionuclides. The Town provided several previous affidavits from a former NRC Commissioner and a well-known nuclear physicist, as well as the arguments of an attorney. Most of this testimony was previously provided back around 2004, prior to the 2015 rule changes to "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" in 10 CFR § 51.23, also known as the "Continued Storage Rule," as applied to Independent Spent Fuel Storage Installations (ISFSIs) as applied under 10 CFR §72. This rule change was based on recent research and NRC technical studies regarding potential canister and cladding degradation mechanisms that were not as well developed in 2005.

Maine Yankee's initial filing for property tax exemption in 2005 was based on the expectations that the spent nuclear fuel (SNF) and greater than class C (GTCC) waste would be removed from the site within a fairly short period of time (no longer than 30 years). Prior to the rule change in 2015, 10 CFR §51.23 (the former "Waste Confidence Rule") had determined that the NRC had confidence that the SNF would be removed from the site within 20 or 30 years, in time to permanently entomb the waste in a geological repository. This conclusion was challenged in Federal Court and the NRC was required to revise this determination. The NRC revised the former Waste Confidence Rule by implementing the current Continuous Storage Rule and publishing NUREG-2157, "Generic Environmental Impact Statement (GEIS) for Continued Storage of Spent Nuclear Fuel." Together, these documents directed Maine Yankee to be prepared to store the SNF in the ISFSI for at least 160 years and for an indeterminate period of time after 160 years. The NRC determined that the SNF can be retrieved and repackaged using a dry transfer

facility (that would be constructed on site) for an indefinite period until there is a consolidated interim storage facility (CISF), monitored retrievable facility (MRF) or permanent storage facility available to accept transfer of the SNF. Hopefully, the fuel can be shipped offsite sooner.

Back in 2005, the primary challenge to the integrity of the canister confinement boundary was thought to be off-normal or accident conditions such as something that might cause the loss of convective cooling leading to the overheating of the canister and fuel. The external corrosion process was considered to be too slow to challenge the cladding and canister barriers before the fuel would be shipped offsite. In my previous testimony from 2004, I testified that the canister system was designed as a whole for the primary purpose of preventing radionuclide release following a loss of cooling, criticality or external penetration. Today, with the longer expected storage times on the ISFSI pad, normal canister and cladding corrosion mechanisms have become a more important contributor to canister integrity preventing the release of the radionuclides.

Recent analyses have shown that the loss of convective cooling will lead to high internal canister temperatures that will accelerate degradation of the cladding resulting in a continuous buildup of radionuclides inside the canister that would be available for release should the canister boundary fail. In a recent study, NUREG/CR-7116,[1] the NRC assessed the potential degradation mechanisms that could compromise the integrity of the confinement barriers around the SNF during extended storage periods. Section 2.2 describes the following fuel degradation phenomena in detail:

- Clad creep,
- Hydrogen induced degradation processes,
- Delayed hydride cracking,
- Flaw stability,
- Hydrogen embrittlement,
- Stress corrosion cracking,
- Fission product and helium gas pressurization,
- Creep and diffusion-controlled cavity growth,
- Air oxidation of the clad (off normal condition), and
- Air oxidation of the fuel pellet materials (off normal condition).

When the SNF was loaded into the canisters, the NRC did not expect the SNF to remain on the ISFSI pad for a long time. Today we have a better understanding that, although the cladding may have provided a fairly effective barrier to confine most of the radionuclides when it was first loaded into the canister, the cladding will degrade over time and the SNF will release both fission product gasses (primarily Krypton 85), volatiles and particulates into the canister atmosphere, as documented in NUREG/CR-7116. If the canister boundary is subsequently compromised, these radionuclides, in gaseous, volatile and particulate forms, in the canister will be released into the environment. The longer the storage period, the greater buildup of radionuclides into the canister atmosphere as the cladding boundary degrades and they diffuse into the canister atmosphere. Thus, the Town's reliance on the cladding to provide containment is insufficient.

[1] NUREG/CR-7116 SRNL-STI-2011-00005, "Materials Aging Issues and Aging Management for Extended Storage and Transportation of Nuclear Fuel," published November 2011.

The canisters are subject to external corrosion in the marine environment at Maine Yankee. Although the canisters are made of robust stainless-steel construction, and are highly resistant to external corrosion, they will eventually experience corrosive degradation as described in my previous report. If the canisters develop a leak in the confinement boundary, the radionuclides will be expelled, and air will enter the canister. The loss of helium gas will reduce the effectiveness of the heat transfer and increase the presence of oxygen inside the canister. These effects will accelerate the corrosion of the cladding and any exposed SNF, which will release more radionuclides, as documented in NUREG/CR-7116.

As further evidence of the porousness of the cladding, every few months when it was operating, Maine Yankee would ship highly contaminated ion exchange resin beds and filter media offsite for burial in Texas. These media were loaded with particulate and ionic impurities (radionuclides) removed from the reactor coolant, spent fuel pool water and ventilation exhaust streams. Radionuclides diffused through the cladding boundary into the reactor coolant, into the spent fuel pool water and into the canister atmosphere.

Thus, even during operations when the cladding was still relatively new the cladding did not completely confine radionuclides. This condition is even more concerning today for waste stored in the ISFSI as the cladding continues to age. In short, what we know today that we did not know in 2004 is that the cladding degradation phenomenon that are characterized in detail in NUREG/CR-7116 became more concerning when the length of fuel storage time inside the canister was extended.

In addition, as discussed in my prior report, the ISFSI must also ensure confinement of radionuclides during off-normal and accident conditions that could readily compromise the integrity of the cladding stored in the canisters. Without robust engineering, the boundary could potentially fail in such situations and release the radionuclides stored inside. This includes events from various environmental conditions,[2] such as:

- tornado and wind loading (including wind-driven missiles),
- flooding (high water level),
- seismic events (earthquake),
- snow and ice,
- extreme temperatures,
- fire, and
- explosion,

as well as various combinations of some of these events. The ISFSI relies on both passive systems and administrative controls to ensure protection of the workers and public by preventing the release of radionuclides even in these unusual scenarios.

## Radionuclides in the Canisters Have Not Decayed Away

The Town also asserts in its Opposition that any radionuclides that could have been emitted from fuel rods with broken cladding would have been emitted by now. The radionuclides inside the fuel rods and canisters will remain radioactive for thousands of years. To be sure, the inventory of radionuclides will

[2] Maine Yankee FSAR-UMS ®section 2.2 and 2.3

decrease as they slowly decay away, but that will take many years before they have decayed sufficiently to be safe without confinement.

The radionuclides inside the canister emit direct gamma radiation, beta radiation (electrons), alpha particles (two protons, two neutrons) and neutron radiation.[3] Under current conditions, the beta and alpha particles are retained inside the canister. Only the direct gamma radiation emitted by the radioactive material penetrates the canister boundary. The direct radiation doses from the canisters beyond the site boundary will always remain below 25 mrem per year, however, because the intensity of the radiation continues to decrease as the distance to the canisters increases as the radiation flux spreads out (by the inverse square law).

If the canister boundary were to fail due to normal corrosion, off-normal or accident events, radionuclides will be released from the canister atmosphere. These radionuclides would be transported by the wind beyond the controlled area boundary and may cause adverse health impacts on the general public who are exposed to the plume of radioactive particles. For this reason, the radionuclides in the plume would be industrial air pollution.

## The Lack of Emissions of Radionuclides Does Not Imply Confinement Is Not the Primary Function

The Town's Opposition reasons that because no radionuclides were previously detected outside either the spent fuel pool building or currently at the ISFSI boundary leads that the primary function of the ISFSI must be something other than confining radionuclides. This conclusion is technically incorrect; the absence of evidence is not the evidence of absence.

Radionuclides were not detected outside the spent fuel pool building because:

- The reactor coolant purification and degasification system removed most of the radionuclides that diffused through the clad boundary into the reactor coolant.
- Inside the spent fuel pool and refueling cavity, filters and skimmers were used to remove ionic and particulate radionuclides directly from the spent fuel pool water.[4]
- The spent fuel pool ventilation system sweeps the air above the spent fuel pool and filters out any airborne particulate or ionic radionuclides in the HEPA and charcoal filters.

Radionuclides are not currently being detected outside the ISFSI because the canister containment boundary remains intact, not because they are trapped within the cladding boundary or have otherwise already escaped.

[3] The neutron radiation levels emitted from the SNF are extremely small, much lower than the other forms of radiation and may be effectively ignored. Neutron radiation would only become a serious threat if an inadvertent criticality occurred inside a canister. This accident is simply not a credible accident because of the passive engineering design features including SNF geometry, neutron absorbers and the lack of a neutron moderator inside the canisters.

[4] The reactor coolant enters with the refueling cavity and the spent fuel pool during refueling operations.

# Brian Haagensen Affidavit

**STATE OF MAINE**
**DEPARTMENT OF ENVIRONMENTAL PROTECTION**

| | | |
|---|---|---|
| Maine Yankee Atomic Power Company<br>Application for Property Tax Exemption<br>Certification | )<br>)<br>) | Affidavit of Brian C. Haagensen |

Upon oath, I, Brian C. Haagensen, state as follows:

1. **Education:** I obtained a B.S. in Physics in 1972 from the U.S. Naval Academy, and a M.S. in Physics in 1973 from the U.S. Navy Postgraduate School.

2. **Certifications:** I was certified as an Operator License Examiner by the Nuclear Regulatory Commission (NRC) in 1986 and have conducted NRC exams for 22 years. I was also certified by the Department of Energy (DOE) as an Examiner at the Savannah River Site (SRS) "K" Production Reactor and as a Chief Engineer by the Navy Nuclear Propulsion Program. I was certified as a Nuclear Power Plant Inspector by the NRC.

3. **Experience:** I retired in 2020 after a 47-year career in the nuclear power field. My career consisted of 10 years in the Navy as an officer on nuclear submarines, 22 years as a principal in two nuclear energy consulting companies and 15 years as an official in the NRC.

4. Most recently, I was the Senior Resident Inspector at the Indian Point Energy Center from 2015 to 2020, and the Resident Inspector at the Millstone Entergy Center from 2008 to 2015. I was responsible for the daily regulatory oversight of the Independent Spent Fuel Storage Facilities (ISFSIs) at both sites, as well as daily NRC oversight of the reactor power operations, engineering services, and emergency preparedness functions. My office was the eyes and ears of the NRC on site.

5. Prior to joining the NRC in 2005, I provided consulting services and support to the NRC and the DOE, including as a contractor/member of the NRC's Diagnostic Evaluation Team

(DET). This was the highest level of NRC oversight activity before the implementation of the Reactor Oversight Process. I have also supported the NRC in such diverse areas as the assessment and evaluation of nuclear utility management and operator training programs at many of the utilities throughout the United States, operator licensing, emergency preparedness, quality assurance engineering, and management consulting.

6. I was an NRC Certified Operator Licensing Examiner for 13 years from 1986 to 1995 and again from 2005 to 2009. I provided technical expertise to assist the NRC regional offices in administering initial and requalification examinations to candidates for reactor operator and senior reactor operator licenses. During these exams, I tested licensed operators in all phases of the examination, including the simulator, an in-plant walk-through, and a written test. From 1996 to 2004, I developed NRC operator licensing exams for the Duke Power Company at the Catawba and McGuire nuclear stations, as well as Florida Power and Light at the St. Lucie nuclear station.

7. From 1984 to 1995, I was the Project Leader and Program Manager for emergency preparedness consulting services to the NRC through Battelle Memorial Institute, coordinating a team of 15 analysts to evaluate over 150 annual emergency exercises at licensee facilities throughout the country. I conducted NRC Emergency Preparedness Inspections and Emergency Response Facility Appraisals at nuclear plants and drafting exercise, inspection, and appraisal reports for submittal to NRC regional team leaders. I also provided technical support and project management for the emergency preparedness services to Northeast Utilities where I was the project leader for 11 full-scale emergency exercises for Northeast Utilities Millstone and Haddam Neck Nuclear Stations between 1983 and 1989. This work required a detailed knowledge of nuclear accident prevention, mitigation, and consequence assessment. Much of the work consisted of the

validation of emergency plans, procedures, facilities, and radiological dose projection process at nuclear stations throughout the United States. I developed accident scenarios and calculated the offsite dose consequences of these scenarios.

8. In 1996, I was the lead management and organizational team specialist for the Maine Yankee Independent Safety Analysis Team (ISAT). In 2001 I led the root cause assessment team that investigated the causes for the significant degradation in the reactor vessel head at the Davis-Besse Nuclear Power Station in Ohio and supported the independent safety culture assessment team. In 2007 I participated in the 95003 (Supplemental Inspection Response to Action Matrix Column 4 (Multiple/Repetitive Degraded Cornerstone) Inputs) Inspection at Palo Verde.

9. Based on my 47 years of experience in the nuclear industry, I am familiar with, among other things, independent spent fuel storage facilities that utilize dry cask storage systems, including the NRC design criteria for those systems and compliance with and adherence to those regulatory requirements. Most recently, as a senior resident inspector at the Indian Point Energy Center, I inspected canister loading operations, canister repairs, canister transportation to the ISFSI and storage on the concrete pad. I was responsible for daily regulatory oversight of the ISFSI and verification of compliance with technical specifications.

10. I am also familiar with the Maine Yankee facility and its operations. In 1996 I served as lead contractor for management and organizational issues to the NRC's Diagnostic Evaluation and Incident Investigation Branch when it conducted an Independent Safety Assessment of the Maine Yankee facility in conjunction with the State of Maine. I was the principal author of the Self-Assessment, Corrective Actions, Planning and Resources section and the Root Cause section of the NRC's Independent Safety Assessment of Maine Yankee Atomic Power Company. I am familiar with Maine Yankee's Independent Spent Fuel Storage Installation

(ISFSI), which is the subject of its application for tax exemption certification, including the ISFSI design, function and purpose.

11. I have prepared a report based on my education, training, and professional experience regarding Maine Yankee's ISFSI, a true and correct copy of which is attached.

DATED: 3/8/2023

Brian C. Haagensen

STATE OF CONNECTICUT
East Lyme, SS

DATE: 3/8/2023

Personally appeared before me the above-named Brian C. Haagensen and swore, based on personal knowledge, and, where stated, information and belief, to the truth of the statements made in this Affidavit.

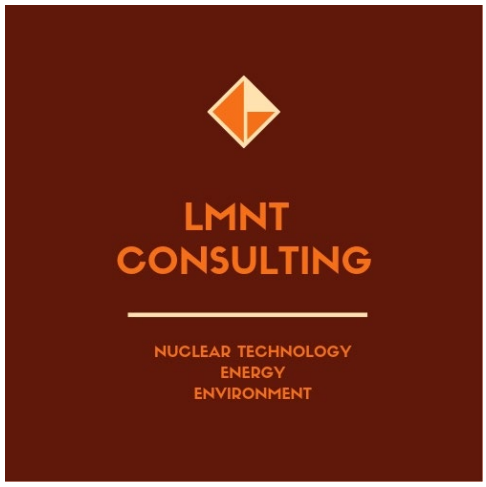
Before me,

Notary Public

Print Name: Karen Miller Gallo

My commission expires:
5/31/2024

# Exhibit B
# Steven Nesbit Supplemental Report




# Maine Yankee Spent Fuel Storage

## Supplement 1

## March 2023

Produced by LMNT Consulting, LLC on the behalf of Pierce Atwood LLP

Principal Investigator: Steven P. Nesbit, P.E.

# Testimony of Steven Nesbit Responding to the Town of Wiscasset Filing Dated February 15, 2023

Introduction

In support of the November 10, 2022 Maine Yankee application requesting certification that a portion of the Maine Yankee Independent Spent Fuel Storage Installation (ISFSI) in Wiscasset is an air pollution control facility, Mr. Brian Haagensen and I submitted reports supporting our expert testimony that the primary purpose of the ISFSI is confinement of radionuclides, thus preventing airborne pollution from those radionuclides. The testimony was based on years of experience in the field and numerous sources, including Nuclear Regulatory Commission (NRC) regulations, the Final Safety Analysis Report for the NAC-UMS® FSAR, materials supporting the NRC license for the ISFSI, Technical Specifications, a probabilistic risk assessment, an environmental impact statement, and regulatory guidance documents. Neither the Additional Comment of the Town of Wiscasset in Opposition to Certification of the ISFSI Pursuant to 36 MRS §§ 655 and 656 dated February 15, 2023 ("Additional Comment") nor the Preliminary Affidavit of Marvin Resnikoff dated February 14, 2023 ("Preliminary Affidavit") provided a substantive basis for disputing the conclusions reached in our expert testimony and associated reports.

In this additional testimony, I address some of the points raised in the Additional Comment and Preliminary Affidavit. First, I take issue with the assertion that radionuclides confined by the Maine Yankee dry storage systems are not industrial air pollutants. Second, I further substantiate the point that the radionuclides present in the Maine Yankee dry storage systems would pose a hazard to people in the vicinity of the ISFSI were they allowed to migrate from the enclosed Transportable Storage Containers (TSCs) to the atmosphere. Finally, I reiterate that the primary purpose of the ISFSI is the confinement of radionuclides from used nuclear fuel and Greater than Class C waste, and that confinement allows for the safe storage of the material.

Radionuclides Are Industrial Air Pollutants

1. In its Additional Comment the Town of Wiscasset ("Town") argues that the radionuclides contained in the ISFSI dry storage systems do not constitute "industrial air pollutants" because they are not "industrial." However, the Town admits radionuclides are listed as hazardous air pollutants under DEP regulations. With respect to whether they are "industrial" in nature, the radionuclides did not exist prior to 1972, but were produced during and as a direct result of operation of the Maine Yankee nuclear power plant from 1972 through 1996, as described in my initial report (pp. 1-2 and p. 5). While operating, the plant generated up to approximately 900 megawatts of electrical energy, a quantity sufficient to power a large city. If production of that much electrical power over that long a time period does not constitute an industrial application, it is difficult to see what would. The argument that radionuclides from electricity production are not industrial in origin seems to defy plain English and common sense.

Hazard from Radionuclides

2. The Town asserts that "Any Theoretical Airborne Radionuclide Release from Stored Nuclear Waste is Minimal" (Section III of Additional Comment). Mr. Resnikoff attempts to support that assertion by arguing that any hazard is theoretical because "… radionuclides at Maine Yankee have not been detected" (Preliminary Affidavit, Nos. 5, 6, and 10). As discussed below, those arguments are not valid.

3. The Town's assertion that "Any Theoretical Airborne Radionuclide Release from Stored Nuclear Waste Is Minimal" is not shared by the nuclear industry, the NRC, or the broader international nuclear technology community. To emphasize that point, I note that I have participated in the Electric Power Research Institute's Extended Storage Collaboration Project (ESCP) since its inception in 2009, when it had 39 members. ESCP has since grown to 750 members from 22 countries. The program brings together utilities (including Maine Yankee), regulators (including the NRC), equipment manufacturers (including NAC, the supplier of the dry cask system that Maine Yankee uses), industry groups, government researchers and others to identify and conduct research and analysis that ensures the safety of long-term dry storage of nuclear fuel.[1] ESCP research addresses a range of issues associated with safe storage, including but not limited to (i) hydride reorientation in the cladding which would render the material brittle and subject to failure, (ii) chloride induced stress corrosion cladding of stainless steel, which could lead to loss of TSC integrity and the escape of gaseous fission products, (iii) the ability of dry storage systems to limit peak cladding temperatures during loading operations, (iv) the ability to monitor the material condition of TSCs, and (v) development of means of mitigating TSC degradation should it occur. This research is focused on the confinement of radionuclides and ensuring the integrity of the barriers to radionuclide release. Clearly the Town's assertion that "… none of the three components of the ISFSI currently under consideration are actually controlling, reducing or eliminating radionuclide emissions from the fuel" is untrue, given the scope of national and international efforts to ensure that nuclear fuel dry storage systems continue to accomplish their mission of confining radionuclides and thereby ensuring public health and safety. Otherwise, why would so many people and organizations from so many countries devote so many resources to something that is not needed?

4. Regarding the inventory of radionuclides contained within fuel rods, the Town maintains they are not present in sufficient quantity to do harm, based on 2004 testimony. The Town cites the fact that the majority of the radionuclides generated through power production have undergone radioactive decay by the time the fuel is loaded into dry storage, but that point is not relevant. As I described on p. 2 of my report, radioactive decay involves the transformation of one radioactive atom into a different radioactive atom, accompanied by the emission of ionizing radiation. The new radioactive atom will transform into yet another and different radioactive atom, and the process continues until the new atom is stable (nonradioactive). The half-lives of the radioisotopes get longer as you proceed through the decay chain toward a stable isotope, but radioisotopes are, by definition, still radioactive and therefore potentially hazardous. As I point out on p. 2 of my report, spent fuel remains radioactive (due to the presence of the aforementioned radionuclides) for millions of years, which is why U.S. regulations governing the disposal of spent fuel cover time periods of 10,000 years to 1,000,000 years.[2]

5. As an example of a specific radionuclide, Mr. Haagensen discusses the presence of Krypton-85 on p. 11 of his report. Krypton-85 is a radioactive gas which has a half-life of 10.5 years; it will therefore be present in the spent fuel in significant quantities for decades. Many other long-lived radioisotopes are present in spent fuel, up to and including iodine-129 (half-life of approximately 15 million years).

[1] Warren, Chris, "A Collective Approach to Safe Used Nuclear Fuel Storage," EPRI Journal, March 10, 2022. See https://eprijournal.com/a-collective-approach-to-safe-used-nuclear-fuel-storage/ .

[2] See Environmental Protection Agency regulations 40 CFR Part 191 and 40 CFR Part 197.

6. There are still large numbers of radionuclides present in the Maine Yankee spent fuel today and there will be many years from now, which is why the dry storage systems are designed to contain them for long time periods. As Mr. Haagensen pointed out on pp. 8-9 of his report, the NRC, in its Continued Storage Rule Environmental Impact Statement,[3] assessed dry storage of spent nuclear fuel and concluded that TSCs should be able to maintain their integrity for tens or hundreds of years, and then spent fuel could be repackaged to ensure safe storage for longer periods of time. Repackaging involves moving spent fuel and GTCC waste out of their current confinement packages (e.g., TSCs) after use for extended periods of time, and placing the spent fuel and GTCC waste into new confinement packages to prevent age-related degradation of the current packages from allowing radionuclides to escape to the air, migrate offsite, and cause doses to humans. It is difficult to see why the NRC would contemplate the need to repackage spent fuel after many years if the potential release of radionuclides was already "minimal" today.

7. The Town also cites the presence of the cladding "… whose primary function is to contain radionuclides." As I discuss in p. 8 of my report, the cladding provides an important defense-in-depth feature for prevention of radionuclide release, but the transportable storage canister (TSC) is the primary containment barrier to prevent airborne dispersal of radionuclides from dry storage systems. That is why the NAC-UMS® Final Safety Analysis Report focuses on the ability of the TSC to maintain its integrity during normal operation and postulated accidents, as discussed on pp. 8-9 of my report, and does not rely on the cladding alone.

8. Mr. Resnikoff cites 1998 data from Maine Yankee as evidence that "… no radionuclide emissions actually occurred" and "… no radionuclides were emitted from the Maine Yankee reactor in the time period when all the spent fuel was in the spent fuel pool" (see Preliminary Affidavit, Nos. 6 and 7). The data show only that radionuclides other than tritium were not emitted in detectable quantities. Moreover, those data are not surprising. With the fuel in the spent fuel pool, and normal spent fuel pool cleanup and filtering operations in effect, no significant emissions would be expected. The data indicate that the pool and its associated systems prevented measurable offsite releases, which is what they were designed to do. The fact that pollution control equipment worked 25 years ago is not a justification for stating that different pollution control equipment (dry storage systems) is not needed today.

9. In minimizing the radiological hazard posed by the spent fuel at the Maine Yankee ISFSI, both the Town in its Additional Comments and Mr. Resnikoff in his Preliminary Affidavit ignore the potential hazard posed by off-normal conditions. The NRC requires that dry storage systems be designed to withstand natural phenomena hazards such as earthquakes, wind, wind-driven missiles, and floods. These requirements drive many aspects of the design of the dry storage systems. My report addresses such considerations on pp. 8-9 (Safety Functions) and pp. 9-10 (The ISFSI Functions as a System). Addressing off-normal conditions is an essential part of protecting public health and safety, as the recent train derailment and fire at East Palestine, Ohio amply demonstrates. The Town ignores this fact in its arguments that the Maine Yankee dry storage systems do not perform essential safety functions.

[3] U.S. Nuclear Regulatory Commission, NUREG-2157 "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel," September 2014. See https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr2157/ .

Safe Storage

10. The Town asserts that the primary purpose of the ISFSI is "… to comply with Nuclear Regulatory Commission license requirements to provide temporary storage of the irradiated spent fuel rods and GTCC waste" (see Additional Comment, p. 7). The Town writes as if the function of storage can be separated from the prevention of harm to the public from radionuclide emissions, in normal or accident conditions, from the ISFSI. It cannot. Safe storage is the focus of NRC regulations, and storage cannot occur at all until safety is assured through the licensing process. Thus, the dry storage system provides safe storage of used nuclear fuel. The safety is provided by the TSC, the VCC, and the concrete storage pad working in concert to achieve the safety functions described on pp. 8-9 of my report, chief among which is confinement of radionuclides within the TSC to prevent airborne releases.

# Steven Nesbit Affidavit

**STATE OF MAINE**
**DEPARTMENT OF ENVIRONMENTAL PROTECTION**

| | | |
|---|---|---|
| Maine Yankee Atomic Power Company<br>Application for Property Tax Exemption<br>Certification | )<br>)<br>) | Affidavit of Steven P. Nesbit, P.E. |

Upon oath, I, Steven P. Nesbit, state as follows:

1. On November 10, 2022 Maine Yankee applied to the Maine Department of Environmental Protection requesting certification that a portion of the Independent Spent Fuel Storage Installation (ISFSI) at Maine Yankee's decommissioned nuclear power plant site in Wiscasset is an air pollution control facility ("the Application").

2. The Application included a supporting expert report, prepared by me based on my education, training, and professional experience, entitled "Maine Yankee Spent Fuel Storage."

3. The Application also included my resume and a list of my pertinent publications, both of which remain accurate today.

4. On February 15, 2023 the Town of Wiscasset filed an objection to the proposed certification of a portion of the Maine Yankee ISFSI ("the Town Response").

5. I have prepared additional testimony with observations on the Town Response entitled "Maine Yankee Spent Fuel Storage – Supplement 1," a true and correct copy of which is attached.

6. This additional testimony provides further support for the air pollution control facility exemption that was requested in the Application.

DATED: March 9, 2023

Steven P. Nesbit

STATE OF NORTH CAROLINA

Mecklenburg, SS DATED: 03/09/2023

Personally appeared before me the above-named Steve Nesbit and swore, based on personal knowledge, and, where stated, information and belief, to the truth of the statements made in his report.

Before me,

Notary Public

ASHISH K C NOTARY PUBLIC CABARRUS COUNTY, NC

Print Name: Ashish kc

My commission expires: 04/03/2027

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