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To: MonticelloEnvironmental Resource
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DEIS at: https://www.nrc.gov/docs/ML2410/ML24102A276.pdf
IN RE LINE OF EMAIL: CIECP-PHASE Comments NUREG 1437, Supplement 26 draft
June 25, 2024
Re: Docket ID NRC-2023-0031 Site-Specific Draft Environmental Impact Statement for License Subsequent License Renewal for Monticello Nuclear Generating Plant, Unit 1, **NUREG-1437 Supplement 26 draft,** Second Renewal, (ML24102A276), Apr 2024.
Office of Administration
Mail Stop: TWFN-7-A60M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attn: Program Management, Announcements and Editing Staff
MonticelloEnvironmental@nrc.gov
The Council on Intelligent Energy & Conservation Policy (CIECP) and Promoting Health and Sustainable Energy (PHASE) submit these Comments to express deep concern regarding the proposed license extension for the Monticello Nuclear Generating Plant (Monticello) owned by Xcel Energy.
Monticello, located on the Mississippi River, is one of the oldest nuclear power plant's in the United States at 53 years old. Continuing to operate the Monticello reactor until it is 80 years old is reckless and ignores age-related deterioration, climate impacts, and the risk to one of the nation's most vital rivers.
The 829,000-gallon radioactive leak which occurred at the site in November 2022, followed by Xcel's inept response, is enough of a reason to avoid the unnecessarily hasty relicensing of the plant. Under the site's existing license, Monticello may operate until the end of the decade.
We ask the Nuclear Regulatory Commission (NRC) to select the No Action alternative. Xcel Energy has already received a renewed operating license. Xcel Energy's application for a Subsequent License Renewal (SLR) and the Site-Specific Draft Environmental Impact Statement for License Subsequent License Renewal for Monticello Nuclear Generating Plant, Unit 1, NUREG-1437 Supplement 26 draft, Second Renewal (EIS) are years premature.
There is no valid public policy rationale, at this point in time, for granting Xcel Energy license to run Monticello until mid-century.
The NRC should opt for the No Action alternative.
Below EIS assertions and statements are bolded under "EIS Assertions". Comments are unbolded under "Comments". Headings are added.

APPLICATION & FEDERAL ACTION

EIS Assertions

On January 9, 2023, Xcel Energy submitted a request for a SLR to continue operation of Monticello Nuclear Generating Plant Unit 1 until September 8, 2050, a period of 20 years beyond the date when its existing license expires, which is in 2030.

The NRC's Federal action is to determine whether to renew the Monticello operating license for an additional 20 years beyond the existing extended license period which ends in 2030. Monticello would be thus license to run until 2050, when it is 80 years.

Purpose and Need for Action

The purpose and need for a subsequent license renewal of a license already extended beyond its initial 40 years of license operation, is to "provide an option" to allow Monticello to run for 20 years beyond 2030, to allow the reactor "meet future system generating needs". (p 1-2 / 36)

Monticello is a 53 years old, the oldest nuclear power plant in the US. It has already received a 20-year license extension which allows it to run until 2030. There is absolutely no 'need' to issue an SLR now, especially given the dramatic advancements and cost reductions in other cleaner, safer, low-carbon energy resource options available.

AGING MANAGEMENT – HARVESTING & SURVEILLANCE

EIS Assertions

Regulatory schemes and the NRC's Aging Management program will ensure safe operation of the plant and site until 2050.

Comments

Operating a reactor beyond 60 years poses unique safety and environmental issues related to the age-related degradation of materials and structures, including safety equipment.

The NRC's Reactor Vessel Material Surveillance Program Requirements in Appendix H to 10 CFR Part 50 require, among other things, that material "surveillance capsules" be withdrawn periodically from the reactor vessel. In simplified terms, there are a fixed number of capsules in the reactor vessel; and a withdrawal schedule apportions their withdrawal and testing over the licensed life of the facility. Plants in the US have an integrated surveillance capsule program. The number of surveillance capsules, however, is limited due to the failure of the regulator and plant builders to consider the prospect of extreme extensions of reactor operation out to 80 years.

Regardless of the withdrawal schedule approved by the NRC, this means that there are not enough surveillance capsules capable of providing an adequate level of meaningful data for extreme license extension.

The problem is exacerbated by the NRC's failure to compel maintenance of licensee operational documents after reactor closures and the failure to require the harvesting and laboratory inspection of aged material samples (base metals, weld materials, reactor internals, buried pipe, concrete, electric cable insulation and jacketing, etcetera) from reactor systems, structures and components that are otherwise irreplaceable, inaccessible and non-inspectable during reactor operations.

In a 2021 presentation to Congressional staff in a Capitol Hill Briefing, "Toward an Evidence-Based Nuclear Energy Policy," the nonprofit watchdog Beyond Nuclear summarized contract work prepared by Pacific Northwest National Laboratory (PNNL) for the NRC Office of Research. The presentation noted that PNNL had publicly released an NRC-requested Technical Letter Report in early December 2017 identifying significant technical knowledge "gaps" in the scientific understanding of known age-related deterioration mechanisms that are attacking the material reliability and safety of nuclear power operations (alkali silica reaction (ASR), neutron embrittlement, stress corrosion cracking), a critical public safety and environmental protection opportunity at decommissioning nuclear power stations linked to extending power operations of nuclear power stations for a second 20-year license renewal, which enables extreme license extensions out to 80 years. (Gunter, 2021; PNNL 2017) In March 2019, after NRC staff apparently scrubbed all references to "technical gaps" from the report and laboratory recommendations to "require" strategic harvesting/analysis at decommissioning, the NRC relicensing division republished a revised report (PNNL-27210 Rev.1) which it publicly released only through the NRC website. (See also, Brenton, 2021)

One does not need to see technical support letters, however. It is basic common sense for the NRC to require nuclear plant licensees to maintain site operation documents after reactor closures and to require harvesting and lab inspection of aged materials. As things now stand, the NRC simply relies on computer modeling which is unvalidated by actual lab analysis of materials subject to real world conditions. Without such empirical evidence, there is thus no firm basis for reaching the conclusion that keeping Monticello running until 2050 is sufficiently protective of public health and the environment.

An entirely separate, interrelated, and arguably more serious deficiency in the NRC's approach which is reflected in the Monticello EIS, the 2014 Generic Environmental Impact Statement (GEIS) and other NRC evaluations is the refusal to duly consider climate change. This is discussed later in these Comments.

CLIMATE CONDITIONS

EIS Assertions

"The effects of climate change on Monticello structures, systems and components are outside the scope of the NRC staff's SLR environmental review. … Site-specific environmental conditions are considered when siting nuclear power plants." (p 3-220 / 284)

If new information about changing environmental conditions (such as rising sea levels or potential flooding that threaten safe operating conditions or challenge compliance with the plant's technical specifications) becomes available, the NRC will evaluate the new information to determine whether any safety-related changes are needed at licensed nuclear power plants." (p 3-220 / 284)

Comments

A report released by the GAO in April 2024 found that NRC actions to address natural hazard risk to nuclear power plants do not full consider the potential effects of climate change. (GAO 2024) The GAO observed:

"Climate change is altering the characteristics of many extreme weather events. According to the NCA, some extreme weather events have already become more frequent, intense, widespread, or of longer duration. Many are expected to continue to worsen." (GAO 2024, p 35, fn 52)

"Following an initial 40-year licensing period, NRC does not reevaluate natural hazard risks, including climate-related risks, to update the safety reviews required for the license renewal process." (GAO 2024 pp 35-36)

NRC officials interviewed told the GAO that NRC probabilistic risk assessments (PRAs) use current estimates of the probability of external events, but neither licensee nor NRC assessments incorporate climate projections. (GAO, p 35)

The NRC's failure to holistically consider the danger to nuclear plants presented by climate change, both directly and indirectly, is a massive abrogation of the agency's duty to the public. With respect to the Monticello EIS, this failure is a fatal flaw.

ECONOMICS

EIS Assertions

The EIS focuses on the regional economic characteristics (including migrant farm workers), housing, education, tax revenues, and transportation. According to 2020 Census estimates, 258,805 people live within a 20 mi (32 km) radius and 3,285,866 people live within a 50 mi (80 km) radius of Monticello. (p 3-169 / 233) Xcel Energy is the largest taxpayer in the county and provided $1.1 million to $1.3 million to the State general tax revenue fund between 2017 and 2022, representing under 1% of the State's revenue. Xcel also contributed $1.6 million in support of emergency planning and preparedness to the State of Minnesota Homeland Security and Emergency Management in 2022. (p 3-173 /

237) "Nuclear power plants generate employment and income in the local economy. Therefore, continued operations associated with SLR can impact employment, income, recreation, and tourism." (p 3-174 / 238) The NRC staff "concludes that employment, income, recreational, and tourism impacts during the Monticello SLR term would be SMALL" (p 3-174 / 238)

Comments

The cost and economics discussion above and in the EIS overall would not pass muster in a high school 'Introduction to Economics' course. The negative costs of electric power market distortion, subsidies, the panoply of negative health and environmental impacts, decommissioning and site remediation, radioactive waste and the potential astronomical safety and security risks externalized and imposed upon the public should, at the very least, be qualitatively reviewed in the EIS.

With respect to waste specifically, a minimal cost quantitative estimate of 20 or more additional years of creation of radioactive waste, especially spent fuel, is feasible and should be candidly communicated to the public which will bear the direct financial cost of long-term management.

It may also be noted that the neglect to review the economic opportunities that would surely arise from the No Action alternative through acceleration of renewables, energy efficiency (including in building construction and operation), storage, and grid upgrades. Add to those the social justice benefits of lowered long-term electric power costs.

In any event, the conclusion of "SMALL" with respect to the impacts of the economic factors considered in the EIS suggests continuing operation should not be advanced as economically more advantageous than the No Action alternative.

EMISSIONS

EIS Assertions

"Long-lived GHGs—CO_2, CH_4, N_2O, and fluorinated gases—are well mixed throughout the Earth's atmosphere, and their impact on climate is long-lasting and cumulative in nature as a result of their long atmospheric lifetimes. Therefore, the extent and nature of climate change are not specific to where GHGs are emitted." (p 3-215 / 279) Operation of Monticello "results in direct and indirect GHG emissions" and GHG emissions from diesel generators, pumps, the boiler, and some vehicles. (p 3-216 /280)

COMMENTS

The EIS is correct, the extent and nature of climate change is not specific to where GHGs are emitted. A necessary corollary is that climate-relevant evaluation of greenhouse gas contribution necessarily involves full fuel cycle analysis. While other kinds of pollution (chemical releases, oil spills, mercury, lead, etc) stay, more or less, within a geographic region, greenhouse gasses pollute not because of where they sit, but because they rise into the atmosphere and alter atmospheric conditions. From a climate change perspective, it is entirely irrelevant where a carbon emitter is located. Therefore, climate change analysis of every form of energy generation – and even every energy efficiency technology – must take into consideration all emissions generated throughout the *entire* fuel cycle. If one stage of a particular cycle produces minimal carbon, but every other stage produces prodigious amounts, that industry is a big climate change polluter.

The full fuel cycle shows why nuclear is a poor choice for the planet. Nuclear power is actually a chain of highly energy-intensive industrial processes which – combined – consume large amounts of fossil fuels and generate potent warming gases. These include:

- Uranium mining
- Milling
- Enrichment
- Fuel fabrication
- Transport

- Construction and maintenance of the heavy concrete nuclear reactors and all the other massive industrial structures
- Emissions of new man-created carbon atoms, released into atmosphere as Radioactive Carbon and Methane
- Environmental remediation of closed nuclear facilities
- Disposal and burial of voluminous amounts of so-called “low-level” nuclear waste (all the structures and components and materials which are contaminated, but not themselves spent fuel)
- Long-term on-site containment of high-level nuclear waste (spent fuel)
- Permanent disposal of high-level nuclear waste, including the construction and maintenance of all waste depositories

Nuclear power plants also create carbon-14 (C-14), which is an anthropogenic form of carbon with a half-life of about 5,730 years. The C-14 created by nuclear plants thus adds to the inventory of carbon. It is false and unscientific to call nuclear a clean or greenhouse gas emission free form of power.

EIS Assertions

Nuclear power plants, under controlled conditions, release small amounts of radioactive elements.

(pp 3-183 / 247)

“Radiation doses to the public from continued operation are expected to continue at current levels and would remain below regulatory limits during the SLR term.” (p 3-184 / 248)

Comments

A vast body of evidence contradicts the NRC’s implicit argument that the radiation doses from nuclear delivered to humans and biota are beyond concern. In any event, there is no basis to assume doses would remain at current (we would argue unprotective) levels or remain below regulatory limits. Regulatory limits are extremely outdated, as the NAS has stated. (NAS 2022)

RISK TO REGION & NATION

EIS Assertions

“The utility and transportation infrastructure at nuclear power plants typically interfaces with public infrastructure systems available in the region. Such infrastructure includes utilities, such as suppliers of electricity, fuel, and water, as well as roads and railroads that provide access to the site.” (p 2-7 / 49)

“The transmission lines that are in scope for the Monticello SLR environmental review are onsite and are not accessible to the general public”. (p 2-7 / 49). “The NRC staff also considers, as part of the proposed continued operation of the transmission lines that supply outside power to the nuclear plant from the grid.” (pp 2-7 – 2-8 / 49-50)

Comments

The EIS puts forth an unacceptable and fallacious narrowing of the aperture when it comes to accident and security risk overall. This is demonstrably evident in the absence of discussion about the potential consequences of extreme floodings, drought, and storms.

EIS Assertions

Under the no-action alternative, Monticello would cease operation at the end of the term. (p 3-208 / 272)

The effects of climate change on Monticello structures, systems and components are outside the scope of the NRC staff’s SLR environmental review. …

(pp 3-220 – 3-221 / 284-285)

Comments

The EIS contains no discussion about the additional risk attendant to what will invariably be an increased inventory of nuclear waste at the site. This risk from decades of additional loading of hot spent fuel into the spent fuel pool.
Even during normal operational activities incidents can happen. (Lochbaum, 2013)
Spent fuel pool risks are completely ignored in the EIS. Yet a major beyond design basis challenge to a spent fuel pool presents the possibility of a catastrophic release of radioactivity into the environment. This risk has been discussed in numerous highly credible studies and papers, with a recent review in the Bulletin of the Atomic Scientists. (Leyse 2024)
Monticello is a General Electric Type 3, boiling water reactor with a Mark I containment, similar to the Fukushima Daiichi Unit 2 reactor. The spent fuel pool is located in the reactor building. With Mark I's questions have persisted for decades about the ability of the design to handle the immense pressures that would result in a loss of coolant accident (LOCA) or a serious station blackout (SBO) event. In 1975, Dale G. Bridenbaugh and two of his colleagues at GE resigned from their jobs over the Mark 1. "'The problems we identified in 1975 were that, in doing the design of the containment, they did not take into account the dynamic loads that could be experienced with a loss of coolant,' Bridenbaugh told ABC News in an interview. 'The impact loads the containment would receive by this very rapid release of energy could tear the containment apart and create an uncontrolled release.'" (ABC, 2011)

<u>WATER</u>

EIS Assertions

Monticello withdraws Mississippi River water for condenser cooling, fire protection, screen washing, and service water cooling. The plant is permitted to withdraw up to 645 cubic feet per second (cfs) of water from the Mississippi River when the river flow is greater than 860 cfs. Special withdrawal restrictions apply when the river flow is less than 860 cfs, and withdrawal restrictions apply if river flow is reduced to under 240 cfs. (p 2-4 / 46)

The intake structure river water used by the circulating water system, the service water system, and the fire protection system consists of an approach channel formed by sheet pile structures that are 98 ft (29.9 m) apart and extend 59 ft 16 (17.9 m) into the river, angled at 81º to the shoreline. At the intake structure, the approach channel reduces to approximately 63 ft (19.2 m) wide. Water enters the intake structure over an ~63 ft (19.2 m) wide concrete sill that serves as a sediment barrier. A 12.5 ft (3.8 m) wide stop log section in the center of the sill can be removed during low river levels to allow water to flow unobstructed. (p 2-5 / 47)

"On the plant side of the sill is a concrete apron extending the width of the approach channel and 16 ft (4.9 m) upstream of the bar rack. The bar rack includes a motor-operated bar rack rake that both prevents large debris from entering the intake structure and lifts debris into a trash hopper to prevent the debris from re-entering the river. Following the bar rack, the water is divided into two separate streams that flows through two parallel traveling screens located 10 ft (3.05 m) behind the bar racks. The traveling screens have ⅜ in. (0.95 cm) mesh that removes fine debris. The traveling screens are rotated and rinsed every 12 hours when the river temperature is below 50°F (10°C). When the river temperature is above 50°F (10°C), certain game fish populations tend to increase (e.g., smallmouth bass, walleye, and northern pike), and the screens are continuously rotated to avoid fish being held against the screen for extended periods. The debris, as well as any impinged organisms, are rinsed from the traveling screens into a common sluiceway that extends back to the river downstream of the intake structures." (p 2-5 / 47)

Comments

These facts point to the potentially significant way continued operation of Monticello could negatively impact aquatic life. Missing is the important discussion of thermal pollution.

EIS Assertions

“In Sections 2.2.3, 3.6.1 and 3.7.1 of its ER, Xcel Energy provides a detailed description of the surface water environment of the Monticello site including the Mississippi River system, flooding potential, and related operational interactions between the Monticello nuclear power plant and surface water resources. The NRC staff incorporates this information here by reference. Except as otherwise cited for clarity, the staff summarizes this information here and in the following subsections. The NRC staff did not identify any new and significant information regarding the surface water affected environment during the site audit, the scoping process, or as the result of its review of available information as cited in this EIS.” (p 3-27 / 91)

Comments

The incorporation of Xcel Energy’s description of water impacts in this EIS is an evasion of the NRC’s responsibility to inform the public. The fact that NRC staff did not identify any new information during a time-limited audit of the site is immaterial. The relevant issues are the potential impacts of the Mississippi on the site, and the potential impacts of extended plant operation and waste production on the Mississippi.

EIS Assertions

“Near Monticello, the Mississippi River is broad and turbulent. The main channel is approximately 980 ft (298.7 m) 42 wide, 6.2 ft (1.9 m) deep and river velocities can exceed 4.9 fps (Xcel 2023-TN9084).” (p 3-27 / 91)

“Hydrological conditions (e.g., river stage, discharge, depth, surface area, temperature, turbidity) of the Mississippi River near the Monticello site are subject to considerable seasonal variations.” (p 3-28 / 92)

“The reach of the Mississippi River (between the Clearwater and Crow Rivers) where Monticello is located is classified as an ‘outstanding resource value water – restricted.’ This classification is assigned to high-quality waters and waters that have exceptional recreation, cultural, aesthetic, or scientific value for which new or expanded waste discharges are restricted”. (pp 3-30-3-31 / 94-95)

Two types of flooding can occur within the Upper Mississippi River drainage basin in which Monticello is situated: backwater flooding and open-water flooding. Backwater flooding usually is caused by ice jams in the river. Open-water flooding results from runoff-producing rains, snowmelt, or both. The most serious flooding throughout the basin has been associated with a combination of excessive rainfall and snowmelt.

The Federal Emergency Management Agency (FEMA) has mapped most of the nuclear power plant site, including the entire main nuclear power plant complex encompassing the nuclear island as Uncus X, which represents areas of 25 minimal flood hazard and lies outside the 0.2% annual chance flood (500 year flood level). (p 3-31 /95)

Comments

Extreme flooding events are precisely the kinds of hazard conditions which mandate a comprehensive and robust evaluation of risk. Unfortunately, this is absent in the EIS.

FEMA mapping has strong limitations. Aside from not being up-to-date, the mapping does not include detailed analyses of how water will interact with geographic and other conditions at a granular site level. And 500 years are now occurring with disturbing frequency in the US. (For example the Houston area experienced three 500-year floods in just 3 years, including the Memorial Day floods in 2015 and 2016, and Hurricane Harvey in 2017. Detroit experienced 500-year flooding in 2014 and 2021. In between it experienced major floodings in 2016, 2019, and 2020.) In any event, use of the 100-year, 500-year and 1000-year flood terminology is a risk assessment tool used for flood insurance (estimating a 1 in x number of year chance of occurring in any given year). It is not an indication that a major flooding event only happens once every 100, 500 or 1000 years. Further, when rainfall falls in a basin, it is highly unlikely that the same amount falls uniformly throughout the basin. Actual impacts and localized flooding in any area will also be affected by the quantity of rain falling in a specific amount of time, the level

of soil saturation before a storm, and other conditions that can influence runoff. (See, e.g., USGHS 2018)

EIS Assertions

Under the NRC's general design criteria (10 CFR Part 50, Appendix A, General Design Criteria for Nuclear Power Plants, "nuclear power plant structures, systems, and components important to safety must be designed to withstand the effects of natural phenomena, such as flooding, without loss of capability to perform safety functions." (p 3-31 / 95) "Additionally, the NRC staff evaluates nuclear power plant operating conditions and physical infrastructure to ensure ongoing safe operations through its Reactor Oversight Process, which is separate from the NRC's license renewal review process. If new information about changing environmental conditions becomes available, the NRC will evaluate the new information to determine if any safety-related changes are needed. The NRC also evaluates new information important to flood projections and independently confirms that a licensee's actions appropriately consider potential changes in flooding hazards at the site." (p 3-33 / 97)

Comments

Pointing to the existence of a regulatory scheme is not evaluation of anything. Either the NRC staff has failed to conduct an in-depth evaluation of potential consequences, or the EIS represents an effort to avoid revelation of the NRC staff's findings. It is hard to decide which course of decision is more troubling.

EIS Assertions

NRC licensees must comply with provisions of the Clean Water Act (CWA) and associated requirements imposed by the EPA or state. "Xcel Energy's NPDES permit … provides a detailed description of the MPCA-permitted outfalls, effluent (water quality) monitoring requirements and a description of the main processes that contribute flow to each outfall. The NRC staff incorporates this information here by reference. NPDES permits are normally issued on a 5-year cycle. MPCA reissued Monticello's NPDES permit in May 2023. … Based on its review, NRC staff did not identify any substantial changes in the 2023 permit conditions as compared to the previous issuance." (p 3-33 /97) "Xcel Energy's NPDES permit specifies the pollutant-specific discharge limitations and monitoring requirements for effluents discharged through each outfall/monitoring station to ensure that discharges from Monticello comply with applicable water quality standards." (p 3-33 /97) "Over the period of 2016 to August 2022, there have been no NOV or non-compliances associated with Monticello wastewater discharges to receiving surface waters." (p 3-33 /97)

Based on the Industry Groundwater Protection Initiative promulgated by the Nuclear Energy Institute (NEI) in 2019, Monticello implemented a Groundwater Protection Program (GWPP) in 2008 "to ensure timely and effective management of situations involving inadvertent releases of licensed material to groundwater (Xcel 2023-TN9084)." (p 3-40 / 104) As part of the GWPP, Monticello monitors groundwater via onsite monitoring wells for tritium, gamma-emitting nuclides, difficult to detect radionuclides, environmental conditions, and groundwater elevation in accordance with their site-specific procedures. ... Locations near to higher-risk systems, structures, and components are monitored monthly for tritium and quarterly for gamma-emitting nuclides." (p 3-40 / 104)

No radioactive materials due to plant operations were detected in offsite samples from 2018 to 2022, but elevated tritium concentrations were measured on site at a well – MW-9A – since installation of the well in 2009. Investigations found that tritiated process water from the turbine building likely migrated through the building's concrete basemat into the groundwater. In 2011, Xcel undertook corrective actions, including installing sump linings and discontinuing the use of embedded piping. It was then also believed

that the plume of tritiated water in the vicinity of the well was stagnant. On November 21, 2022, however, a sample from MW-9A recorded a tritium concentration of 5,020,000 pCi/L. Xcel notified the NRC and State of Minnesota of the finding. … Beginning in December 2022, Xcel expanded Monticello's network of monitoring wells to better assess the extent of the tritium plume. On December 21, 2022, Xcel Energy identified the leak location as a 3 in. (7.62 cm) condensate to control rod drive (CRD) suction line pipe between the reactor building and the turbine building. In January 2023, Xcel initiated diversion of the leak using a catchment system coupled with a groundwater recovery system which directed the effluent to holding tanks, waste process systems, and/or for reuse onsite. Then, on March 23, 2023, sampling showed the effluent was no longer contained within the catchment system. On March 25, 2023, the plant was fully shut down. Xcel then removed and replaced the CRD suction pipe. (pp 3-41 – 3-42 / 105-106)

On May 23, 2023, Xcel Energy reported to the NRC and State of Minnesota that 300–600 gallons of water with 194,000 pCi/L tritium activity had been released from a holding tank associated with the ongoing remediation efforts back to the area from which it was pumped. (p 3-43 / 107)

"Corrective action measures are ongoing to recover the tritium plume in onsite groundwater and minimize the discharge of tritiated groundwater to the Mississippi River. Eight pumping wells for tritium extraction have been installed since the detection of the leak, two of which were monitoring wells that were over-drilled and converted to pumping wells. A storage pond was constructed for managing recovered groundwater with elevated tritium activity. A water balance analysis estimated the volume of water released into the subsurface from the initial leak to be 829,000 ±68,100 gal (3,138,106 ± 257,786 L), with a total activity of 4.0 ±1.2 Ci (99 percent of the activity from tritium). As of October 2023, approximately 6.6 million gal (25 million L) of tritium-contaminated groundwater had been pumped from onsite wells." (p 3-43 / 107)

Comments

Again, the NRC staff's incorporation of Xcel information by reference rather than by exposition is unacceptably nontransparent.

Further, the staff's focus on changes in permit conditions and Xcel Energy programs side-steps the relevant area of inquiry. What is of interest to the public is: What is the potential cumulative level of hazardous effluent releases which may be unleashed upon the Monticello region and the Mississippi River by allowing an aging reactor, stressed by all reasonably foreseeable climate conditions, to keep running until mid-century?

What is quite clear is that Xcel Energy's May 2023 NPDES permit and Monticello's Groundwater Protection Program did nothing to prevent sizable accidental release of tritium into the site, its groundwater, and – to a post ipso facto unknown degree – into the Mississippi River.

Indeed, the events surrounding the tritium release illuminate three important points. One is that having regulation is not evidence of being adequate. Two is that having regulation does not mean it will be complied with. Three is that stuff happens, meaning uncertainty – of which there is a considerable quantity with respect to this and other SLRs – must be provided far more identification and weight in NRC EISs. The glaring omission of, and failure to stress uncertainty when observed, constitutes a de facto fraud upon the public. No more is this more glaring than with the intimation that standards are sufficiently protective of either the health of the public or the environment, particularly source water ecosystems.

Contrary to the NRC's false and unfounded assurances, the National Academies' "Leveraging Advances in Modern Science to Revitalize Low-Dose Radiation Research in the United States" report is quite clear: "Low-dose and low-dose-rate radiation effects on human health outcomes and the biological mechanisms of these effects are not fully understood." (NAS 2022, p 1). Moreover, there is "increasing evidence that low-dose radiation exposure may be associated with non-cancer health outcomes such as cardiovascular disease, neurological disorders,

immune dysfunction, and cataracts." (NAS 2022, p 1). The NAS report further notes that Doses from industrial applications (including operation of nuclear power plants) "are of concern to the impacted communities due to the disproportionate level of exposure compared to the general U.S. population and the higher past exposures" (NAS, 2022, p 13)

The NAS report confirmed deficiencies in the current radiation protection system which have been raised by public health experts and advocates for years, to wit:

- "Estimates cancer risks resulting from low-dose and low-dose-rate exposures based on interpolations from health effects observed in populations exposed to higher doses of radiation and to types of radiation that are different from those that may be of most relevance to the general population."
- "Assumes that stochastic effects are limited to cancer, despite accumulating evidence of effects on non-cancer outcomes including circulatory diseases, neurological disorders, immune dysfunction, and cataracts"
- "Derives risk estimates from population averages that do not account for the known or potential variation in sensitivity among individuals due to genetic, lifestyle, and environmental factors."

(NAS 2022, p 53, Box 3.1 Current Assumptions of the Radiation Protection System)

The NAS also highlighted the fact that "the U.S. NRC's regulations for protection against radiation (known as *10 CFR Part 20*) are still based primarily on scientific publications issued in the 1970s". (NAS 2022, p 55)

The NRC's dismissal of the tritium hazard is particularly worrisome, because tritium (3H) is radioactive water, which makes it readily ingested or inhaled (as vapor) and its distribution into the environment a matter which should be of high concern. Once inside biota and human beings, the radioactive beta decay can lead to the disruption of molecular structures and intermolecular bonds.

As water, tritium entering the body will enter the cytoplasm of virtually every cell, a biologic event which has been poorly explored, but which mechanistically is manifestly implicated in the potentiality of initiation of cascading dysfunctional innate immune response.

Moreover, tritium can be integrated into organic molecules in the form of organically bound tritium (OBT). As a consequence, OBT can remain in body tissues affecting bodily processes for a prolonged period. The tritium that replaces hydrogen in a carbon-hydrogen bond is difficult to remove and is, therefore, referred to as non-exchangeable organically bound tritium (OBT).

As Dr. Arjun Makhijani wrote in his groundbreaking 2023 monograph, "Exploring Tritium Dangers: Health and Ecosystem Risks of Internally Incorporated Radionuclides", tritium, with a half-life of 12.3 years, persists in the environment for decades (in diminishing amounts as it decays). Yet its half-life is short enough that it is extremely radioactive. "For a given mass, it is, for instance, about 150,000 times as radioactive, in terms of disintegrations per unit time, as plutonium 239. One teaspoon of tritiated water (as HTO) would contaminate about 100 billion gallons of water to the U.S. drinking water limit; that is enough to supply about 1 million homes with water for a year." (Makhijani 2023, pp 4-5) The combination of tritium's two properties "– tritiated water is chemically like ordinary water and tritium is highly radioactive – makes tritium a very pernicious pollutant that is difficult to contain and, once in the water, very difficult to remediate; in trace amounts, remediation is essentially impossible." (Makhijani 2023, p 21) Both tritiated water and organically bound tritium can cross the placenta and irradiate developing fetuses *in utero*. (Makhijani 2023, p 22)

The concern is not just for humans, because tritium (3H) "is one of the most biologically significant radionuclides", it can pollute the biosphere on local, regional, and global scales. (Bondareva, 2022) Tritium contamination may result in an imbalance in the natural equilibrium in water ecosystems. Disequilibrium can be introduced via vegetation and in microorganisms, which are the basic and simplest organisms of aquatic ecosystems, whose metabolic products may influence all water inhabitants. As Bondareva, et al note: "Fish are sensitive to a wide

variety of direct impacts and integrate the adverse effects of the entire range of different impacts, including impacts on other components of the aquatic ecosystem (habitat, macroinvertebrates, primary products, etc.). The dose loads on fish bodies are formed due to external radiation (from water and bottom sediments) and, internal radiation (from incorporated radionuclides)." (Bondareva, 2022)

Because tritium is actually the radioactive form of water, the fact that it can be readily ingested or inhaled (as vapor) makes its distribution into the environment of high concern. Once inside biota and human beings, the radioactive beta decay leads to the disruption of molecular structures and intermolecular bonds.

EIS Assertions

"Monticello, located in Wright County, is in the central groundwater province of Minnesota. … The Cambrian-Ordovician aquifer system is a major source of groundwater in southeastern Minnesota for public, domestic, agriculture, and industrial uses (USGS 1992-TN9637). The Cambrian-Ordovician aquifer system overlies a crystalline-rock aquifer of low water-bearing capacity (USGS 1992-TN9637)." (p 3-36 / 100) "Water generally flows toward the Mississippi River in the surficial aquifers, while deeper bedrock groundwater flow tends to be to the southeast regionally (Xcel 2021-TN9633). At Monticello, a similar trend in groundwater flow is observed with some variation due to interference from plant structure foundations". (p 3-36 / 100) "The surficial aquifer system supplies the majority of groundwater (72 percent) in Wright County … The public supply well nearest to Monticello is registered to the River Terrace Mobile Home Park, which serves approximately 250 people and is approximately 2 mi (3.2 km) southeast of the plant. The City of Monticello uses groundwater from the surficial aquifer system and sandstone aquifer for public water supply." (p 3-38 / 102)

Comments

The vital nature of the aquifer to the area and the potential risk posed by contaminants delivered over the course of decades to agriculture and drinking water should be given prominent consideration in the EIS. The tritium release alone should have served as a red flag. What is relevant is not only current condition and use of the aquifer and groundwater, but potential future conditions and use needs. From what we can tell, the NRC staff merely adopted its customary boilerplate dismissal of risk to water.

Since the issuance of the NRC Groundwater Task Force Final Report nearly 15 years ago, we are aware of no publicly issued update. The findings in that report are telling. They included the following:

- A September 2006 Liquid Radioactive Release Lessons Learned Task Force (LRRLLTF) focused on releases of radioactive liquids that were unplanned and unmonitored (ADAMS Accession No. ML062650312). Most of the incidents involved tritium, but other radioactive isotopes were found to have been also inadvertently been released to the environment.
- (p B-1)
- NRC has not fully developed a learning environment that ensures lessons are captured and communicated within NRC.
- (p B-6)
- The voluntary industry initiative is neither a requirement nor standard; therefore, the inspection reports used the term discrepancy to identify areas of incomplete implementation of the voluntary initiative.
- (p B-7)
- Going forward, incidents involving a loss of confinement of licensed material may increase. Because of power uprates and longer life reactor cores, the inventory of tritium

in the fleet has been and is increasing. These facilities will likely have more losses of confinement from non-safety related systems.

- (p B-7)
- The GTF concluded that NRC inspection response to incidents of leaks/spills has varied widely. As a result, NRC's response has been inconsistent and unpredictable, and expenditures of inspection resources have varied significantly.
- (p B-8)
- The radiological effluent PI reporting requirement does not provide meaningful data.
- (p B-8)

(U.S. NRC: Groundwater Task Force Final Report)

The continuing NRC disinclination to recognize risk to groundwater and source waters from aging buried systems at nuclear power plants is indicative of pro-nuclear industry bias.

CONCLUSION

CIECP and PHASE respectfully request the NRC adopt the No Action alternative.

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