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Office of Administration

ATTN: Program Management, Announcements and Editing Staff

Mail Stop: TWFN-7-A60M ❖

U.S. Nuclear Regulatory Commission

Washington, DC 20555-0001

*Via email only to PalisadesRestartEnvironmental@nrc.gov and Stacy.Schumann@nrc.gov*

RE: Scoping comments for Environmental Assessment of Palisades Nuclear Plant,  
Docket ID NRC-2024-0076

Dear Office of Administration of the Nuclear Regulatory Commission:

The undersigned organizations \_\_\_\_\_

and proffer the below scoping comments for the NEPA document which must be compiled as part of the NRC licensing of Palisades Nuclear Plant to operate in the future.

**I. An Environmental Impact Statement (EIS), Not an Environmental Assessment (EA), Is Required By 10 CFR § 51.20**

The NRC has committed to compilation of an environmental assessment (EA) instead of an environmental impact statement (EIS) or a supplemental environmental impact statement (SEIS). This is legally unsupported.

Presently, pursuant to 10 CFR § 50.82(a)(2), the 10 CFR part 50 renewed facility operating license for Palisades no longer authorizes operation of the reactor or emplacement or retention of fuel in the reactor vessel. The facility is still authorized to possess, and store irradiated (*i.e.*, spent) nuclear fuel.<sup>1</sup> Palisades' spent fuel is currently stored in the spent fuel pool there, and in dry cask storage at the independent spent fuel storage installation (ISFSI).

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<sup>1</sup> Notice, Holtec Decommissioning International, LLC, and Holtec Palisades, LLC; Palisades Nuclear Plant; Exemption (January 4, 2024), <https://www.federalregister.gov/documents/2024/01/04/2023-28951/holtec-decommissioning-international-llc-and-holtec-palisades-llc-palisades-nuclear-plant-exemption>

Holtec seeks the issuance or renewal of a full power or design capacity license to operate Palisades, *i.e.*, an operating license. When Entergy voluntarily ended operations (and the need for the OL), the license devolved into a “possession only” license. Assuming without conceding that the *ad hoc* relicensing pathway proposed by Holtec is in any way appropriate, the obligatory NEPA compilation for the Palisades restart is not an EA, but instead, an EIS, pursuant to the mandatory wording of § 51.20(b)(2):

(b) The following types of actions require an environmental impact statement or a supplement to an environmental impact statement:

(2) ***Issuance or renewal of a full power or design capacity license*** to operate a nuclear power reactor, testing facility, or fuel reprocessing plant under part 50 of this chapter, or a combined license under part 52 of this chapter.

Because 10 CFR § 51.20(b)(2) encompasses Holtec’s objective of having a full power or design capacity license, the company must file an application for a new OL, accompanied by an Environmental Impact Statement. Otherwise, the NRC will stand in violation of 10 CFR § 51.21:

All licensing and regulatory actions subject to this subpart require an environmental assessment except those identified in § 51.20(b) as requiring an environmental impact statement, those identified in § 51.22(c) as categorical exclusions, and those identified in § 51.22(d) as other actions not requiring environmental review.

10 CFR § 51.21.

NRC regulations at 10 CFR § 51.20(b) list the circumstances where an EIS or SEIS is required. There is no regulatory pathway to “reverse” a possession-only license back to an operating license. That explains why the essence of Holtec’s exemption request at the Palisades is to pole vault backwards over the shutdown and decommissioning steps in 10 CFR § 50.82(a)(2) that were discharged in May and June 2022. The NRC regulations do not contemplate such an unprecedented maneuver. Holtec’s only recourse is to submit an application for a new operating license pursuant to 10 CFR Part 50 and for the NEPA document to be an EIS, not an EA.

The Palisades restart, if allowed, would be an unprecedented reversal of the mothballing of a nuclear plant to renewed operation. It is a “major federal action” under the National Environmental Policy Act. *See Scientists’ Institute for Public Information, Inc. v. Atomic Energy Commission*, 481 F.2d 1079, 1088 (D.C. Cir. 1973), (there is “Federal action” within the meaning of the statute not only when an agency proposes to build a facility itself, but also whenever an agency makes a decision which permits action by other parties which will affect the quality of the environment).

Holtec has indicated to the NRC its intention to apply for a license extension after what Holtec believes would be the expiration of current licensing in 2031. However, the within commenters’ position is that a new operating license application must be made by Holtec, and that there can be no mere resumption of the former operating license under the Atomic Energy Act. The within commenters demand that a new license application be submitted by Holtec that would implicate a license period appropriate to the actual physical conditions of relevant

components of the Palisades reactor, along with supporting infrastructure and plant-specific environmental circumstances.

## **II. A Programmatic Environmental Impact Statement Is Necessitated**

The Palisades licensing controversy is unique insofar as the licensing pathway from permanent shutdown and back to operability has never taken place under the Atomic Energy Act, which does not appear to contemplate such a track. The determinations being made by the NRC here will likely set legal precedents for at least two other shutdown reactor reversals under contemplation, at Duane Arnold Energy Center in Iowa and Three Mile Island, Unit 1 in Pennsylvania.<sup>2</sup> There are some environmental considerations in common as to the three reactors, and there may even be more reactors returned from mothballs and partial dismantling implications at each reactor. A Programmatic Environmental Impact Statement (PEIS) is warranted, and demanded by the within commenters.

The Supreme Court has recognized the need for national programmatic environmental analysis under NEPA where a program “is a coherent plan of national scope, and its adoption surely has significant environmental consequences.” *Kleppe v. Sierra Club*, 427 U.S. 390, 400 (1976). Programmatic direction can often help “determine the scope of future site-specific proposals.” *Laub v. U.S. Dep’t of Interior*, 342 F.3d 1080, 1089 (9th Cir. 2003). CEQ regulations define this practice as “tiering.” 40 C.F.R. § 1502.20.

## **III. Climate Chaos Effects Must Be Investigated and Analyzed in an EIS**

Notably, there are two 300 MWe small modular reactors, or SMRs, anticipated to be constructed on the Palisades plant compound site in the 2030s. Difficulties caused by climate chaos effects to those power plants may have synergistic or cumulative implications for the Palisades Nuclear Plant.

### ***A. Extreme Weather and Natural Disaster Potential***

Extreme weather from the onset of climate chaos, and its possible interactive effects with natural disasters pose risks for Palisades.<sup>3</sup> The possibility of earthquakes, lake seiches and variable Lake Michigan water levels all are present at Palisades. In 2020, Lake Michigan had historic high water levels. This meant that the lakeside dry cask storage was significantly closer than the often cited 150 yards to the waters of Lake Michigan. Whether from tornadoes, hurricanes (like the deadly White Hurricane blizzard of 1913 on Lake Huron, the natural disaster causing the largest loss of life on the Great Lakes and its shores in history), floods, shoreline erosion of fragile sand dunes and beaches, wildfires, etc., the list of extreme weather threats to the reactor(s) and radioactive wastes at Palisades is long and will grow with intensifying climate destabilization. The Government Accountability Office<sup>4</sup> (GAO, Congress's investigative arm),

<sup>2</sup> <https://neutronbytes.com/2024/07/06/long-shot-restart-efforts-for-duane-arnold-and-tmi-1/>

<sup>3</sup> See generally Kevin Kamps, “The Safety and Reliability – or Lack Thereof – of Nuclear Reactors in a Destabilized Climate,” (slideshow), Nuclear Information & Resource Service (NIRS) [www.nirs.org](http://www.nirs.org) Takoma Park, MD, (July 8, 2006), at <http://archives.nirs.us/climate/background/ieerprestationjuly82006.pdf>

<sup>4</sup> “NRC Should Take Actions to Fully Consider the Potential Effects of Climate Change,” GAO-24-106326 (Government Accountability Office, April 2024), <https://www.gao.gov/assets/d2410632>

and a Yale University scholar<sup>5</sup> have excoriated NRC for neglecting climate risks, and have questioned the U.S. nuclear power industry's ability to operate reactors (and on-site radioactive waste storage, for that matter) safely, during ever more extreme weather conditions. The GAO found a “high” prospective flood hazard level at Palisades that would be attributable to unstable climate circumstances.<sup>6</sup>

#### B. Efficacy of Cooling Tower Array

Adequacy of the cooling tower array to mitigate thermal pollution and the greenhouse effects of water vapor from the cooling tower array at Palisades must be investigated and analyzed. The cooling tower array is quite old by industry standards. As the ambient air becomes more humid, the performance of Palisades’ wet cooling towers will fall.<sup>7</sup>

The constant humidity from cooling towers can expand the volume of microbes capable of causing dangerous illnesses like legionnaires’ disease<sup>8</sup> and amoebic meningitis.<sup>9</sup> The trend toward warmer water in the Great Lakes from anthropocene climate change is unmistakable, and future operations of Palisades – particularly with the cumulative cooling water usage from Lake Michigan that will occur if small modular reactors are built near Palisades – may directly combine to prompt conditions for very contagious illnesses that must be assessed and addressed under NEPA.

### **IV. A Purpose and Need Statement is Missing But Required**

There is no purpose and need statement appearing in the document the NRC considers to suffice for Holtec’s Environmental Report.<sup>10</sup> A purpose and need statement is required for an Environmental Impact Statement, 40 CFR § 1502.13, and also for an Environmental Assessment, 10 CFR § 51.30(a)(1)(i).

### **V. Presentation and Discussion of Alternatives is Missing But Required**

There is no presentation of alternatives, even a no-action alternative, in the Holtec ER. Under NEPA, Holtec’s environmental review must “rigorously explore and objectively evaluate all reasonable alternatives.” 40 C.F.R. § 1502.14(a). NEPA requires a “searching inquiry into

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6.pdf

<sup>5</sup> James Dinneen, “Can Aging U.S. Nuclear Power Plants Withstand More Extreme Weather?” <https://e360.yale.edu/digest/u.s.-nuclear-power-climate-change>

<sup>6</sup> See fn. 4 *infra*, p. 63.

<sup>7</sup> <https://deltacooling.com/resources/news/understanding-wet-bulb-temperatures-and-how-it-affects-cooling-tower-performance>

<sup>8</sup> <https://www.getchemready.com/water-facts/what-are-the-risks-of-legionella-in-cooling-tower-water/>

<sup>9</sup> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8619718/>

<sup>10</sup> The NRC Staff has indicated that it considers Holtec’s September 28, 2023, “Request for Exemption from Certain Termination of License Requirements of 10 CFR 50.82” (ADAMS Accession No. ML23271A140), specifically Enclosure 2, “Environmental New and Significant Review Proposed Resumption of Power Operations Palisades Nuclear Plant,” to suffice as a Holtec Environmental Report. References in these comments to the “Holtec ER” are to ADAMS Accession No. ML23271A140.

alternatives.” *Simmons v. U.S. Army Corps of Eng'rs*, 120 F.3d 664, 666 (7th Cir.1997). Identification and discussion of alternatives to the project must appear in an Environmental Assessment for an NRC license. 10 CFR § 51.30(a)(1)(ii and iii).

NEPA regulations also require a discussion of a no-action alternative. 40 C.F.R. § 1502.14(d). The purpose of the no-action alternative is to “compare the potential impacts of the proposed major federal action to the known impacts of maintaining the status quo.” *Custer Cnty. Action Ass'n v. Garvey*, 256 F.3d 1024, 1040 (10th Cir. 2001).

NEPA expects a “substantial treatment of each alternative” to be considered in an EIS. 40 C.F.R. § 1502.14(b); see also, *Southeast Alaska Conservation Council v. FHWA*, 649 F.3d 1050 (9th Cir. 2011).

Notably, the “no-action” alternative is the *de facto* circumstance presently in the Palisades power distribution region. Regional grid administrators had timely prepared for the permanent cessation of operations and for more than two years there has been adequate power for all purposes in that portion of the regional electrical grid which formerly received power from Palisades. Effects on present and planned power grid arrangements caused by restoration of Palisades to operation must be encompassed within the scope of the NEPA document here.

## **VI. There Are Cumulative Risks and Environmental Impacts from Unreplaced and Unrefurbished Plant and Equipment Requiring NEPA Identification and Analysis as Potentially Damaging to the Environment**

Concerns, usually framed as safety-related, also implicate potentially large negative environmental impacts. A Palisades reactor core meltdown at the Palisades reactor would have large environmental impacts for the Great Lakes region. Palisades has long had multiple high-risk pathways to meltdown, including the single worst neutron-embrittled reactor pressure vessel in the country,<sup>11</sup> at risk of through-wall fracture. The plant has steam generators and a reactor vessel closure head, or lid, that have needed replacement for two decades.

Full replacement of the steam generators at Palisades may well be required,<sup>12</sup> at a cost of \$510 million. In mid-2022, Holtec had paid some lip service to repairing tubes, or even entirely replacing the steam generators (at a cost of \$510 million), in a secret bailout application to DOE,<sup>13</sup> obtained from the State of Michigan via a Freedom of Information request submitted by Beyond Nuclear. But recently, Holtec spokesman Nick Culp revealed the company no longer plans to repair or replace the dangerously age-degraded steam generators.<sup>14</sup>

Although Holtec seems to ignore the need to also replace Palisades’ reactor vessel closure head, previous owner Consumers Energy acknowledged the need to do this as long ago as May 2006.<sup>15</sup> Replacement of the reactor vessel closure head also represents another significant construction impact.

Another significant construction impact is the need to address chronic control rod drive mechanism (CRDM) seal failures. A CRDM seal leak forced Entergy to close Palisades 11 days

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<sup>11</sup> NRC letter 4/18/2013, <http://pbadupws.nrc.gov/docs/ML1310/ML13108A336.pdf>

<sup>12</sup> Holtec DOE Application, pp. 4, 7, <https://beyondnuclear.org/wp-content/uploads/2023/10/7-5-22-42-p-age-Holtec-application-to-DOE-for-CNC-funds-to-restart-Palisades.pdf>

<sup>13</sup> <https://beyondnuclear.org/5775-2/>

<sup>14</sup> <https://beyondnuclear.org/wp-content/uploads/2024/07/ni240405-1.pdf>

<sup>15</sup> <http://archives.nirs.us/reactorwatch/licensing/kampsconsbrifeinf051806.htm>

earlier than planned, on May 20, 2022. Palisades has suffered CRDM seal leaks since 1972, a uniquely bad operating experience, as documented by David Lochbaum, retired Nuclear Safety Project director at Union of Concerned Scientists.<sup>16</sup> As Lochbaum concluded, little more than band-aid fixes have been applied to this chronic problem at Palisades. The root cause and a comprehensive solution – that is, preventative corrective action – has never been achieved at Palisades, not in more than a half-century. Given their location very near the reactor core, replacement of CRDM seals exposes workers to significant doses of hazardous radiation, putting their health at risk – risk that must be quantified and analyzed. Around a decade ago, Entergy chose to entirely replace its CRDM infrastructure. In the course of the work, 192 workers were exposed to high radiation doses during this near-core job, including young women of child-bearing age.<sup>17</sup> Despite this complete replacement of CRDM infrastructure, Palisades continued to experience CRDM seal leaks during its last several years of operations.

Additionally, there are additional problems with Palisades' physical structure that are extraordinary and reveal that the physical condition of the Palisades Plant deteriorated terribly while Entergy was the owner. There are many examples of this degradation, including but not limited to:

- The steam generators must be manufactured and constructed for the second time.
- The reactor is dangerously embrittled because the wrong welding material was used in 1969 during manufacture.
- The reactor head has needed replacement since at least 2009, which may account for continuing Control Rod Drive failures, which Palisades is infamous for.
- The interior piping has become excessively radioactive and needs to be cleaned with caustic chemicals to reduce radiation exposure. (Item #6, \$25 Million
- Physical improvements to the switchyard are also identified (Table 3, Item #2) and require new construction.
- Incredibly, Entergy appears to have sold its inventory of safety-related replacement parts, forcing Holtec to spend at least \$18 Million to find NOS (New Old Stock) replacement parts on eBay!
- The Flow Accelerated Corrosion Program, similar to the failed program at the Surry reactor in Virginia that caused the death of four staff members at the Surry reactor when a pipe ruptured, must be recreated (Item# 5b Table 2, \$ 4 million).
- The safety-related wires operating the Control Rod Drives and Incore instrumentation have degraded and require construction (Item# 8, \$16 Million).<sup>18</sup>

Holtec appears not to have performed active maintenance of safety-significant systems, structures, and components since taking over on June 28, 2022. Holtec has not put the steam generators into wet layup, so significant degradation may have already occurred.<sup>19</sup> Respecting the huge turbine shaft that turns the generator, Arnold Gundersen states:

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<sup>16</sup> Lochbaum, “Headaches at Palisades: Broken Seals and Failed Heals,”

<https://www.nrc.gov/docs/ML1035/ML103540571.pdf>

<sup>17</sup> <https://archive.beyondnuclear.org/safety/2014/12/11/nrc-cites-palisades-for-worker-radiological-safety-violation.html>; NRC White Finding,

<https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML15056A072>

<sup>18</sup> Declaration of Arnold Gundersen, pp. 16-17,

<https://beyondnuclear.org/wp-content/uploads/2023/12/12-5-23-CURRICULUM-VITAE-Palisades-APPX-10-COMPILED.pdf>

<sup>19</sup> Gundersen Declaration, Apx. 10, p. 11.

The main plant turbine generator weighs well in excess of one million pounds and is about 100 feet long. If left idle for extended periods, the weight of the turbine will cause the main shaft to bend and the bearings will develop flat spots. Hence, if Entergy had planned to restart Palisades, it would have placed the turbine on a turning gear to keep it slowly rotating while it was shut down. Since Palisades was sold as scrap, no such precautions would have been taken. When a plant is decommissioned, no such wet layup and preventive maintenance would be required as the reactor has become non-functioning scrap. Holtec knew it bought a non-functioning scrap reactor from Entergy that was meant to be entirely dismantled.<sup>20</sup>

Holtec has not operated pumps and valves, so these may not function properly if called upon during full power operations.<sup>21</sup>

An NRC-commissioned, Sandia National Lab 1982 CRAC-2 report has documented the shocking number of casualties and property damage that would result from a core meltdown at Palisades. CRAC is short for Calculation of Reactor Accident Consequences. The report is also referred to as the Sandia Siting Report, as well as NUREG/CR-2239.<sup>22</sup> For Palisades, CRAC-2 reported that a reactor core meltdown would cause 1,000 peak early fatalities (acute radiation poisoning deaths), 7,000 radiation injuries, and 10,000 latent cancer fatalities. CRAC-2 reported property damage would be more than \$52 billion.

But adjusting for inflation alone, those property damage figures from 1982 would surmount \$163 billion in present day dollar figures. And as Associated Press investigative journalist Jeff Donn reported in his post-Fukushima four-part series “Aging Nukes,” populations have soared since 1982 around reactors like Palisades, so today expected casualties would be significantly worse.

Fire protection<sup>24</sup> and containment coating/sump strainer upgrades, also needed 20 years ago, have likewise been largely to entirely neglected. According to retired Union of Concerned Scientists nuclear safety director Dave Lochbaum, fire represents 50% of the risk of core meltdown at atomic reactors. And inadequate sump strainers mean that containment coating debris could clog emergency cooling water flow pathways, as former Entergy senior engineer Alan Blind, who worked for six years at Palisades, has explained.<sup>25</sup> All these admissions about safety-significant systems, structures, and components in need of replacement, or significant upgrade, were made by Palisades’ initial owner, Consumers Energy, to the Michigan Public Service Commission, in spring 2006. Yet Entergy never fixed any of this, during its ownership tenure from 2007 to 2022 — because the industry-captured NRC, in full regulatory retreat, did

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<sup>20</sup> Gundersen Declaration, pp. 12-13, Apx. 10.

<sup>21</sup> *Id.*

<sup>22</sup> [archives.nirs.us/reactorwatch/licensing/pg2.jpg](https://archives.nirs.us/reactorwatch/licensing/pg2.jpg)

<sup>23</sup> <https://www.nrc.gov/docs/ML0723/ML072320420.pdf>

<sup>24</sup> <https://archive.beyondnuclear.org/safety/2016/7/9/beyond-nuclear-backgrounder-re-fire-security-risks-at-palisa.html>

<sup>25</sup> <https://podcasts.apple.com/us/podcast/radioactive-raindrops-the-view-from-inside-palisades/id1745885298?i=1000655273297>

not require it.<sup>26</sup> Now Holtec plans to continue to run Palisades into the ground, with at best inadequate monitoring and minimal repairs.

## **VII. Cumulative and Synergistic Site Risks from Construction of Additional Reactors Onsite**

Yet another risk to consider is Holtec's publicly stated intention to build two so-called SMR-300s (Small Modular Nuclear Reactors of 300-Megawatts-electric capacity each) at the Palisades site.<sup>27</sup> SMR-300 new builds would bring together breakdown phase risks at the age-degraded restarted Palisades reactor with break-in phase risks at the SMRs.

Palisades will continue to experience worsening age-related degradation, breakdown phase risks, from August 2025 to 2051 (Holtec has announced application for a 2031 to 2051 license extension, amounting to 80 years of operations, twice the initial 40 years.) The two SMRs will each have their own break-in phase risks. Chernobyl Unit 4 in Ukraine in 1986, Three Mile Island Unit 2 in Pennsylvania in 1979, and Fermi Unit 1 in Monroe County, Michigan in 1966, are examples of break-in phase reactor disasters. Fermi Unit 1's partial core meltdown in Monroe County, Michigan, on October 5, 1966, documented in We Almost Lost Detroit.<sup>28</sup>

Three reactors operating on the tiny, 432-acre Palisades site would also represent a risk of multiple, domino-effect reactor core meltdowns, as happened at Fukushima Daiichi, Japan in March 2011.

NEPA requires the evaluation of projects which are likely to be accompanied by significant environmental events to be based, in part, on potential or actual public health effects, and also for the assessment of direct and indirect project impacts to be cumulative. NEPA requires "an agency to evaluate 'cumulative impacts' along with the direct and indirect impacts of a proposed action." *TOMAC, Taxpayers of Michigan Against Casinos v. Norton*, 433 F.3d 852, 864 (D.C. Cir. 2006) (citing *Grand Canyon Tr. v. FAA*, 290 F.3d 339, 345 (D.C. Cir. 2002)). A cumulative impact is "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." 40 C.F.R. § 1508.7. Consideration of cumulative impacts must also consider "[c]losely related and proposed or reasonably foreseeable actions that are related by timing or geography." *Vieux Carre Prop. Owners, Residents, Assocs., Inc. v. Pierce*, 719 F.2d 1272, 1277 (5th Cir. 1983).

These potential accident scenarios, and others, must be made part of the risk assessment conducted for the restart of Palisades and disclosed in the NEPA document.

## **VIII. Palisades' Tritium Problem**

Tritium leakage and migration through groundwater beneath and surrounding Palisades is becoming a major problem. Tritium is radioactive Hydrogen and thus radioactive water travels easily and is often a harbinger of other leaking radioisotopes from a nuclear plant. It can go

<sup>26</sup> <https://www.ap.org/media-center/press-releases/2012/aging-nukes-a-four-part-investigative-series-by-jeff-donn/>

<sup>27</sup> <https://holtecinternational.com/2023/12/04/first-two-smr-300-units-slated-to-be-built-at-michigans-palisades-site-for-commissioning-by-mid-2030/>

<sup>28</sup> Fuller, John, We Almost Lost Detroit, <https://www.amazon.com/Almost-Lost-Detroit-John-Fuller/dp/0345252667>

anywhere in the human anatomy, right down to the DNA molecule. It poses from 123 to 246 years of hazard. Cesium-137 (a muscle-seeker), causes around 300 to 600 years of hazard. Strontium-90 (a bone-seeker), around 300 to 600 years of hazard; Carbon-14 (which can also go anywhere in the human body, right down to the DNA molecule), 55,000 to 110,000 years of hazard; Plutonium-239, 240,000 to 480,000 years of hazard; Iodine-129, 157 to 314 million years of hazard; to name but a small number of the more than 200 hazardous artificial radioactive isotopes contained in irradiated nuclear fuel.

#### A. *Tritium Problems at Palisades Date at Least to 2007*

In 2007, groundwater monitoring equipment at Palisades detected a leak from a tank onsite that contained tritium water. That water made its way into the groundwater and from there into Lake Michigan.<sup>29</sup> The tank was repaired, but additional sections of piping have had leaks in the years since and needed to be fixed.

Since 2009, the only target radionuclide detected above its minimum detectable activity (MDA) has been tritium.<sup>30</sup> Until 2021, tritium was detected at fluctuating levels in onsite wells north of storage tanks. Concentrations were below the U.S. Environmental Protection Agency (EPA) drinking water maximum contaminant level (MCL) of 20,000 picoCuries per liter (pCi/L). Between 2013 and 2018, tritium was detected in two monitoring wells, MW-2 and MW-1 1, and in six temporary monitoring wells at concentrations that fluctuated over time but remained below its MCL. Underground piping leaks were identified and repaired; tritium concentrations subsequently decreased, remaining below the EPA MCL.

In 2019 through 2022, GPI monitoring was conducted in the 23 monitoring wells and 16 of the 18 temporary monitoring wells. In 2019, tritium was detected above its MCL in wells within an area approximately 200 feet wide (north to south) and 120 feet long (east to west) near the plant.<sup>31</sup> Tritium was detected in 2020 above its MCL in three monitoring wells (MW-2, MW-3, and MW-1 1) and several temporary monitoring wells with a maximum detection of 63, 153 pCi/L in TW-10. These wells had been contaminated with previously discharged radiological effluents. High lake levels and consequently high mixing basin levels is believed to have caused some of the effluent to migrate to a storm drain that normally discharges into the mixing basin. The extent of this leakage polluted an area 270 feet wide by 90 feet long. These tritium detections were determined to be the result of recapture of previously accounted-for effluents.<sup>32</sup>

Between October 2019 and January 2020, an increasing trend in tritium concentrations was observed in five temporary monitoring wells and two permanent groundwater monitoring wells. No gamma isotopes were detected, however.<sup>33</sup> The heating boiler rooms' sump and the underground piping that discharges to it were determined to be a potential source of tritium impacts to groundwater; therefore, cured-in-place liners were installed in the underground piping

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<sup>29</sup> [https://www.mlive.com/news/kalamazoo/2013/05/leak\\_at\\_palisades\\_nuclear\\_plan.html](https://www.mlive.com/news/kalamazoo/2013/05/leak_at_palisades_nuclear_plan.html)

<sup>30</sup> Palisades ER p. 25.

<sup>31</sup> *Id.*

<sup>32</sup> *Id.*

<sup>33</sup> *Id.* at p. 26.

in 2020, and a chemical coating and seal were applied to the sump cavity. During installation of the underground pipe liner, it was difficult to install the line through two of the elbows; therefore, the elbows were excavated and replaced in 2021.

In 2022, tritium was detected above its MCL in two wells with a maximum detection of 32,254 pCi/L in MW-2. Wells in which tritium was detected above the MDA in 2022 are within an area of approximately 280 feet wide by 40 feet long. (Entergy 2022b; HDI 2023b). Data collected in 2023 showed that tritium was not detected above MDAs in the monitoring wells.<sup>34</sup>

In May 2022, tritium in the IC switchgear sump located within the protected area reached a concentration of as high as 645,255 pCi/L but at least no plant-related gamma isotopes were detected.<sup>35</sup> Investigation showed that the tritium leaked either the tank T-91 recirculation line or the transfer line between tanks T-87 and T-91. The tanks and associated underground piping were flushed with domestic water, and tank T-91 was removed from recirculation after it was flushed and drained. Tritium detections in the sump steadily decreased to typical levels pCi/L.<sup>36</sup> Remediation and repairs are planned as part of the resumption of power operations efforts. Holtec plans to cap the underground piping, install aboveground piping, and reroute radwaste through the above ground pipes.<sup>37</sup> Holtec currently believes that “any tritium impacts are limited to the upper 10 to 15 feet of the dune sand aquifer (Entergy 2019; Entergy 2020; Entergy 2021b; Entergy 2022b; I-IDI 2023b).”<sup>38</sup>

### *B. Tritium Is an Understated Health Threat*

The lightest of all radionuclides, tritium, or H3, has largely escaped public and scientific scrutiny. This is surprising given that tritium is usually the single largest radioactive substance emitted as a part of normal nuclear power plant operations.<sup>39</sup> Contrary to some popular notions that tritium is a relatively benign radiation source, the vast majority of published studies indicate that exposures, especially those related to internal exposures, can have significant biological consequences including damage to DNA, impaired physiology and development, reduced fertility and longevity, and can lead to elevated risks of diseases including cancer.<sup>40</sup> Tritium is a very underrated environmental toxin that deserves much greater scrutiny.

In his book, Exploring Tritium Dangers, Dr. Arjun Makhijani states that “tritium crosses the placenta with facility,” and that by ionizing water in the cytoplasm, it “set[s] in motion processes that can profoundly disrupt mitochondrial DNA and hence the system that converts

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<sup>34</sup> *Id.*

<sup>35</sup> *Id.*

<sup>36</sup> *Id.*

<sup>37</sup> *Id.*

<sup>38</sup> *Id.*

<sup>39</sup> Mousseau, Timothy and Todd, Sarah A., Biological Consequences of Exposure to Radioactive Hydrogen (Tritium): A Comprehensive Survey of the Literature (April 11, 2023), Abstract. Available at SSRN: <https://ssrn.com/abstract=4416674> or <http://dx.doi.org/10.2139/ssrn.4416674>

<sup>40</sup> *Id.*

food to usable form, ATP, that the body uses for all functions.”<sup>41</sup> By “affecting ova during the time of their formation *in utero* and during the time of the maturation during pregnancy,” he continues, tritium can “exemplify the ways in which other internal emitters can have non-cancer impacts, including during the early period of pregnancy, when internal radiation can result in miscarriages and malformations.”<sup>42</sup>

Dr. Makhijani, who is president of the longtime Institute for Energy and Environmental Research in Takoma Park, Maryland and holds a Ph.D. from Berkeley in nuclear fusion, further asserts that tritium is “about 150,000 times as radioactive, in terms of disintegrations per unit time, as plutonium-239.” One teaspoon of tritiated water would contaminate about 100 billion gallons of water to the U.S. drinking water limit, enough to supply about 1 million homes with water for a year.<sup>43</sup> It becomes easier to imagine contamination of a large share of the Great Lakes from just one poorly-managed chronic leaking nuclear plant in light of this.

The presence of tritium as a byproduct of generating electricity at nuclear power plants is growing as those plants age. In 2014, the NRC admitted that “[T]ritium levels as high as 3.2 million pCi/L have been reported to the NRC in the ground water at some nuclear power plants.”<sup>44</sup>

### C. Tritium at Palisades Isn't Trivial

Nuclear power plants may have a mile or more of water and drainage pipes built into their foundations and laying immediately beneath them. At Palisades, the leakage is so pervasive and voluminous that Holtec is resorting to constructing new pipe connections to bring them to the surface and to build bypasses over and around buried and inaccessible pipes. One of the reasons that the undersigned commenters are insisting that a new license, and not merely an amended license to operate based on a suspect exemption be required is the entrenched, difficult to mitigate or reverse tritium leakage that is a given from Palisades' nearly 60 year old plant structures. In the decades since the plant opened, there is considerably more population in the neighborhood of Palisades, and also, in the communities up and down the Lake Michigan shore, many of which draw drinking water from the Lake but also use it for recreation such as skiing, boating, fishing and swimming, all of which mean contact with the waters of Lake Michigan. Given that Holtec is signaling interest in reopening Palisades for perhaps 26 years of operation, the tritium leakage is probably going to worsen and may do so exponentially given the age of pipes and concrete, not to mention shifts in the soil in which the plant reposes. Monitoring and especially remediation will become larger obligations of the plant owner. Requiring an entirely new license and for Palisades to meet contemporary construction and operating standards is legally required. Remediation and mitigation is a hit-or-miss proposition at best and cannot provide an overall solution. This must be addressed at length in the NEPA document associated with the pending license change request.

## IX. Irradiated Fuel Management and Storage Issues

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<sup>41</sup> Makhijani, Arjun, Exploring Tritium Dangers, p. 5 (Opus Self-Publishing Services 2022), <https://ieer.org/wp/wp-content/uploads/2023/02/Exploring-Tritium-Dangers.pdf>

<sup>42</sup> *Id.* at p. 5.

<sup>43</sup> *Id.* at p. 5.

<sup>44</sup> <https://www.federalregister.gov/documents/2014/02/04/2014-02307/environmental-radiation-protection-standards-for-nuclear-power-operations>

### A. Voluminous Radioactive Waste Is Stored at Palisades

Past and potential present and future environmental impacts resulting from the ongoing problem of radioactive waste storage at Palisades are significant. More than 800 metric tons of highly radioactive irradiated nuclear fuel have accumulated onsite at Palisades. Around two-thirds is still stored in the wet indoor storage pool; one-third is stored in a growing number of outdoor dry casks, near the Lake Michigan shore. As with operating reactor core meltdowns, catastrophic amounts of hazardous radioactivity can also be released into the environment from radioactive waste disasters, such as a fire in the pool-stored waste, or a dry cask breach. As a matter of fact, Palisades narrowly averted catastrophe in October 2005<sup>45</sup> under previous owner Consumers Energy, due to the near-drop of a 107-ton load into the pool: the floor could have been pierced, draining cooling water, leading to overheating and ignition of the zirconium metal cladding of the stored highly radioactive irradiated nuclear fuel. Since the pool is not located within a radiological containment structure, radioactivity releases from the hundreds of metric tons of densely packed fuel would be large-scale, and directly into the environment. Princeton University researchers reported in 2016 that a radioactive waste pool fire could contaminate a large region of the United States downwind, leading to millions of nuclear evacuees, and trillions (with a T) of dollars in property damage.<sup>46</sup> A near-miss waste pool fire at Fukushima Daiichi Unit 4 in March and April 2011, very narrowly averted through sheer luck,<sup>47</sup> led the then-serving Japanese Prime Minister, Naoto Kan, to order an emergency contingency plan to evacuate 35 to 50 million people from northeastern Japan and metro Tokyo. He said it would have been the end of the Japanese state. ***The Palisades pool is more densely packed with irradiated nuclear fuel than was the pool at Fukushima Daiichi Unit 4.***

### B. Cask No. 4, an Experiment No One Needs

Dry cask storage at Palisades has been controversial and risky from the start in 1993. The fourth cask to be loaded, in summer 1994, was quickly announced by then-owner Consumers Energy to be defective. Weld defects were detected in the 130-ton VSC-24 cask after it was loaded in 1994. Engineers for then-owner Consumers Energy predicted that placing the thermally hot inner canister which contains the thermally hot SNF into the 100 degree F. indoor storage pool water while the SNF was at 400 degrees C. (750 degrees F.) could cause a steam flash and thermal shock to container and fuel. The steam flash could expose workers to dangerous radiation doses, while the thermal shock could degrade the canister and fuel, making physical conditions even worse than they already are. They determined that the SNF could not be adequately cooled during the short window of time to cut into the storage cask and move SNF into a transfer cask. Disruption of the convection air flow needed, by design, to cool the cask's contents would cause overheating and violate the cask's technical specifications. Director's Decision DD-97-1, *Consumers Power Company* (Palisades Nuclear Plant), 45 NRC 33, 37-38 (1997). As a result, Cask No. 4 was not opened and has been left on the storage pad at Palisades

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<sup>45</sup> <http://archives.nirs.us/reactorwatch/licensing/caskdanglesummaryreport4406.pdf>

<sup>46</sup> <https://archive.beyondnuclear.org/on-site-storage/2016/5/26/spent-fuel-fire-on-us-soil-could-dwarf-impact-of-fukushima.html>

<sup>47</sup> <https://static1.1.sqspcdn.com/static/f/356082/27045322/1464275575100/May+2016+SNF+pool+Fukushima+Lessons+Learned.pdf?token=E8jQplcGhGcRqI3caKiMOa5lqOc%3D>

in defective condition for the ensuing 30 years. Remediation in order to move the SNF in Cask No. 4 will have to happen someday, and whenever it takes place, it will be dangerous and expensive.

The continued and possibly unstable presence of Cask No. 4 must be investigated under NEPA and disclosed for its environmental effects and implications of those effects.

### *C. Seismic Problems with Dry Cask Storage Pads*

In February 1994, Dr. Ross Landsman, dry cask storage inspector at NRC Region 3 in Chicago, warned the agency that the original storage pad at Palisades for dry casks, just 150 yards or less from the water of Lake Michigan, violated NRC earthquake safety regulations.<sup>48</sup> This was due to the pad “floating” on 55-feet of loose sand underneath, anchored to nothing. He warned that even a mild earthquake could part the beach, allowing the Lake to fill the void. One or more dry casks could be buried under sand, leading to overheating. Or, they could tumble into the Lake, submerging. Breaches of casks could then lead to radioactive releases into the Lake. Dr. Landsman, then retired from NRC and serving as an expert witness for the environmental coalition opposing Palisades, warned in 2006-2007 that the second pad at Palisades, located somewhat further inland from the Lake, also violated NRC earthquake safety regulations.<sup>49</sup> In Holtec’s own December 2020 Post-Shutdown Decommissioning Activities Report, the company seemed to lend credence to Dr. Landsman’s warning about the nearer-Lake, older pad — Holtec proposed transferring all the dry casks to the newer pad, further inland. But given Dr. Landsman’s 2006-2007 warning about the newer pad, this could simply be jumping from the frying pan into the fire.

A breached, submerged cask could lead to an inadvertent nuclear criticality event within the highly radioactive waste. If the waste formed a critical mass during the disaster, infiltrating Lake water could serve as a neutron moderator, sparking a chain reaction. This would worsen radioactive releases into the Lake, and would make emergency response operations a potential suicide mission, given the fatal radiation emissions due to breach of radiation shielding, as well as containment.

### *D. Prospective Radioactive Waste Inventory Would Have Environmental Effects*

The proposed Palisades restart would mean that the highly radioactive waste inventory stored onsite at Palisades would grow by around 15 metric tons per year, from 2025 to 2051. Thus, the associated large impacts on the environment would grow. Holtec’s proposed SMR-300 new builds at Palisades (and also at Big Rock Point), absent economies of scale in the generation of electric power, would each generate more highly radioactive waste per unit of electricity generated than Palisades. Drs. Allison Macfarlane, and Rodney Ewing, President Obama’s NRC chair and U.S. Nuclear Waste Technical Review Board chair, respectively, reported recently that, depending on their specific design, SMRs will generate 2 to 30 times the radioactive waste, as compared to current reactors, per unit of electricity generated.<sup>50</sup> Holtec’s SMR new build schemes would exacerbate the Palisades reactor restart scheme to manage high-level radioactive waste at the site, situations which must be documented and analyzed under NEPA.

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<sup>48</sup> <http://archives.nirs.us/reactorwatch/licensing/021794rosslandsmanltrnrcchairmanselin.pdf>

<sup>49</sup> <http://archives.nirs.us/reactorwatch/licensing/020207landsmandec.pdf>

<sup>50</sup> <https://www.pnas.org/doi/full/10.1073/pnas.2111833119>

## X. Cumulative Effects of Routine Releases of Radioactivity

Palisades' so-called "routine releases" of hazardous radioactivity since 1971 have been significant. These include planned and permitted radiation releases,<sup>51</sup> but also unplanned or unpermitted leaks and spills.<sup>52</sup> Palisades' "routine" releases of radioactive and toxic chemical wastewater into Lake Michigan — including seasonal "batch releases" — are harmful to Lake Michigan, its fisheries and ecology. Lake Michigan serves as the drinking water supply for a very large number of shoreline communities, from South Haven, to Chicago, and beyond. Some 16 million people drink Lake Michigan water, not only in Michigan, but also Indiana, Illinois, and Wisconsin. Such discharges of artificial radioactive substances from Palisades into Lake Michigan do not dilute — they increase the concentration of such artificial radioactive hazards in the Lake, and in fact the radioactivity bio-accumulates, bio-concentrates, and bio-magnifies up the ecosystem and food chain, as via fisheries, harming animals at the top of the ecosystem/food chain, from predators to people. As the U.S. National Academies of Science have repeatedly confirmed for decades, citing the long-established "Linear, No Threshold" theory<sup>53</sup> which forms the very foundation of the Biological Effects of Ionizing Radioactivity reports, any exposure to ionizing radiation, no matter how small, still carries a health risk, such as cancer causation; and such risks accumulate over a lifetime. Such risks are not limited to cancer, but also include radiogenic birth defects, genetic damage, and a very long list of other health risks, maladies, and morbidities. Given that Lake Michigan water is also used for agricultural irrigation, hazardous radioactive contamination of the food supply can also occur via this exposure pathway.

The Palisades zombie reactor restart will involve cumulative effects, on top of the 1971-2022 operational impacts on the environment thus far. This will include not only "routine releases" of hazardous radioactivity and toxic chemicals (planned/permitted, as well as unplanned/unpermitted leaks, spills, etc.) from 2025 to 2051 at the restarted zombie reactor (likely worse than in the past, given the nuclear power plant's severe age-related degradation), but also "routine releases" from the SMR-300 new builds. The environmental impacts are not only cumulative, but also synergistic. As Rachel Carson warned in her iconic book Silent Spring in 1962, credited with helping launch the environmental protection movement, hazardous ionizing radioactivity and toxic chemicals have synergistic negative impacts on the environment — the harm from the synergistic hazardous exposures is greater than the sum of their parts.

A NEPA document must examine a proposal's direct, indirect and cumulative effects.<sup>54</sup> 42 U.S.C. § 4332(C)(iii); 40 C.F.R. §§ 1502.16, 1508.7, 1508.8.<sup>55</sup> The Council on Environmental

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<sup>51</sup> [http://static1.1.sqspcdn.com/static/f/356082/26605366/1444852853757/BN\\_RoutineRadioactiveReleases\\_Oct2015.pdf?token=zwsUExAyfOttAa88dOgh7qJ3NkE%3D](http://static1.1.sqspcdn.com/static/f/356082/26605366/1444852853757/BN_RoutineRadioactiveReleases_Oct2015.pdf?token=zwsUExAyfOttAa88dOgh7qJ3NkE%3D)

<sup>52</sup> <https://archive.beyondnuclear.org/reports/>

<sup>53</sup> <http://archives.nirs.us/press/06-30-2005/1>

<sup>54</sup> "Effects" and "impacts" are synonymous as they are used in NEPA's implementing regulations. 40 C.F.R. § 1508.8.

<sup>55</sup> "Direct" environmental effects "are caused by the [agency's] action and occur at the same time and place." 40 C.F.R. § 1508.8. "Indirect" environmental effects "are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." *Id.* "Cumulative" environmental effects account for "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." *Id.* § 1508.7.

Quality (CEQ) mandates that environmental impact assessments and statements include “impacts, which may be cumulative” within their scope. 40 CFR § 1508.25(c).

An EA, like an EIS, must take a “hard look” at the environmental consequences of the proposed action, *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n.21 (1976), including its direct, indirect, and cumulative effects, see *EarthReports, Inc. v. FERC*, 828 F.3d 949, 953 (D.C. Cir. 2016); 40 C.F.R. §§ 1508.9, 1508.25(c). NEPA requires “an agency to evaluate ‘cumulative impacts’ along with the direct and indirect impacts of a proposed action.” *TOMAC, Taxpayers of Michigan Against Casinos v. Norton*, 433 F.3d 852, 864 (D.C. Cir. 2006) (citing *Grand Canyon Tr. v. FAA*, 290 F.3d 339, 345 (D.C. Cir. 2002)). A cumulative impact is “the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.” 40 C.F.R. § 1508.7. “Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” *Id.* § 1508.7.

A NEPA cumulative impact analysis must include discussion of “other actions—past, present, and proposed, and reasonably foreseeable—that have had or are expected to have impacts in the same area,” “the impacts or expected impacts from these other actions,” and “the overall impact that can be expected if the individual impacts are allowed to accumulate.” *Grand Canyon Tr.*, 290 F.3d at 345.

Respectfully,

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