

**Hudson River Sloop Clearwater Comments Submitted**  
**to the US Nuclear Regulatory Commission**  
**on Holtec's Planned Shut-down Activities Report (PSDAR)**  
**Submitted July 29, 2021**

Problems with Holtec's planned spent fuel handling and dry storage systems include:

**Cask and Canister issues:** There is a 20 - 25 year warranty on canisters and cask system; what will happen after that? Will fuel assemblies need to be moved again?

- Holtec plans to continue to use a containment system for Spent Nuclear Fuel (SNF) of thin-walled canisters ( $\frac{1}{2}$ " --  $\frac{5}{8}$ ") inside thicker concrete casks lined up like bowling pins on a concrete tarmac -- a configuration which is more vulnerable to terrorism than Hardened Onsite Storage (HOSS), which could be much safer and should be explored. In Europe and many other countries nuclear waste is stored in more robust canister systems (10" - 20" thick) and often in hardened buildings.
- Visual inspection of canisters is not adequate (see below under monitoring). There are no pressure monitors or relief valves to assess and protect canister integrity. The Nuclear Waste Technical Review Board (NWTRB) recommends that Spent Nuclear Fuel (SNF) and its containment must be *maintained, monitored, and retrievable* in a manner that prevents radioactive leaks and hydrogen gas explosion.
- The radiation release limit of 10 mRem embodied in Joint Proposal should be honored, as opposed to the 25 mRem required by NRC

**High Burnup Fuel:** About 60% of Indian Point's spent fuel inventory is high-burnup (HBU) fuel, which is much hotter and more radioactive than ordinary spent fuel, and requires at least seven years or more before moving it to dry cask storage. Holtec's plan to compress this process to three years or less may reduce costs, but also puts workers and the surrounding community in jeopardy.

**Inadequate Site Remediation:** Holtec's preliminary Post Activities Shutdown Report (PSDAR) indicates that it will do nothing to remediate radiological contamination known to be leaking into the groundwater and the Hudson River, and that it will only superficially remediate contaminated soils,

**Radiation Monitoring:** Holtec's Post shutdown plan makes no provision for effective, accurate, off-site radiation monitoring despite the fact that radioactive particles and gasses are expected to be released into the air during the demolition of structures on site. The NRC has no requirement for offsite monitoring and therefore absolves Holtec from paying for it. There is also no plan to detect increasing pressure or temperature, container crack formation, or other problems that can lead to radiation leakage from the sealed thin-walled canisters they plan to use -- nor any way to respond to and remediate a leak or other failure, should it occur.

- Perimeter monitoring is not adequate to capture issues directly at the work site which can impact the workers.
- Offsite monitoring is needed, especially at the nearby elementary school.
- At Bruce Units 1 & 2 in Ontario, Canada more than 500 workers were exposed to radioactive dust and volatilized isotopes while cutting channel tubes that needed to be replaced.

**Pipeline Risks:** Indian Point is not only located at the intersection of two earthquake faults, it is also unique in that it has the Algonquin and a new 42" high-pressure AIM gas pipelines running under and adjacent to the facility. No other nuclear site in the nation is so threatened by pipelines. Demolition work inherent to decommissioning elevates the hazard. NYS and multiple independent experts recognize the risk. However, the pipelines are not even mentioned in Holtec's PSDAR. The NRC's Office of Inspector General (OIG) harshly criticized the NRC staff for dismissing the danger of an explosion as "not credible, and instead ignoring key data and tailoring its modeling of explosion risks to fit the desired foregone conclusion that no action is necessary.

**Earthquake Zones** should be studied further to have a full picture of the environment in which the decommissioning will take place. Request information from Columbia University Lamont Doherty Earth Observatory (LDEO)

- North Anna: Dominion is seeking a license to build a new plant, despite the Aug. 23 earthquake at North Anna 1 & 2, which didn't meet seismic standards -- but they are now designing Unit 3 to do so. Units 1 & 2 are still operating
- Information on two earthquake zones has been scrubbed from record

**Emergency Planning and Response:** In the Joint Proposal, NYSDHSES will oversee Emergency Management and Response, with funding provided by Holtec, starting at \$1,000,000 per reactor in 2022, decreasing when all the radioactive fuel is move to dry cask storage and then dropping to \$250,00 -- \$750,000 depending on when that transfer is completed, and to \$100,000 after Partial Site Release and as low as \$25,000 until License Termination. Although dangers resulting from failure of a reactor, steam turbines, transformer explosions or other major failures have decreased since the plant ceased operation, nearly 2,000 tons of highly radioactive fuel is stored on site and dismantling the facility poses new dangers and the need for emergency planning will continue as long as waste is stored on site. The funding schedule is clear but not the actual emergency evacuation plan for various occurrences.

- Oyster Creek has a transfer pit, but no onsite overpack. It will take many hours or days to get one transported from Camden to Lacey Township and it is questionable whether this is an effective solution or whether a very expensive hot cell is needed.

**Transportation:** Holtec's plan envisions shipping Indian Point's radioactive waste, including highly radioactive spent fuel, down the Hudson River by barge.

- Barging contaminated materials down the Hudson River through NY Harbor poses a risk to river towns and the greater NYC Metropolitan area.
- As the high-level nuclear waste is transported across the country, it will threaten the safety of communities along the transport routes, especially EJ populations in under-represented cities and rural areas.
- A 2019 Department of Energy (DOE) Gap Analysis indicates that more needs to be understood about the impact of changing the vertical orientation used in dry cask storage to a horizontal orientation for transport, including increased temperature and possibility of degrading the cladding which hold the fuel pellets in place in the fuel rod. It recommended additional modelling, which is not being done.
- Aging infrastructure along transportation routes -- road, bridges, overpasses, and tunnels -- has not been assessed to see if it is capable of handling 120,000 metric tons of nuclear waste

that would be sent to proposed Consolidated "Interim" Storage (CIS) in Texas or New Mexico -- let alone preparing for effective emergency response should an accident occur due to failed infrastructure and/or other causes. Note: Interim is in quotes because, if allowed, it could well become indefinite, if not permanent.

**Environmental Justice Concerns:** The operation and decommissioning of nuclear power plants, transportation and storage of spent nuclear fuel disproportionately impacts communities of color and low income in reactor communities, such as those at and surrounding Indian Point, those transportation routes, and especially indigenous and Latinx communities at potential recipient communities in TX and NM.

- Leona Morgan, Dine activist, gave a compelling overview of the long history of harmful impacts to the Downwinders from the Trinity Atomic test site, uranium mining, milling, processing, transportation and now storage. These communities -- mainly indigenous and Latinx -- have been burdened with radiation exposure and have suffered health and other impacts and should not be forced to host most of the 3,200 spent fuel canisters -- the nuclear waste from nearly 100 reactors across the nation.
- The proposed CIS facilities are collocated in areas of fossil fuel extraction -- including active oil fields and hydraulic fracking sites, which can induce earthquakes.
- Holtec's plans for off-site transport of radioactive waste, shipping Indian Point's spent fuel to New Mexico to be stored at Holtec's consolidated interim storage facility are unacceptably dangerous, and violate the principles of environmental justice and consent-based siting, as well as federal law, which prohibits interim storage before a permanent repository is sited.

Because transportation is so dangerous and the proposed CIS storage is both unjust and unlawful, we must be very certain that onsite storage is done as safely as possible.

### **Pressing need for Nuclear Harvesting and Autopsy, especially to inform License Extension**

**Applications:** Reactor owners are now seeking 40 - 60 - 80 year license extensions, but little to nothing has been learned about effects of operations on aging. Indian Point can serve as a pilot to design an engineered testing system to send samples for autopsy. We need regulations requiring autopsy of closing reactors so that lawmakers and the NRC and other regulatory bodies will have information on which to base future decisions, especially in the face of so many license extension applications. The *Seattle Times* will publish an article on this in Sept, which we will add to the NRC and NYS Decommissioning Oversight Board dockets.

**Financial Risk to New Yorkers:** With the License Transfer, Holtec has taken over the \$2.3 billion plus Decommissioning Trust Fund. While NYS has negotiated some important financial assurances, Holtec is a privately owned company with no financial transparency. Ultimately, if everything does not go according to Holtec's Plan, New York taxpayers may be left holding the bag.

**NRC Oversight:** Given its history of easily granting waivers and exemptions to the nuclear industry, often at the expense of public health and safety, and of at times not following its own regulations, the NRC has been described as an "industry-captured agency".

- Frank von Hippel, former assistant director for national security in the White House Office of Science and Technology, recently wrote, "*Over the past two decades, the NRC has been*

*captured by the nuclear power companies it is supposed to regulate. The process of capture and resulting erosion of regulation has been driven in part by the increasingly poor economics of nuclear energy as companies struggle to avoid large costs due to additional safety measures. However, the path has been laid to a potential disaster."*

- NRC ignores or dismisses many of the problems cited above. It has allowed Holtec to make unauthorized and flawed design changes stand, has exempted Spent Nuclear Fuel (SNG) containment from meeting American Society of Mechanical Engineers Standard (ASME) Standards, ignored NWTRB recommendations, and made other decisions that compromise their role as regulators and could have severe consequences.
- This is a chance for the NRC to honor its mission by putting public health and safety and environmental protection before industry profit and making wise decisions that include planning for worst case scenarios, rather than dismissing those as "not credible."

On Feb. 25, 2021, Clearwater submitted a more detailed document on Holtec's PSDAR as contained in the License Transfer Application and the Joint Proposal to the NYS Public Service Commission, which is attached to these brief comments.

Thank you for considering these comments.



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To the Public Service Commission:

Regarding the Joint Proposal (JP) for resolving CASE 19-E-0730, in the matter of license transfer of Indian Point to Holtec, Clearwater would like to thank the New York State Public Service Commission (PSC) and the parties to the negotiations, which have borne fruit. We recognize that in some ways the JP would advance the public interest, including in the area of financial assurance.

But we also agree with national and local groups and concerned citizens that continue oppose the license to transfer to Holtec. We note that many of their substantive concerns about how Holtec will conduct decommissioning and spent fuel management at Indian Point, and the dangers their approach will pose to our region, are not remedied by the JP. In most cases, the JP addresses them only tangentially or not at all.

Clearwater has consistently opposed Holtec and its joint venture with SNC-Lavalin taking over Indian Point due to their long record of malfeasance, Holtec's poor performance at other nuclear plants, its flawed dry storage system for spent fuel, its denigration of public concerns and citizen advisory functions, and its adversarial and often litigious relationships with public officials. For example, Holtec is currently under investigation in New Jersey for lying to state officials. Local objections to Holtec license applications have, thus far, prompted Attorneys General in four states (New York, Massachusetts, Michigan, and New Mexico) to intervene against Holtec, and/or sue the NRC to halt the licensing process. A well-documented summary of Holtec's and SNC Lavalin's track record, which we have also submitted in comments to the Nuclear Regulatory Commission (NRC), is attached as an addendum to these comments, and should be part of the record of the Public Service Commission's (PSC) decision on this matter.

For the record, while it contains measures that would mitigate financial and other risks to the State, and we're grateful to the parties for negotiating those measures, the JP does not allay

our skepticism of Holtec as the licensee. We remain concerned that Holtec has not demonstrated the expertise, financial stability, ethics or trustworthiness required to conduct and complete safe decommissioning of Indian Point.

That said, we welcome the JP's requirement that Holtec maintain a minimum of \$400 million in the decommissioning trust fund (DTF) for ten years, and a minimum of \$360 million until partial site release, and additional third-party financial assurance with the New York State Department of Environmental Protection's (DEC) named as beneficiary. This will cover more contingencies and help with management of radioactivity onsite.

We also welcome Holtec's concession that it will put half of the money it recovers for spent fuel management by suing the U.S. Department of Energy (DOE) back into the DTF. That's better than the previous position of Holtec and the NRC, that Holtec would get to keep all of the DOE money it recovered, which Clearwater strongly opposed.

But as we've noted many times in public statements, the DTF is ratepayer money levied from surcharges on electric bills to fund safe decommissioning, not to enrich the licensee, and DOE money is taxpayer money. Holtec sought and received from the NRC an exemption that would allow it to pay itself out of the DTF for spent fuel management, even though this is not normally an authorized use of the DTF, which is supposed to be reserved for decommissioning proper. With this exemption from the normal restrictions of how the DTF can be used, Holtec will be well paid with ratepayer money for spent fuel management. Turning around and suing DOE to recover spent fuel management costs would in effect pay Holtec twice, at public expense, for the same services – a windfall estimated at \$600 million.

Requiring Holtec to put half the DOE money back in the DTF, and letting it keep half, is definitely an improvement over letting it keep it all. It makes it less likely that Holtec will deplete the DTF before decommissioning is finished and use its LLC subsidiary structure to walk away from the project, leaving the state and the surrounding communities with the costs and the risks. That's a significant gain. At the same time, it is also a half-measure in terms of serving the public interest and using ratepayer and taxpayer money to protect the public interest as opposed to enriching Holtec. To uphold ratepayer and taxpayer interests, we maintain that Holtec should be required to put all DOE money it recovers for spent fuel management back into the DTF.

We welcome the JP's requirement that Holtec remediate the site to the DEC radiation safety standard of 10 millirems per year rather than the more lax NRC standard of 25 millirems per year. However, the JP leaves it to Holtec (HDI) to conduct its own site characterization and investigation. This is in Holtec's interest, but not in the public interest.

Indian Point is one of the most contaminated reactor sites in the U.S. Holtec lacks financial or other incentives or the regulatory requirement to conduct comprehensive, objective assessments of the extent of the contamination. Clearwater and national groups including the Natural Resources Defense Council (NRDC) have long argued for independent, third-party site

characterization, without which we have no reliable assessment of the degree of contamination at the site, and therefore no reliable baseline for scoping site remediation work to meet State standards for release. NRDC staff scientist Bemnet Alemayehu made this case at a public forum on Indian Point decommissioning which Clearwater organized in 2019.

We welcome the JP's new reporting requirements and staff representation provisions that will keep state and local government apprised of decommissioning decisions and progress, and of cost estimates and how the DTF is being spent. This is an improvement over the status quo in which the licensee need not account for its DTF expenditures or report on its decommissioning decisions and actions, except in the most perfunctory terms. But beyond having representation and receiving reports, and beyond enforcing DEC guidance of remediating the site to a safety standard of 10 millirems a year, it's not clear from the JP what actual oversight authority state and local entities will have over Holtec's decisions, and this needs clarity.

We find the arrangement that Holtec provide funding to state agencies to monitor decommissioning and onsite management of spent fuel and radioactive waste appropriate, though we note the amounts are modest and decrease to negligible levels in 2026, a decade before planned partial site release.

Holtec's agreement to give Westchester County \$50,000 for FY2022 and \$35,000 for FY2023 to help fund emergency preparedness functions is tokenism and inadequate. Although the risk of a meltdown ends when Indian Point's reactors shut down, decommissioning entails significant ongoing risks of radiological release from dismantling and moving radioactive components, excavating radiologically contaminated soil, handling and storing spent fuel, and shipping radioactive waste, including high-level waste offsite. The JP says Holtec will agree to participate in emergency preparedness exercises with first responders as long as spent fuel remains onsite, but it is vague on what these exercises would consist of: "The parties would mutually agree on the type and scale of exercises (e.g., seminar, workshop, tabletop, etc.) Commensurate with site risks, the type and scale of exercises will transition over time."

Holtec's token payment for emergency preparedness over two years amounts to a declaration that it discounts and ignores any possibility that a serious radiological emergency could occur, but such an emergency is definitely a credible possibility, and the State has an obligation to plan for it. Protecting public health and safety and the environment demands a robust, adequately funded and staffed emergency preparedness program for the duration of decommissioning and on-site storage of radioactive waste, which we call on the State and Westchester County to establish. At the same time, we recognize that prevention of radiological accidents is more important than response. We need both. Tighter oversight of Holtec's decommissioning work is needed to guard against serious accidents, and more robust emergency preparedness measures are needed in case they occur.

Similarly, the radiation monitoring provisions in the JP are also inadequate and reflect Holtec's attitude that no serious radiological is possible, which the PSC should not adopt. Given that decommissioning is likely to release radiation into air and water, rigorous on- and off-site

monitoring and timely public notification of any detected radiological release are critically important.

The JP stipulates that HDI will conduct “area” radiation monitoring around the spent fuel pools but it does not say with what kind of equipment or where it will be placed. It provides offsite response organizations with remote access to “agreed upon offsite radiological equipment” but again does not specify type, placement or the number of monitors. Once all the spent fuel is in dry storage and placed on the independent spent fuel storage installation (ISFSI), all active monitoring ceases. The only radiation monitoring of the ISFSI mentioned in the JP is passive monitoring via personal thermoluminescent dosimeter (TLD).

There is no provision for monitoring that could actively detect radiation leakage from the dry storage canisters, and currently no provision for repairing cracks or leaks if they were to be detected. Yet we have data indicating that Holtec’s canisters could be subject to through-wall cracking and failure (see Appendix A). We need robust, active, ongoing radiation monitoring onsite and offsite, including at area schools, throughout decommissioning and onsite storage of spent fuel at Indian Point. We also need clear, timely public notification of radiation leaks from decommissioning activities and from the ISFSI.

The JP does not address the configuration of the ISFSI, e.g., whether it will stand on a concrete pad in a “bowling pin” configuration with clear sight lines which make it more vulnerable to attack, or whether it will be bermed or otherwise shielded. We assume Holtec plans the former because it’s less expensive, but this falls well short of the best practice of hardened onsite storage (HOSS), and is far inferior to systems used in Germany, Switzerland, and other countries. Using HOSS and other best practices would prevent further site contamination and reduce danger to the surrounding communities.

Especially given Indian Point’s location, with 20 million people in a 50-mile radius, we believe the State should have a role in requiring best practices for onsite storage of Indian Point’s 2000 metric tons of spent fuel. For more on spent fuel storage issues, see Appendix A below.

There is currently little or no provision in the JP for monitoring and remediating radioactive dust, yet we know that this is a significant risk in decommissioning. For example in 2009-2010, as Bruce Units 1 and 2 in Ontario were refurbished, more than 500 workers were exposed to radioactive dust and volatilized isotopes while cutting channel tubes that needed replacing. The exposure was due to lack of air monitoring at the location where the work was being done. As far as we know, the same level of monitoring will be used at Indian Point. The exposed workers were not plant employees, but contracted laborers, who inhaled plutonium and other radioactive materials for more than two weeks. They were told they did not need to wear respirators. Bruce Energy had been warned to ensure proper monitoring and that workers use personal protective equipment. They ignored the warning and then covered up the incident. To protect decommissioning workers at Indian Point, air monitoring of dust onsite is crucial. Samples should be processed right away, and workers and state agencies need to be informed of the results immediately.



The JP states that “Holtec acknowledges the presence of the Algonquin Gas Transmission Company interstate gas transmission pipelines that traverse the Site as well as the Algonquin Incremental Market line in the vicinity of the Site,” and that it will notify the New York State Department of State (DPS) and pipeline operator Enbridge five days prior to activities that may impact the pipelines, such as excavation, spent fuel handling, or heavy crossings, and ten days prior to dredging, blasting or other explosive demolition. This is an improvement over Holtec’s previous representations, for example when it [told](#) the Cortland Town Council in February 2020 it knew nothing about the Algonquin pipeline or how it would affect decommissioning. But the provisions in the JP regarding the pipeline are still inadequate to protect the public. No matter how many days’ notice Holtec gives, continuing to operate the pipeline compounds significant radiological and other risks of decommissioning. High-level radioactive waste and high-pressure gas pipelines don’t mix.

In a 2018 [joint letter](#) from DEC, DPS, NYS Department of Homeland Security and Emergency Services (DHSES), and NYS Department of Health (DOH), the State told the Chairman of Federal Energy Regulatory Commission (FERC), “Given the heavy excavator work that will be part of decommissioning, FERC may need to require Enbridge, Inc. to temporarily cease gas operations during the decommissioning activities that may threaten the pipeline integrity.” We agree.

Holtec notifying Enbridge of impactful activity is not enough to protect the public. It should also notify New York State agencies and FERC, and they should require pipeline shutdown in advance of these activities.

Many other well-founded, important safety concerns that citizens’ groups have raised regarding how Holtec would conduct Indian Point decommissioning and spent fuel management are not directly addressed by the JP. These include problems with Holtec’s plans spent fuel handling and dry storage systems, and plans announced in its preliminary Post Activities Shutdown Report (PSDAR), in which it indicated it would do nothing to remediate radiological contamination known to be leaking into the groundwater and the Hudson, that it would only superficially remediate contaminated soils, and that it envisioned shipping Indian Point’s radioactive waste, including high-level waste, down the Hudson River by barge.

Problems with Holtec’s spent fuel handling and dry storage systems are discussed below in Appendix A. Holtec’s plans for offsite transport of radioactive waste and shipping Indian Point’s spent fuel to New Mexico to be stored at Holtec’s consolidated interim storage facility are unacceptably dangerous, and violate the principles of environmental justice and consent-based siting, as well as federal law. These issues are discussed below in Appendix B.

To address those issues which remain unaddressed or only partially addressed in the JP, we will need to rely heavily on the newly created Decommissioning Oversight Board (DOB). We call on the State to empanel and convene the DOB right away to get started on providing the detailed oversight Indian Point decommissioning will clearly need. It’s particularly important that the DOB convene and address the concerns raised herein *before* a determination is made on Holtec’s Post Shutdown Activities Report (PSDAR). The composition of the DOB and its funding and powers should closely follow the recommendations in the widely supported proposed



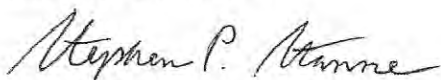
legislation S.8154b/A.10236b. In keeping with the bill, the DOB should include representatives from the local community, labor, environmental groups, first responders, and independent scientific experts, in addition to representatives of the relevant State agencies.

We recognize that according to the principle of federal preemption, safeguarding the public and the environment from radiological dangers in decommissioning is the NRC's job. But as we and leading experts keep pointing out, the NRC is not doing it. Frank von Hippel, former assistant director for national security in the White House Office of Science and Technology, recently [wrote](#), "Over the past two decades, the NRC has been captured by the nuclear power companies it is supposed to regulate. The process of capture and resulting erosion of regulation has been driven in part by the increasingly poor economics of nuclear energy as companies struggle to avoid large costs due to additional safety measures. However, the path has been laid to a potential disaster."

The same is true of decommissioning. This puts New York State under heightened obligation to use what powers it does have to oversee Indian Point's decommissioning and prevent a potential disaster. The State has jurisdiction over decommissioning-related issues, including surface water protection (i.e. from thermal heat pollution and non-radiological impacts), impacts on future energy policy and future land use, impacts on tourism and recreation, and other broad economic impacts. It also has authority over hazardous material and toxic chemical contamination at Indian Point, and an obligation protect its jurisdictional interests on behalf of New York residents and citizens. There is no hard and fast separation between these issues and radiological issues; they are all deeply intertwined.

We therefore call on the PSC and the State to make full use of the DOB and its other powers to exert robust oversight of Holtec for the duration of decommissioning and storage of spent fuel at Indian Point. The JP is a start, and will deliver certain protections for the public, especially regarding financial assurance, for which we applaud the PSC and the parties to the negotiation. But we're only at the beginning of a long road on which the State and local governments and civil society will need to work tirelessly to watchdog the decommissioning of Indian Point and the safeguarding of its spent fuel, so as to fill the vacuum left by lax NRC oversight, and protect public health and safety and the environment. Clearwater thanks the Commission and the parties to the JP for getting us started on this long road, and pledges to travel it with them on behalf of the public in the years ahead.

Respectfully submitted,



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## APPENDIX A

### PROBLEMS WITH HOLTEC'S SPENT FUEL MANAGEMENT SYSTEMS AFFECTING INDIAN POINT

Holtec's Post Activities Shutdown Report (PSDAR) filed with the NRC indicated that it plans to complete transfer of Indian Point's spent fuel from the fuel pools to dry storage in three years or less. Five years is the industry standard to allow ordinary, low-burnup spent fuel to cool (thermally and in terms of radiation) sufficiently to be moved. About 60% of Indian Point's spent fuel inventory is high-burnup (HBU) fuel, which is much more radioactive than ordinary spent fuel, and requires at least seven years or more before moving (some experts say much longer). Compressing the process to three years or less may cut costs, but also puts workers and residents in jeopardy.

The NRC approved HBU for use in civilian reactors to lengthen the time between reactor refueling and cut owner's operating costs. It generally contains a higher percentage of uranium-235, allowing reactor operators to effectively double the time between refueling. Since it stays inside reactors about twice as long as conventional fuel, when it comes out of the reactor as spent fuel, HBU is about twice as radioactive, has much higher decay heat, and is more unstable.

According to the NRC "there is limited data to show that the cladding of spent fuel with burnups greater than 45,000 MWd/MTU [megawatt-days per metric ton of uranium] will remain undamaged during the licensing period." But there is a body of research showing HBU degrades the zirconium metal cladding around the fuel rods, causing it to thin, become embrittled and fail. The same research shows that high burnup fuel temperatures make spent fuel more vulnerable to damage from handling and transport. Cladding can fail when HBU spent fuel assemblies are removed from cooling pools, vacuum dried, and placed in dry storage canisters. Failure limits for HBU in dry storage, or for newer zirconium cladding alloys (which degrade faster with HBU than older alloys) remain unknown, but the unknowns don't suggest HBU dry storage is safe – on the contrary.

There is currently no way to monitor HBU in dry storage canisters to ensure it has not become damaged, and no way for damaged HBU in canisters to be repacked in damaged fuel cans. At a minimum, HBU loaded into canisters is supposed to be surrounded by conventional low-burnup fuel to serve as a buffer. But Holtec canisters are loaded the opposite way: HBU surrounds the low-burnup fuel which enables packing more of it into the canister. The NRC acknowledged that this is a mistake. Yet despite unknown failure limits and evidence it's unsafe, the NRC continues to allow HBU to be loaded into dry storage canisters. Since the NRC concedes that "data is not currently available" to support the claim transportation of spent HBU fuel is safe, DOE researchers suggest HBU could be "trapped" at reactor sites for long periods -- presumably overloaded into canisters which aren't safe to store it. This is likely to be the case at Indian Point, where 60% of the spent fuel inventory is HBU.



Holtec uses the UMAX system of thin-walled, convection-cooled dry storage spent fuel canisters of its own manufacture. Since 2001 Holtec committed [multiple violations](#) of NRC quality assurance procedures, which are meant to insure its canisters met safety standards. The violations [included](#) Holtec changing designs in ways that did not follow NRC procedures, revising quality assurance procedures on its own without NRC approval, and taking ineffective corrective actions. Dr. Ross Landsman, NRC dry cask inspector for the Midwest regional office, wrote [a damning memo](#) to his superiors expressing full support for a whistleblower's quality assurance allegations against Holtec's storage/transport casks, but was overruled. Holtec uses its spent fuel system at the San Onofre Nuclear Generating Station (SONGS) near San Diego and at nuclear plants it acquires for decommissioning. It unilaterally changed the design of its canisters in safety-significant ways without seeking NRC permission. The NRC fined Holtec for the unauthorized change, but let it stand.

A [design flaw](#) in Holtec's redesigned canisters surfaced at SONGS during loading, when loose bolts from the shim support that holds the waste were discovered inside. Due to poor engineering, the canisters are unavoidably damaged by protrusions as they are downloaded into carbon steel-lined concrete casks and storage holes, embedding carbon particles into the canisters, and creating scratches, scraped and gouges. This hastens corrosion and cracking which can cause early canister failure. At San Onofre, loaded canisters are stored just steps away from a popular surfing beach, and subject to moisture intrusion from fog and on-shore winds along the Pacific Coast, not to mention flooding and earthquake risks.

Although the Electric Power Research Institute (EPRI) claimed ambient moisture even in the coastal environments of SONGS and the Diablo Canyon plant would be too low to dissolve salt particles, corrosive salts were nonetheless found on the canisters. At San Onofre, seagull droppings, which are highly corrosive to stainless steel, are damaging the spent fuel storage system lids, which Holtec is trying to combat with metal sprays on air vents.

Moisture intrusion also hastens corrosion of the canisters and eventual cracking and failure. Moisture and flooding also issues at the Indian Point site, where critical components sit just 15 feet above the level of the Hudson River. Problems similar to the ones encountered at San Onofre could also threaten spent fuel canisters at Indian Point.

Since the NRC is not even evaluating many key triggers for cracking in thin-walled canisters, including manufacturing defects, gouging and scratching, carbon particles, chlorides (formed by moist salt air, potash, etc.), pitting, bird droppings, mishandling, etc., Holtec's claims that its dry storage system is safe remain unsubstantiated, and lack credibility.

Spent fuel exposed to air in fuel pools or dry storage can result in hydrogen gas buildup and explosions. As spent fuel is removed from fuel pools, any remaining water is irradiated and converts to hydrogen. Uranium reacts with water to produce uranium dioxide and hydrogen, forming uranium hydride, which can further damage zirconium cladding. Hydride formation in both uranium fuel and zirconium cladding gets worse with moderate- and high-burnup fuel, which accounts for a substantial portion of U.S. spent fuel inventory. Zirconium hydride gas and



zirconium powder (which is used in fireworks and old flash bulbs) ignites at 270 degrees Celsius. Oxidation of fuel cladding also compromises fuel rod integrity, which can lead to criticality risks and buildup of potentially explosive hydrogen. Spent fuel can also go critical when exposed to unborated water (i.e. water in the environment as opposed to boron-treated water in spent fuel pools). Many reactors located in coastal areas, on islands, in flood plains and adjacent to water bodies are at risk for flooding.

Lack of monitoring inside the canisters Holtec uses means that there is no way to know how much water might infiltrate them. The canisters have no pressure monitors or pressure relief valves, but over time, buildup of gases can overpressurize the canister, embrittle the welds, and reach flammable concentrations. These risks have been documented by experts and researchers, though NRC dismisses them. It ignores the problem of hydride formation, assumes through-cracking in canisters won't happen, and concludes criticality and explosion of stored spent fuel won't occur. But that doesn't mean these risks are dismissible. On the contrary, dismissing them and failing to mitigate them makes them more of a threat.

The NRC approved thin-wall dry storage canisters of the type Holtec uses for short-term storage of spent fuel. EPRI claims it would take at least 80 years for thin-walled canisters to develop through-cracks and leak radioactivity. Yet a comparable component, a refueling water storage tank (RWST) at the Koeberg nuclear plant in South Africa, failed after just 17 years from chloride induced stress corrosion cracking triggered by corrosive salt in the marine environment. The Koeberg tank had cracks as deep as 0.61." The steel walls of thin-wall canisters used in the U.S. are 0.5" to 0.65" thick. There are over 3200 of these canisters loaded with spent fuel in the U.S. Most are about a decade old, some are as old as 27 years. More such casks are being loaded all the time. Yet they could be subject to failure in less than two decades. The NRC [acknowledged](#) in 2014 that that once cracks start they can grow through the thin wall and cause component failure in as little as 16 years. High heat loads can also accelerate component failure.

The NRC now approves more than doubling previously permitted heat loads for each storage canister, in order to accommodate faster transfer from fuel pools in fast decommissioning. It also stopped requiring verification of heat loads. When it approved the Holtec canisters, it did away with the requirement that licensees verify that the cooling is working. Today, as long as the utilities assert that heat load in each canister is under 30 kW, the NRC doesn't require proof. Monitoring canisters is obviously necessary for safe extended storage or transportation of spent fuel. But given the intense heat and radiation of loaded canisters and the difficulty of transmitting sensor signals, monitoring isn't easy to do, and the NRC has refused to require it. There is therefore no reliable way to know when the canisters might become damaged and fail.

A 2019 [Gap Analysis to Guide DOE R&D in Supporting Extended Storage and Transportation of Spent Nuclear Fuel](#) acknowledged there is currently no way to find cracks in the canisters. Even if there were a way to identify cracks, DOE also admitted there is currently no way to stop them from progressing, or to repair them. It offered no real solutions, and Holtec and the NRC have



adopted the stance the reparability is irrelevant since the canisters can't fail. Speaking about Holtec's canisters at a 2014 SONGS Community Engagement Panel meeting, Holtec CEO Kris Singh said, "It is not practical to repair a canister if it were damaged...if that canister were to develop a leak, let's be realistic; you have to find it...and then find the means to repair it; we think it's not a path forward...In the face of millions of curies of radioactivity coming out of canister; we think it's not a path forward."

At San Onofre, Holtec had a serious near-miss accident in 2018, when it nearly dropped a heavy container loaded with spent fuel dangling from a crane as it was transferred into dry cask storage, which could have resulted in a severe radiological release. The incident was kept quiet, and only came to light thanks to a whistleblower. When the SONGS Citizen Engagement Panel raised concerns about it, Holtec shot back with a vitriolic, dismissive response, and withdrew from participation in the CEP. A similar near-miss incident [occurred](#) at Michigan's Palisades nuclear plant in 2005, which long went unreported, where the spent fuel container dangled from a crane for two days. Citizen's groups had to FOIA relevant documents to [assess](#) what happened. Plenty of mishaps and non-compliances in moving spent fuel [have occurred](#) at other reactor sites (e.g. Clinton, Fort Calhoun, Kewanee, Pilgrim, Prairie) and are likely to happen again at Indian Point.

"Although there is no specific requirement to do so," the NRC wrote concerning these incidents, "licensees can prevent [such] issues...by verifying that calculations for load-handling systems and structures designated to support spent fuel casks are consistent with the plant-specific design and licensing bases; and that procedures, training and oversight of spent fuel movement are adequate." It's remarkable that there is no regulatory requirement that licensees do this.

For both short-term and long-term storage of spent nuclear fuel, the Nuclear Waste Technical Review Board recommends that SNF and its containment must be maintained, monitored, and retrievable in a manner that prevents radioactive leaks and hydrogen gas explosion. It also recommends canisters have pressure monitoring and pressure relief valves, since canisters are pressure vessels subject to gas buildup.

The American Society of Mechanical Engineers (ASME) N3 standards require pressure vessels to have pressure monitors or and pressure relief valves. ASME further requires them to be examined for surface defects and for defects to be eliminated. Holtec's canisters don't and can't meet these basic standards, though canisters used in many other countries do (e.g. Switzerland, Germany, Belgium Czech Republic, France, Italy, and others). The NRC simply exempts the canisters from ASME standards, and ignores NWTRB expert recommendations, for example refusing to require remote sensor monitoring systems.

Under current NRC regulations and industry practices, if a canister does fail, there is virtually no way to repair or repackage it. This will also be the case with the ISFSI at Indian Point.

The NRC permits destruction of fuel pools once the fuel is removed (which saves licensees about \$25 million per pool per year in overhead costs). But even for sites with intact fuel pools, it's not proven whether putting damaged spent fuel canisters back into a pool would be safe. This has never been done with a welded canister of the type Holtec uses, for example.

Many experts argue the only way to repackage damaged canisters safely is to use a dry handling facility, aka a "hot cell," where spent fuel can be repackaged while inside a radiation containment vessel. The NRC has admitted hot cells will eventually be needed at some point, though it doesn't say when. Since loaded canisters may fail in less than two decades, and surface damage and other problems that can accelerate failure are common, the timing question is urgent. But hot cells are expensive, so with one exception, U.S. nuclear reactors don't use them, and the NRC doesn't require them.

The proposed alternative, to put breached canisters inside a sealed, thick metal overpack, is designed to save money and create the appearance of a solution while avoiding dealing seriously with canister failure risks. Even so, Holtec has declined to provide onsite overpacks at Oyster Creek, preferring to store them at its headquarters in Camden, New Jersey, and claiming it can ship an overpack to the site by barge if a canister fails. We should note that sealing a canister inside an overpack would eliminate convection cooling, causing it to overheat. Rather than incur the expense of building hot cells, Holtec and the NRC prefer to assume that canisters won't fail, though that's far from a safe assumption for reasons described above.

In addition to the inherent risks of spent fuel handling and storage, and the self-inflicted risks of flawed dry storage systems, there are also external factors that can multiply these primary risks, such as earthquakes, terrorism, cyberattacks, loss of backup power, and more severe storms and flooding due to climate change. These risks were mostly unforeseen when U.S. civilian reactors were built, but evolved in the decades since.

The NRC has downplayed or ignored these risks as not credible. It has consistently failed to update risk assessments for civilian reactors as their risk profiles evolve, including dismissing the threat the high-pressure Algonquin natural gas pipeline crossing the Indian Point site poses to the plant and the spent fuel stored there. A whistleblower complaint, sustained by the NRC's Inspector General, showed that rather than take the threat seriously, NRC staff ignored key data and tailored its risk modeling of explosion risks to fit the desired foregone conclusion of no action being necessary. In addition to ignoring or downplaying certain primary risks as described above, failure to consider risk multipliers (both individually and in terms of how they might interact), to incorporate new data and modeling, or to update risk assessments, is aggravating spent fuel risks.



## APPENDIX B

### PROBLEMS WITH HOLTEC'S PLANS FOR TRANSPORTING INDIAN POINT'S SPENT FUEL

Holtec's spent fuel canisters rely on convection (passive) cooling. For convection cooling to work, canisters must be upright. But in transport, canisters are laid down horizontally, which stops convection, causing the canister to overheat. Higher heat loads exacerbate canister failure risks, including higher pressurization and radiation leaks. The 2019 DOE gap analysis admitted we need to learn more about the horizontal orientation on temperature profiles inside dry casks, and proposed using a dry cask simulator for more study, as well as more modeling and new methodologies to predict temperatures inside real casks "without excess conservatism."

There is no technology in place to fully inspect canisters for damage, and the impacts of shaking and bumping of radioactive materials on railways are not known. In 2019 the NWTRB identified 30 unresolved technical issues in transporting SNF and other high-level radioactive waste that still need to be addressed.

No cask has been approved for transporting thin-walled spent fuel canisters – in fact no vendor has even requested such approval. The NWTRB recommended DOE allow for a minimum of a decade to develop new cask and canister designs for SNF and HLW storage and transportation. Yet Holtec is pushing ahead with licensing its proposed consolidated interim storage facility in New Mexico, which expects accept spent fuel shipments in 2023. The vast majority of these shipments would be thin-walled canisters. No new technology for transporting thin-walled spent fuel canisters is on the horizon now. It's much more likely that when CISFs are ready to open in 2023, the NRC will adjust its methodologies to avoid "excess conservatism" and approve current cask technology for transport, despite the risks.

In addition to the risk of canisters leaking and failing in transport, there is also significant risk of transportation accidents. Transporting spent nuclear fuel by rail long distances, through major cities, via out-of-date or weakening infrastructure would subject large numbers of people to accident risks. Roads, rails, bridges, and other infrastructure are not designed for the 100-ton weight of loaded spent fuel canisters plus transport casks plus vehicles. Trucks carrying them are massive and travel at very low speeds on secondary roads, with communities and neighborhoods all along the way running risks of accidents and exposure to leaking canisters. In 2002, DOE proposed barge routes for shipping spent fuel from reactors for reactors without direct rail access.

That plan has been echoed recently by decommissioning companies, including in Holtec's PSDAR for New York's Indian Point, and in plans for shipping radioactive components and



eventually high-level radioactive waste from Michigan's Palisades plant, which Holtec seeking to acquire for decommissioning.

Barge shipment raises the prospect of potentially catastrophic maritime accidents involving spent fuel. Planned DOE barge routes from Indian Point would go down the Hudson River past Manhattan. From the Oyster Creek plant in New Jersey, which Holtec is now decommissioning, the DOE barge route crosses Barnegat Bay, where past barge shipments to Oyster Creek ran aground in bad weather, and in which other barges have sunk.

Holtec expects to be well paid by the federal government to store spent fuel at their CISF. They therefore have a strong financial incentive to expedite spent fuel transfer at nuclear plants they are decommissioning to dry storage and to transport, despite the heightened safety risks. That poses a fundamental conflict interest between decommissioning Indian Point safely vs. maximizing revenues from disposition of their spent fuel.

The CISF business model violates current federal law, and the NRC is currently being sued in federal court over permitting them. The facility is predicated on the idea that DOE will take title to spent nuclear fuel as it leaves the reactor site, thus relieving the decommissioning companies of their liability for it. But this is specifically prohibited by the Nuclear Waste Policy Act, unless and until a geologic repository is up and running. The lawsuit against the NRC argues that advancing the NRC licensing procedure despite this, in anticipation of the law changing, is itself illegal.

Holtec's proposed CISF violates basic principles of environmental justice and consent-based siting, since the indigenous communities and communities of color located nearby do not consent. They are already overburdened by impacts from the nuclear industry, including uranium mining and milling and nuclear weapons testing over the past 75 years. They have yet to be compensated for these impacts under the Radiation Exposure Compensation Act (RECA). The governor of New Mexico, the All Pueblo Council of Governors, and many other state and municipal officials oppose the project. The CISF threatens significant Native American cultural sites in New Mexico. Forcing lower-income, more impacted, predominantly indigenous and LatinX communities to accept spent fuel from wealthier communities, including the Indian Point reactor community, implicates communities like ours in violating basic principles of justice and consent.

The International Atomic Energy Agency (IAEA) has warned against co-locating high-level radioactive waste storage or disposal facilities in areas also hosting fossil fuel extraction, as too high risk. For example, certain fracking activities can induce significant artificial earthquakes, which can damage CISFs. Holtec's proposed CISF is sited in the oil- and gas-rich Permian Basin. Up to 2,500 oil, gas and mineral wells or sites are operated in the area by 54 businesses within a 10-mile radius of the site.

The New Mexico State Land Office owns the mineral estate beneath the surface. New Mexico State Land Commissioner Stephanie Garcia Richard opposes the project, citing “serious safety concerns.” “We are talking about storing over 120,000 metric tons of nuclear waste in an extremely active oil field without a clear picture of the potential hazards of that combination,” she said. She questioned any contention that hydraulic fracturing can occur safely beneath a nuclear storage site, or that the waste can be safely transported through New Mexico joint venture with numerous local organizations, owns the surface rights. According to Garcia Richard, Holtec “falsely” represented it secured agreements with nearby oil and gas operators to restrict extraction operations near the proposed site. She also accused Holtec of making misleading statements on the matter in submissions to the NRC. “I understand that we need to find a storage solution,” she said, “but not in the middle of an active oil field, not from a company that is misrepresenting facts and unwilling to answer questions, not on our state trust lands.”

As former NRC Chair Gregory Jaczko [points out](#), CISFs are “interim” in name only, and should be viewed as *de facto* permanent storage sites. Yet the permitting and planning processes are treating them as temporary installations. CISF host communities are ill-equipped and ill-prepared to manage their risks over the long term. “Transporting material of this nature requires both well-maintained infrastructure and highly specialized emergency response equipment and personnel that can respond to an incident at the facility or on transit routes,” wrote New Mexico Governor Michelle Lujan Grisham in a letter to the NRC and DOE. “The state of New Mexico cannot be expected to support these activities.”

A 2018 NRC Atomic Safety Licensing Board proceeding on licensing Holtec’s CISF dismissed all 50 contentions of the intervenors opposing the project, including Sierra Club, Beyond Nuclear, Fasken Oil, AFES, and others. Not a single contention of opponents of the project was allowed, but that doesn’t mean they didn’t have merit. The ASLB did acknowledge that the CISF violates the Nuclear Waste Policy Act, but it dismissed Beyond Nuclear’s legal challenge anyway, on the ground that Holtec could be depended on not to implement the unlawful provision if the license were granted. The issue is now before the U.S. Court of Appeals for the District of Columbia Circuit.

Part of the business case for gathering spent fuel in one place is to facilitate reusing it. DOE has funding for “integrated fuel cycle management,” seeking to reclose the fuel cycle to create more uses for spent fuel. A planned Urenco high-assay low-enriched uranium (HA-LEU) facility capable of re-enriching spent fuel has been sited near the New Mexico and Texas CISFs. Small modular reactors of the kind Holtec is seeking to build may run on re-enriched spent fuel. But re-enrichment entails new risks. One of HA-LEU’s byproducts is depleted uranium, which becomes chemically unstable over time and for which there is no disposal or management plan. Some proponents of the project, including the Mayor of Hobbs, NM where Holtec’s CISF is sited, have suggested that storing spent fuel there would make it a center of spent fuel reprocessing. Reprocessing is an especially dirty and dangerous process. Reprocessed fuel can be used in the weapons industry, and is considered a nuclear proliferation risk.