Three Empire State Plaza, Albany, NY 12223-1350
www.dps.ny.gov

September 21, 2023

VIA EMAIL

Hon. Michelle L. Phillips
Secretary to the Commission
3 Empire State Plaza
Albany, NY 12223-1350

Re: Matter No. 21-01188 – In the Matter of the Indian Point Closure Task Force and Indian Point Decommissioning Oversight Board.

Dear Secretary Phillips:

Please accept for filing in the above-captioned matter, independent technical expert Dave Lochbaum's September 21, 2023 presentation to the Indian Point Decommissioning Oversight Board regarding independent spent fuel storage installation inspections. Should you have any questions regarding this filing, please contact me. Thank you.

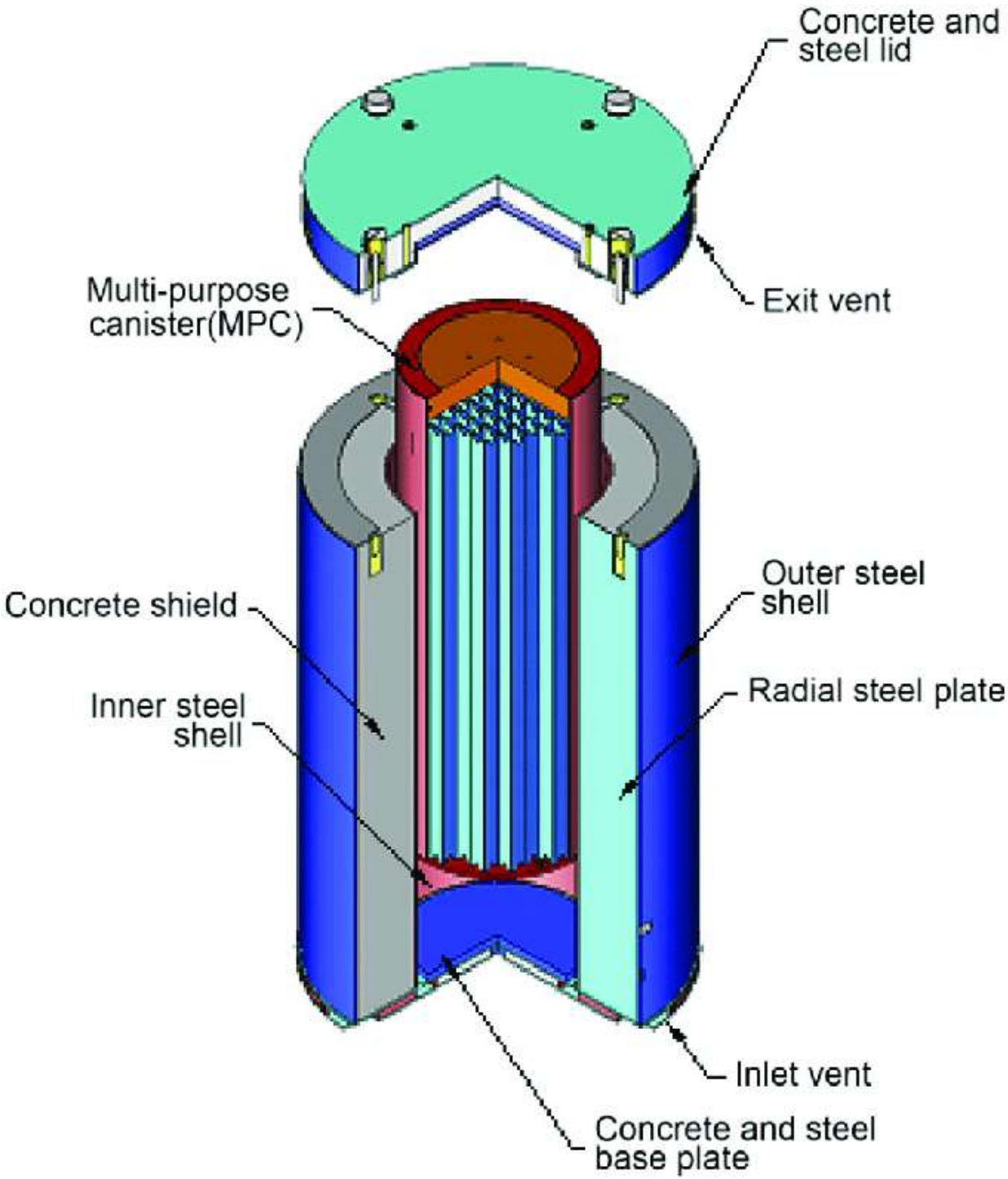
Respectfully submitted,

Tom Kaczmarek
Executive Director
Indian Point Closure Task Force
Indian Point Decommissioning Oversight Board

Indian Point

Independent Spent Fuel Storage Installation
(a.k.a. Onsite Dry Storage of Spent Fuel)

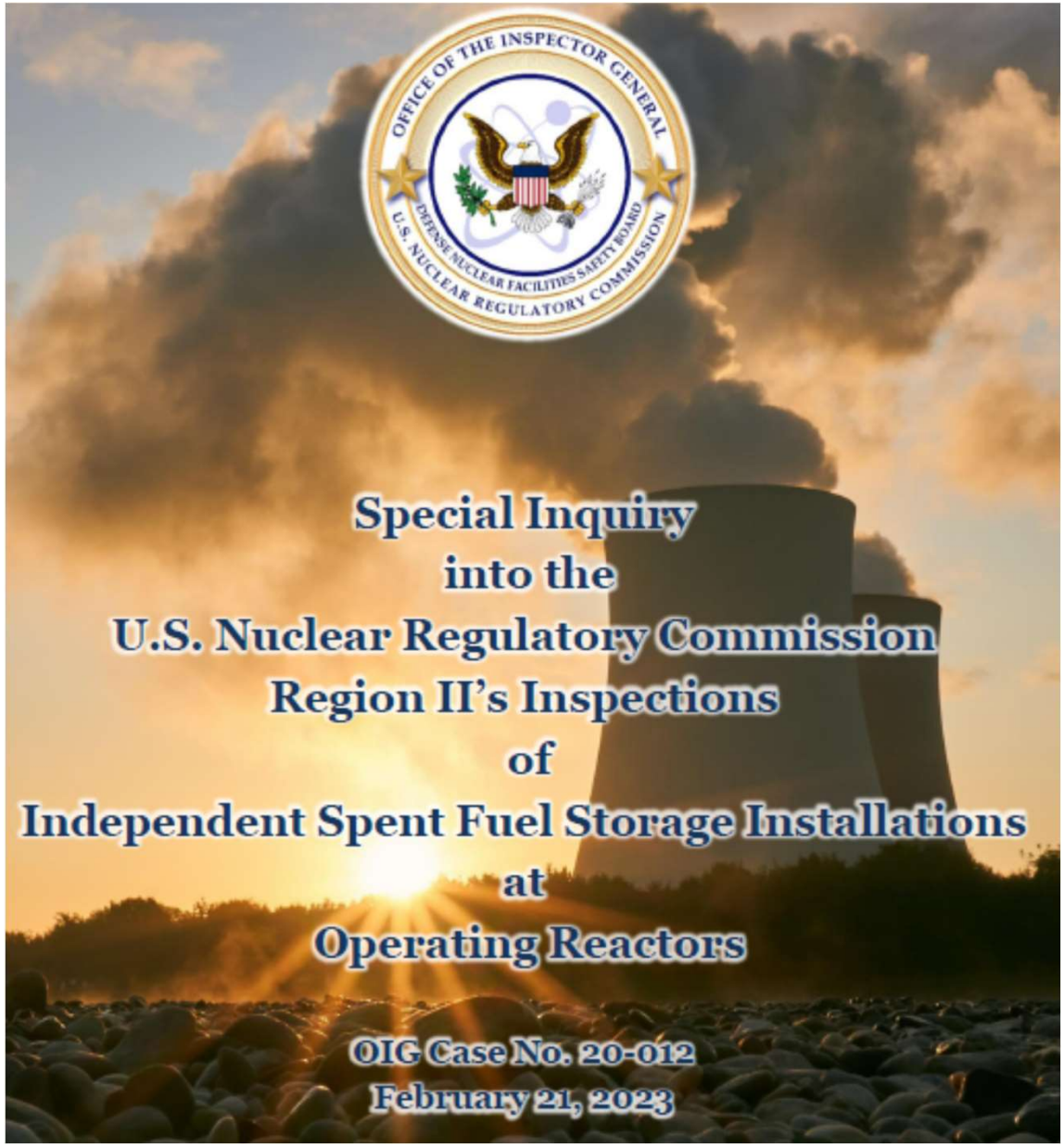
Dave Lochbaum
09-21-2023



Terminology

Spent fuel assemblies are loaded into a canister that is sealed. The canister is then placed inside a concrete and steel cask. Air flows through the space between the canister and cask to remove the spent fuel's decay heat.

Inspections review procedures, test results, etc. and observe work to check compliance. Examinations look at canisters' outer surfaces for indications of degradation.



Responding to allegations from an NRC worker, the NRC's Office of the Inspector General (OIG) looked into how NRC Region II (southeast USA) assessed ISFSI safety.

OIG's report was issued in February 2023.

Source: OIG Case No. 20-012

IV. DETAILS

Finding: Region II's past inspection practice resulted in missed opportunities to identify ISFSI violations

Through this Special Inquiry, the OIG determined that Region II's inspections of repeat loading campaigns from 2012 through 2020 deviated from NRC policies in that (1) resident inspectors did not obtain ISFSI qualifications before inspecting ISFSIs, and (2) Region II likely did not fully meet ISFSI inspection requirements based on the actual number of inspection hours charged. Fully qualified ISFSI inspectors began inspecting Region II ISFSIs in 2021, and since then, those inspectors have found multiple ISFSI violations that might have been detected earlier; however, there are still a significant number of loaded casks that have not been properly inspected.

Figure 6: Region II ISFSI inspection hours for repeat loading campaigns

	2018	2019
Region II inspection hours charged to IP 60855.1	231	273
Spent Fuel Loading Campaigns at Region II plants	14	12
Percentage of inspection hours compared to estimated 100 hours per campaign resourced in IP 60855.1	15%	20%

Source: OIG generated from Region II assessment

Region II inspectors confirmed that the hours they spent inspecting repeat loading campaigns were far fewer than those estimated in IP 60855.1, and some stated that, in their view, inspection requirements were not fully met. A Region II principal stated that

OIG found that NRC Region II was using unqualified inspectors who performed 20 percent or less of the specified dry cask storage inspection scope.

Source: OIG Case No. 20-012

After the OIG report was issued, I reviewed dry cask loadings at Indian Point and NRC's oversight efforts.

As of February 1, 2023, 81 casks containing 2,592 fuel assemblies had been loaded at Indian Point.

I found 14 publicly available NRC inspection reports for ISFSI operations at Indian Pont between 2010 and 2023. The reports documented NRC's observation of several canister loadings.

What those inspection reports did not reveal:

- **How many inspection hours were devoted to the inspections?**
- **While the names of the NRC inspectors were listed in the inspection reports, their qualifications were not provided. Were all these inspectors fully qualified to perform ISFSI inspections?**

Source: Indian Point Cask Loadings and NRC Oversight

NEW YORK STATE | Indian Point Decommissioning Oversight Board

Thomas Congdon
Chair

August 31, 2023

Via Email

Douglas Tifft
State Liaison Officer, Region 1
U.S. Nuclear Regulatory Commission
475 Allendale Road, Suite 102
King of Prussia, PA 19406-1415
doug.tifft@nrc.gov

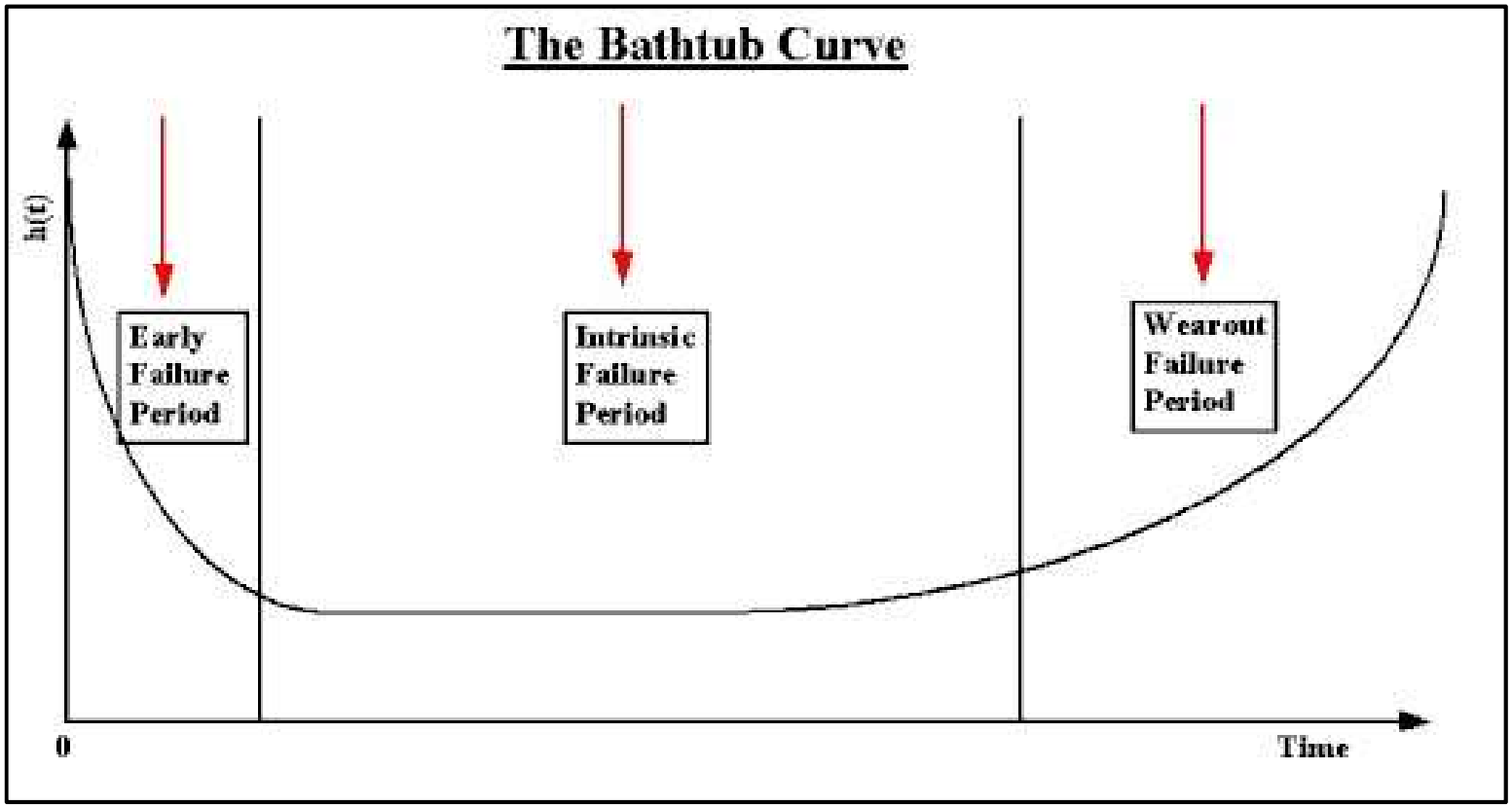
Re: ISFSI Inspection and OIG Report

Dear Mr. Tifft,

The Indian Point Decommissioning Oversight Board was recently made aware of an issue concerning NRC oversight and inspections of spent nuclear fuel storage. In February 2023, the Nuclear Regulatory Commission's Office of the Inspector General (OIG) issued a report on its audit of the U.S. Nuclear Regulatory Commission (NRC) Region II's oversight of Independent Spent Fuel Storage Installations (ISFSIs).[1] OIG's chief findings were that NRC Region II, which covers the southeast states, used unqualified inspectors between 2012 and 2020 for dry cask oversight and the inspectors used less than 20 percent of the hours specified to adequately perform the dry cask inspections.

The Indian Point DOB has requested that NRC Region I formally explain whether its ISFSI inspections at Indian Point and other nuclear plants in the state were conducted by qualified inspectors who performed full-scope inspections.

Source: Indian Point DOB Letter to NRC



Why It Matters

Risk over lifetime is defined by the Bathtub Curve. Material imperfections, assembly errors, operator mistakes, etc. cause the failure rate during the "break-in" phase to be relatively high.

Figure 8: Region II issued ISFSI violations in 2021 and 2022

	Violation	Description
1	Severity Level IV, NCV of 10 C.F.R. Part 72.162, "Test Control." (ADAMS Accession No. ML22308A179)	Failure to incorporate the design basis flow rates for the Forced Air Cooling units into ongoing testing procedures or other instructions to ensure the criteria in FSAR Section 4.2 for the fuel cladding and the various components of the transfer casks were satisfied.
2	Severity Level IV NCV of 10 C.F.R. 72.48(d)(1),6, "Changes, Tests, and Experiments." (ADAMS Accession No. ML22308A179)	Failure to provide the basis for the determination that the presence of boiling water in the dry shielded canister and transfer cask annulus does not require a CoC amendment.
3	Green finding and associated NCV of Title 10, C.F.R. Part 50, Appendix B, Criterion III, "Design Control." (ADAMS Accession No. ML22130A795)	Failure to develop appropriate acceptance criteria associated with the ISFSI haul path and the railway access hatch hoisting system and failed to verify the adequacy of the Auxiliary Building Crane testing program.
4	Green finding and associated NCV of Title 10, C.F.R. Part 50, Appendix B, Criterion III, "Design Control." (ADAMS Accession No. ML22132A308)	Failure to translate the maximum cask lift elevation and the locking of the trunnion axis into site procedures.
5	Green finding and associated NCV of 10 C.F.R. Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings." (ADAMS Accession No. ML21314A186)	When procedure 0-TI-561, "Underground Piping and Tanks Integrity Program," (a procedure described in the UFSAR) was changed, the licensee failed to perform the 10 C.F.R. 50.59 evaluation to determine whether the calculation "Evaluation of Cask Transporter Haul Route ([ ]Report [ ]-2022947 for the Dry Cask Storage Project)" continued to demonstrate that ISFSI operations will not compromise plant underground safe shutdown equipment.
6	Green finding and associated NCV of 10 C.F.R. Part 50, Appendix B, Criterion III, "Design Control." (ADAMS Accession No. ML21314A530)	Failure to translate applicable acceptance criteria for the spent fuel bridge crane into its plant maintenance procedure.

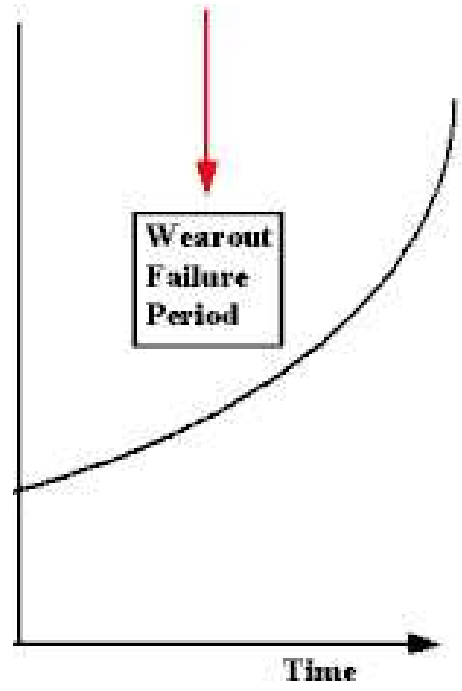
When NRC Region II resumed using qualified inspectors performing full-scope dry cask storage inspections, many safety violations during the "break-in phase" at Region II plants were readily identified.

What about the right-hand side of the Bathtub Curve, the "wear-out" phase where failure rate increases?

Source: OIG Case No. 20-012

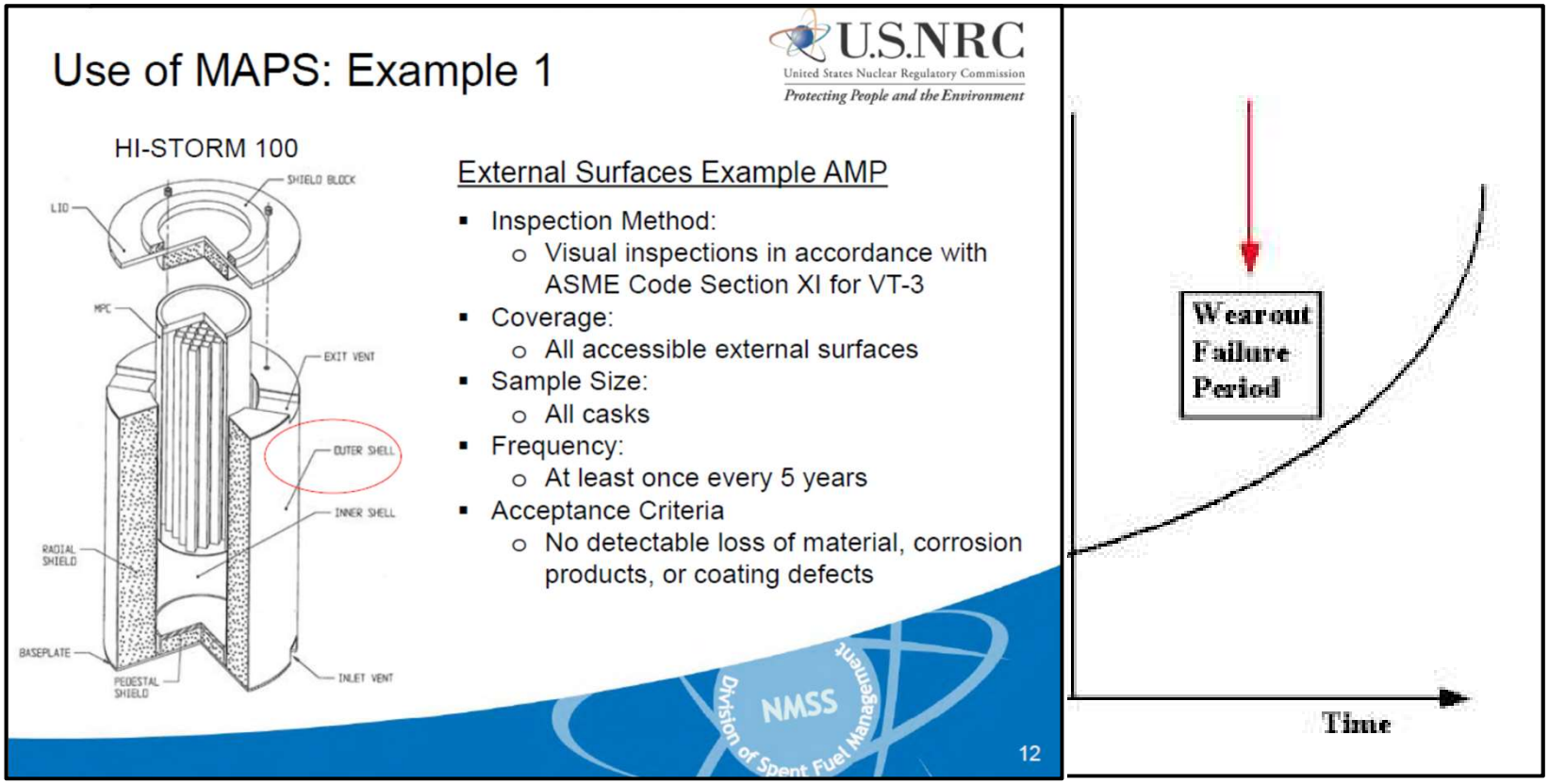
DCSS Inspection Background

- DCSSs were not designed with inspection in mind
  - High temperature
  - High radiation
  - Difficult to access & confined space
- Components of interest:
  - Stainless steel canisters used in canister-based systems
- Aging degradation mechanism of primary concern:
  - Chloride-induced stress corrosion cracking in stainless steel storage canisters



All Dry Cask Storage Systems (DCSS) are headed towards, if not already in, the wear-out portion of the Bathtub Cure where chloride-induced stress corrosion cracking is the primary aging degradation concern.

Source: Electric Power Research Institute presentation (ADAMS ML16347A481)

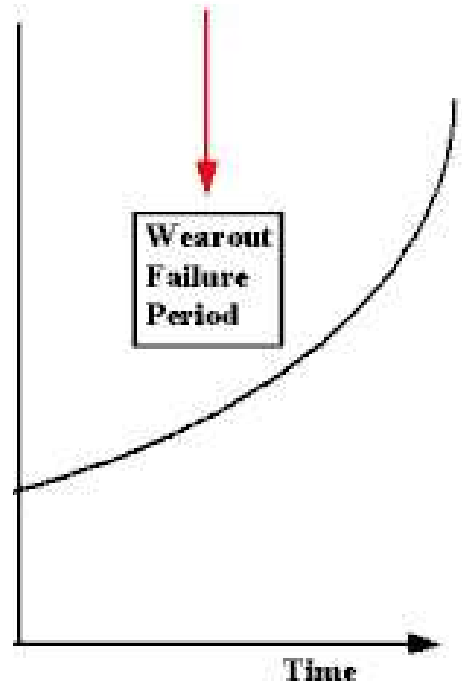


Managing Aging Processes in Storage (MAPS) calls for examinations every five years. Industry typically plans to examine one, maybe two, "most vulnerable" canisters over and over to facilitate trending of degradation results.

Source: Nuclear Regulatory Commission presentation (ADAMS ML16347A483)

Table 6-5
Summary of Ranking Factors for Vertical Canister

Parameter		Value
Deposition Factor[4] (Section 4.3)	$X_{Cl} < 1.5$	+1
	$1.5 \leq X_{Cl} < 2.5$	+2
	$2.5 \leq X_{Cl} < 4$	+3
	$4 \leq X_{Cl} < 5$	+4
	$X_{Cl} \geq 5$	+5
Canister Alloy (Section 4.4)	316L(N)	0
	316	+1
	304L(N)	+2
	304	+3
Current Decay Heat Load (Section 4.5.2)	> 16 kW	0
	6.5 to 16 kW	+1
	< 6.5 kW	+2
Additional Factors (Section 4.7)	• Canister in storage longest • Specific canister placement • Pre-loading storage and installation experience • Fabrication record information	Identify priority canister from among those with the same rank

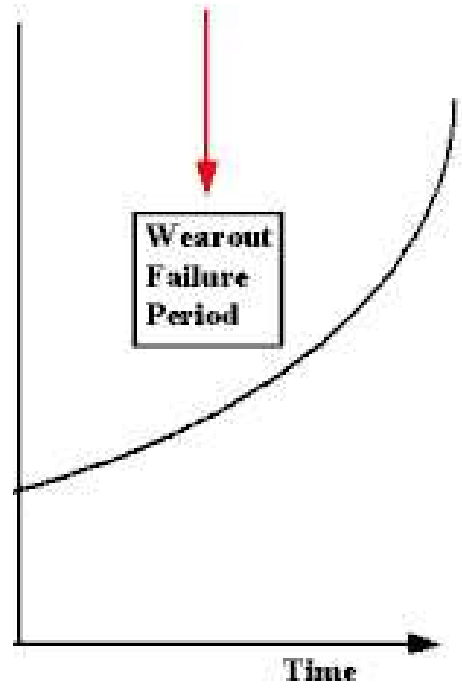


"Most vulnerable" is defined by nearness to salt spray (e.g., deposition), canister metal type, and decay heat levels of spent fuel inside canisters.

Source: Electric Power Research Institute Technical Report, September 2015

Table 4-1
Most Likely Locations for CISCC Degradation (Adapted from Reference [21])

Factor for CISCC Susceptibility	Locations on Horizontal Canister	Locations on Vertical Canister
Tensile Stresses on OD	Regions in the vicinity of welds (e.g. within about 2 thicknesses)	Regions in the vicinity of welds (e.g. within about 2 thicknesses)
Low Surface Temperature(1)	Lids; shell along canister underside and along ends	Lower region of canister OD
Elevated Chloride Deposition	Upward-facing surfaces of canister shell	Top lid; possibly the areas in the vicinity of the overpack inlets
Crevice-like Geometry	Support rail contact region	Areas where canister contacts the overpack channels/standoffs(2)
Material Condition	Areas of heavy grinding or mechanical damage (e.g. gouges)	Areas of heavy grinding or mechanical damage (e.g. gouges)
Most Susceptible Location(s)	Shell welds at canister ends (top surface); support rail interface near welds	Canister sides near welds at the bottom of the canister



"Most vulnerable" should also consider pre-existing gouges, scratches, etc. on canister walls that facilitate initiation of chloride-induced stress corrosion cracking.

Source: Electric Power Research Institute Technical Report, September 2015

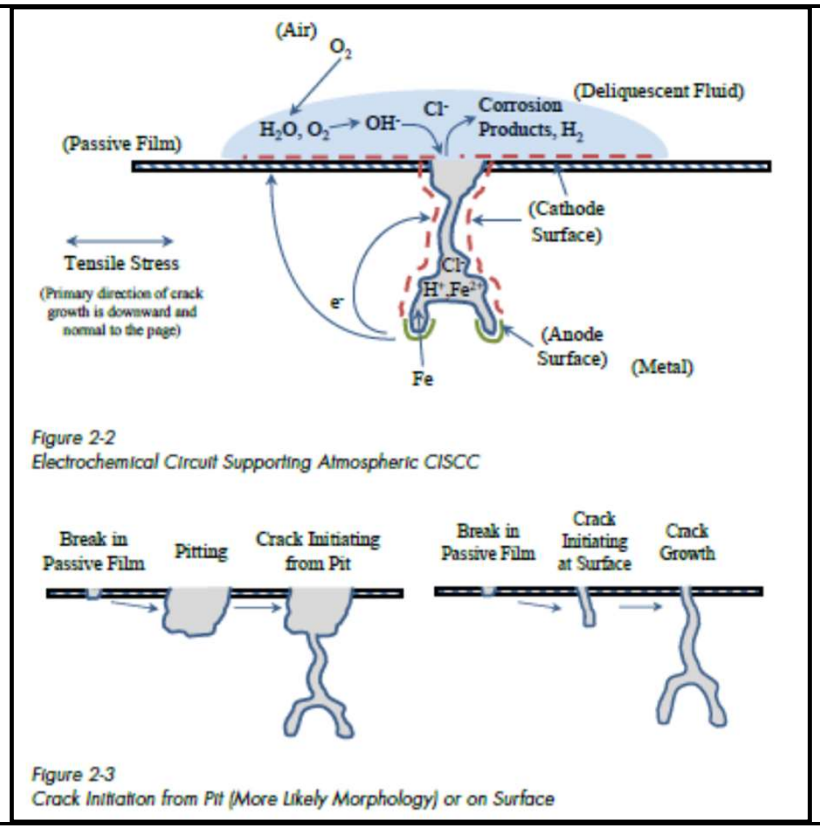
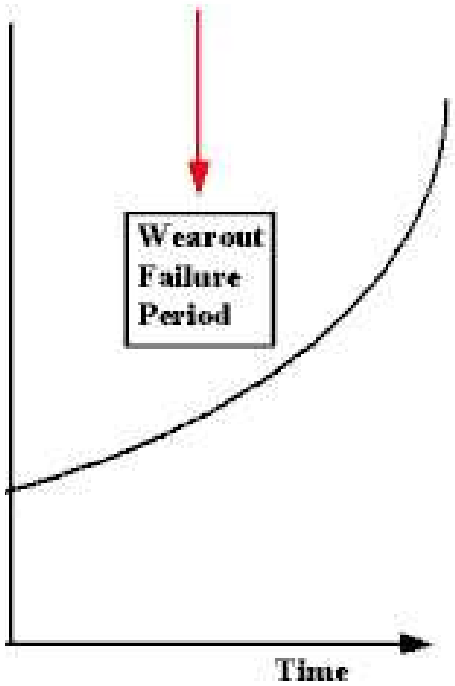


Figure 2-2
Electrochemical Circuit Supporting Atmospheric CISCC

Figure 2-3
Crack Initiation from Pit (More Likely Morphology) or on Surface



Not unlike how a small chip in a car's windshield spawns a widening crack, a surface crack aids the initiation and propagation of metal cracking.

Source: Electric Power Research Institute Technical Report, September 2015

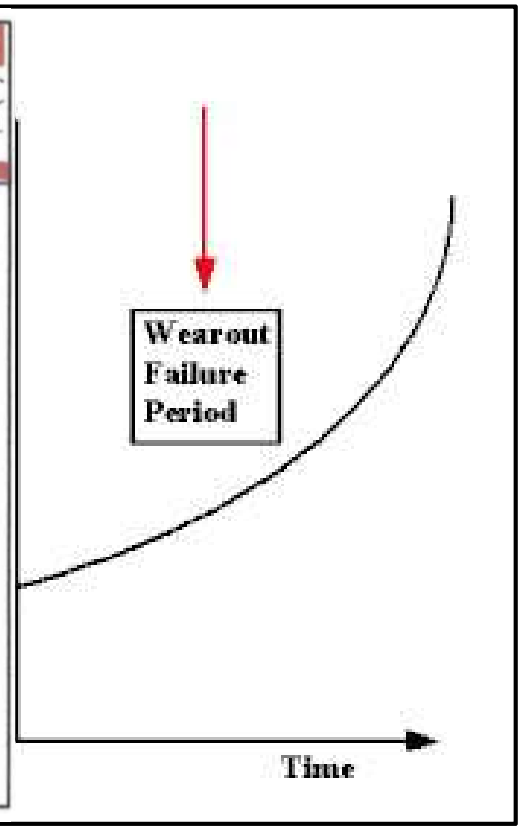
Origin and Prevalence of Scratches

HOLTEC INTERNATIONAL

a generation ahead by design

> Scratches in plates and shells in the manufacture of any weldment are present everywhere. From the time a stack of plates arrives at the factory, the rubbing between the plate layers causes scratches to develop. Most plates come from the mill bearing scratches. Rolling, bending, forming, shearing, machining, etc., necessary to fabricate are all potential scratch-making operations. Surface scratches are commonplace and expected in MPCs.

> Quality manufacturing plants, such as ours, place a limit on admissible depth and population density of scratches, primarily to address workmanship considerations. Holtec's procedure HSP-320 has been used to screen scratches in thousands of hardware supplied by the company to nuclear plants.



HOLTEC concedes that surface scratches in its dry casks and canisters are everywhere and commonplace.

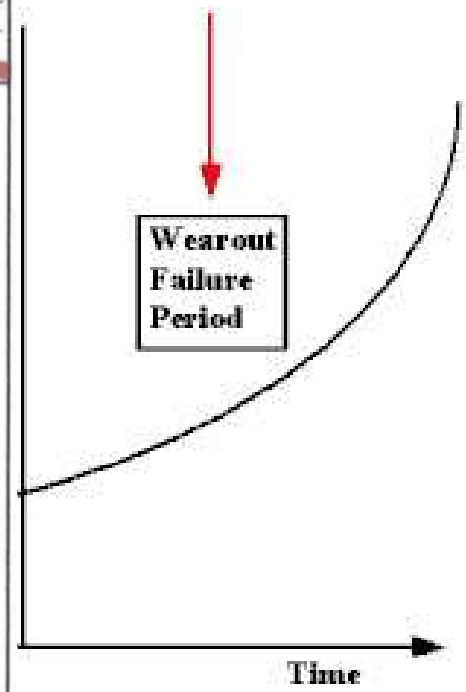
Source: Holtec presentation (ADAMS ML20254A065)

Regulatory and Licensing Perspectives

HOLTEC INTERNATIONAL

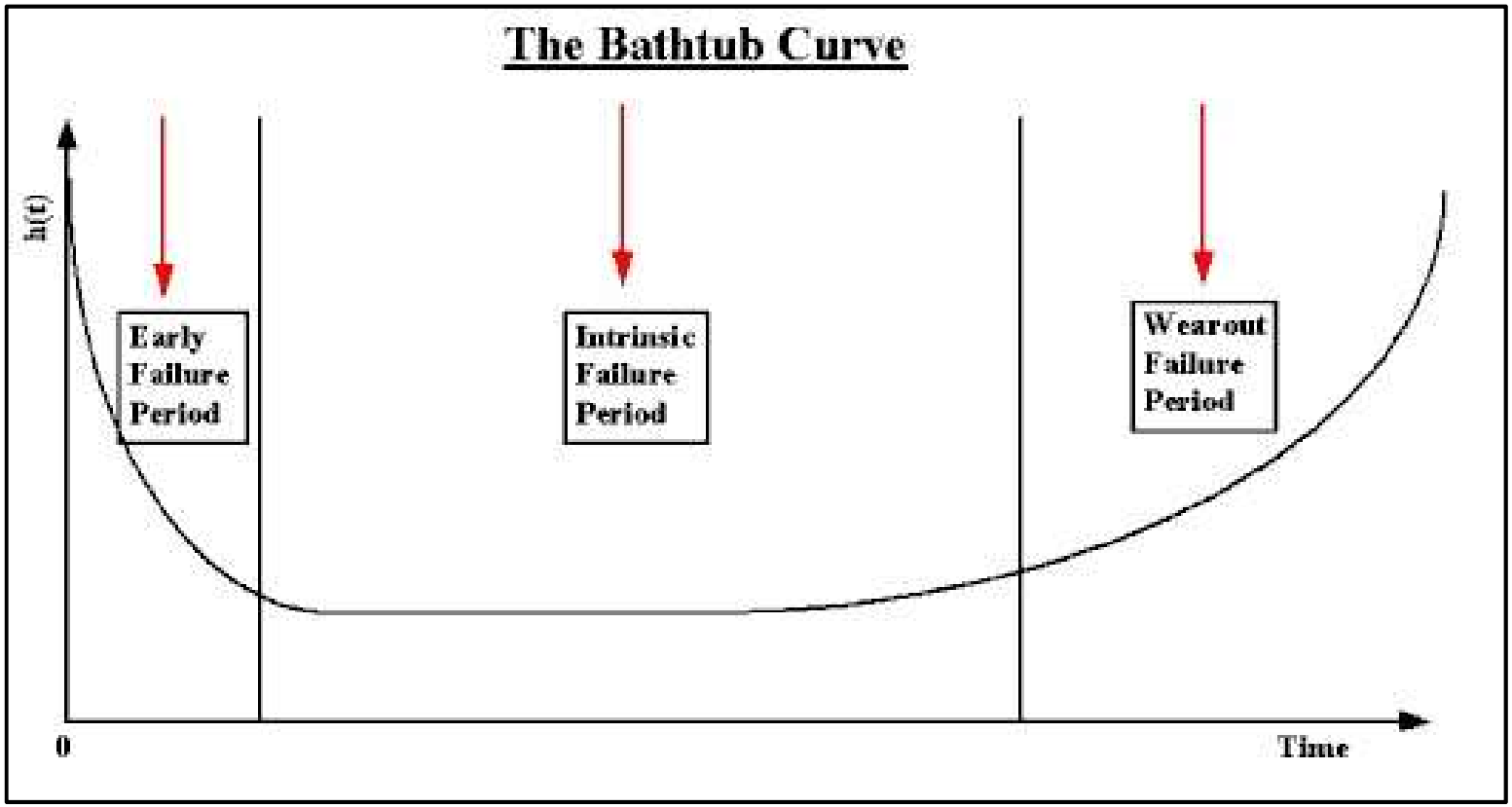
a generation ahead by design

- From a regulatory perspective, the presence of surface scratches on the MPC are not relevant to the safety determination.
- Any discussion of scratches in the FSAR represents non-safety significant information, along with numerous other non-safety items in the MPC.
- Given that information in the FSAR on surface scratches is non-safety significant, clarifying the associated FSAR discussion cannot, by definition, imply a change of any safety consequence.
- The statement in the FSAR regarding no risk of scratching during insertion can be deleted or amended without affecting the safety analyses and conclusions in the FSAR.

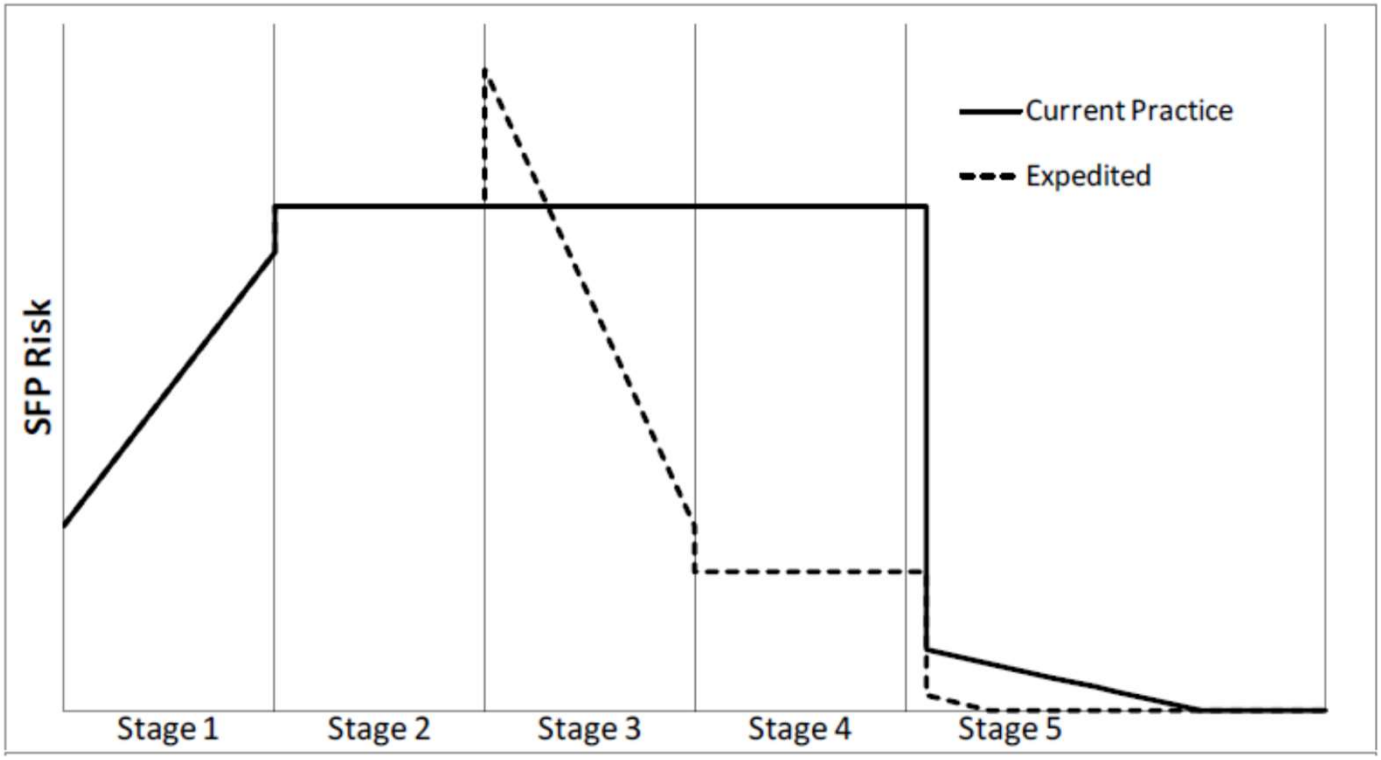


HOLTEC contends that canister surface scratches "*are not relevant to the safety determination*" despite being a factor in the primary aging degradation mechanism.

Source: Holtec presentation (ADAMS ML20254A065)



NRC needs to perform full-scope ISFSI inspections using qualified inspectors. Periodic examinations of dry cask storage systems must be based on science rather than convenience.



The State's agreement with HOLTEC accelerated transfers from the spent fuel pools to the ISFSI pads. While not zero risk, the ISFSI poses significantly lower risk than a spent fuel pool. Each canister holds 32 fuel assemblies. Each spent fuel pool held several hundred assemblies. Lower energy levels and lesser amounts of radioactivity in each canister translates into lower risk.

Should a thru-wall crack form in a canister wall, little to no radiation will leak out. The crack will require patching to restore integrity and structural strength before the canister is moved.

Source: NRC Spent Fuel Pool Consequence Study (ADAMS ML13256A342)