Will America’s Nuclear Waste Problem Be Passing through MO?

Highly Radioactive Irradiated Nuclear Fuel: Need for Hardened On-Site Storage; Risks of Off-Site Transport

Kevin Kamps, Radioactive Waste Specialist, Beyond Nuclear, March 19, 2019
Shutdown of operating reactors, and their decommissioning, is the answer to the radioactive waste generation problem. We welcomed the closure date Oyster Creek, New Jersey in September, 2018, for example.

But for the more than 80,000 metric tons of commercial irradiated nuclear fuel that already exists, and the additional ~2,000 metric tons generated by the nearly 100 still operating reactors annually across the US...
• We oppose current risky indoor “wet” pool storage, and inadequate dry cask storage.

• We oppose the Yucca Mountain dump and so-called “centralized interim storage” schemes, including their inherent, unnecessary, high-risk high-level radioactive waste shipments.

• We advocate for Hardened On-Site Storage (HOSS), as close as possible to the point of generation, as an urgently needed safety, security, health, and environmental protection upgrade.
Irradiated Nuclear Fuel Transfer, from Pools to Casks

Indoor “Wet” Storage Pool → Outdoor Dry Casks
Pools are outside robust containment
Because pools are outside radiological containment structures that surround reactors (which can themselves fail, as shown at Fukushima Daiichi), the first step in the direction of Hardened On-Site Storage (HOSS) is to “expedite transfer” of irradiated nuclear fuel from indoor “wet” pools to outdoor dry storage. However, there must be significant upgrades to safety, security, health- and environmental protection associated with dry cask storage – that is, Hardened On-Site Storage (HOSS).
“Very close” call with catastrophe

Fukushima Daiichi Unit 4

Japanese Prime Minister
Naoto Kan
• The three reactor meltdowns, and associated containment breaches, at Fukushima Daiichi, resulted in 160,000 nuclear evacuees in Japan, beginning on 3/11/11.

• However, then serving Prime Minister Kan publicly revealed on the one year commemoration of the beginning of the nuclear catastrophe, than had the Unit 4 high-level radioactive waste storage pool caught fire, he had a secret contingency plan in the works to evacuate 35 to 50 million Japanese citizens from the metro Tokyo area and northeastern Japan. He said it would have been the end of the Japanese state.

• The pool came precariously close to catching fire. The only reason it didn’t was sheer luck.
Risks of Pool Storage, Transfers

• Indian Point, NY’s long term (~early 1990s-present) pool leakage of radioactivity into soil, groundwater, Hudson River (tritium, Sr-90, radioactive cesium, cobalt, nickel)

• Heavy load drop risk of pool drain down, zirconium fire (Prairie Island, MN & Palisades, MI transfer cask crane dangles; Vermont Yankee crane slip)

• 22 still-operating reactors across the U.S. (including Cooper, NE & Duane Arnold, IA) are Fukushima Daiichi twin designs, and others are close sibling designs--including the elevated storage pools
Crane Risks
Independent Spent Fuel Storage Installation (ISFSI) Configurations

Vertical

Horizontal
ISFSIs (Cask/Canister issues)

Vertical

Horizontal
Some examples of dry cask/canister failures

• Defective welds (Ventilated Storage Cask-24s, Palisades, MI)
• Inner canister wall thickness ground too thin, below technical specifications (TransNuclear/NUHOMS, Davis-Besse, OH)
• Hydrogen gas generation, explosion, and fires (VSC-24s, Palisades, MI & Point Beach, WI)
• Vertical casks moved several inches out of position; horizontal casks’ concrete structure and radiation shielding damaged by earthquake (accompanied by a week-long cover up exposed by CNN), multiple cask models at North Anna, VA (continued)
Some more examples of dry cask/canister failures

• Cracking visible on exterior surface of cask concrete face (radiation shielding), VSC-24s at Palisades

• Problematic shims – Palisades, 1994; San Onofre, CA, 2018

• Inner seal leaks, risking loss of inert Helium gas heat transfer medium, which could lead to corrosion of irradiated nuclear fuel, as well as overheating (Surry, VA).
Need for Robust, or Hardened On-Site Storage (HOSS)

Dr. Arjun Makhijani, IEER

Dr. Gordon Thompson, IRSS
• Dr. Makhijani originated the concept, and coined the phrase, Hardened On-Site Storage (HOSS). He was the keynote speaker in April 2002 at a Citizens Awareness Network (CAN) summit at Wesleyan U. in Middletown, CT, opposing the Yucca dump by advocating HOSS as an alternative.

• Commissioned by CAN, Dr. Thompson wrote a report, “Robust Storage,” in Jan. 2003, putting more flesh on the bones of the HOSS concept.
Statement of Principles for Safeguarding Nuclear Waste at Reactors (HOSS)—2006; 2010; 2016; 2018

- Require a low-density, open-frame layout for fuel pools (to provide convection air current cooling) – *that is, empty the pools as much, and as soon, as possible* (a.k.a. “expedited transfer”);
- Establish hardened on-site storage (retrievability; real-time monitoring for radiation, temperature, pressure; as close as possible, as safely as possible, to point of generation);
- Protect fuel pools;
- Require periodic review of HOSS facilities and fuel pools;
- Dedicate funding to local and state governments to independently monitor the sites;
- Prohibit reprocessing (*something Holtec/ELEA wants to do at its CISF in southeastern NM*).
Statement of Principles for Safeguarding Nuclear Waste at Reactors (HOSS)—2006; 2010; 2016; 2018

• [https://www.eesi.org/files/Principles_for_Safeguarding_Nuclear_Waste_at_Reactors.pdf](https://www.eesi.org/files/Principles_for_Safeguarding_Nuclear_Waste_at_Reactors.pdf)

• Many hundreds of endorsing public interest and environmental organizations, representing all 50 states, including from MO: Missourians for Safe Energy & Missouri Coalition for the Environment
There are a number of sites where Hardened ON-SITE Storage is not appropriate. Prairie Island, MN is in the flood plain of the Mississippi River, immediately adjacent to the Prairie Island Indian Community, an environmental injustice.

Palisades, MI’s dry cask storage is just 150 yards from the water of Lake Michigan, and violates NRC earthquake safety regulations. (Davis-Besse, OH flooding risks, as well, such as seiches!)

San Onofre, CA is on the edge of the Pacific, in an earthquake and tsunami zone.
Dr. Mary Sinclair, a co-founder of Don’t Waste Michigan, warned about such radioactive waste risks to the Great Lakes, as well as rivers – the drinking water supplies of our nation – and the coasts, at risk of rising sea levels, more than 20 years ago.

In those cases, hardened storage should still be implemented, as close as possible to the point of waste generation, as safely as possible, as by moving irradiated nuclear fuel a short distance inland, to higher ground.

For example, San Onofre’s wastes could move a number of miles east, deeper into the heart of Camp Pendleton, rather than a thousand miles east to New Mexico. At Camp Pendleton, they’d have the added bonus of thousands of U.S. Marines to provide security.
Dispersed/Concealed HOSS v. Plain View/Clustered Configuration

“Bowling Pins”

Graphic from “Robust Storage” by Dr. Gordon Thompson, Jan. 2003
The image on the left in the previous slide was taken at a “fully decommissioned” atomic reactor in New England.

Such out-in-plain-sight, dense configurations, are at risk of line-of-sight attack, as by anti-tank missiles, as well as large-scale explosions or fires that could engulf the entire ISFSI.

Fortification for security, as well as camouflaging and dispersal (distancing between dry casks), are important elements of HOSS.
Schematic representation of HOSS

Earth/gravel berms should surround each cask and hide from ground-level view.

Potential Target: 24 to 36 Bundles of Nuclear Rods

Nuclear rods cooled by simple air convection.

Air outflow vent

24 ft

Inner steel liner

Outer steel liner

Air inflow vent
Such earthen berms (in other words, dirt walls) have been installed, as at Prairie Island, MN under public pressure, as well as at Palo Verde, AZ, the largest nuclear power plant in the U.S.

This is but a basic first step in the direction of implementing HOSS.
First things first... The need for HOSS regardless of other developments

HOSS is needed even if the Yucca Mountain dump, or Centralized Interim Storage Facilities (CISFs), opened today. Why? Because it will take 50 years, or more, to move high-level radioactive wastes to such Away-From-Reactor sites. Still operating reactors are at the back of the line for such export shipments.
Cask/Canister Integrity
(Or Lack Thereof)

Holtecs at D.C. Cook, MI

Quality Assurance violations
Summary of Whistle-blower Allegations of Holtec QA Violations

- Faulty welds
- Unqualified fabrication materials
- Defective neutron shielding material
- Failure to perform coupon testing, Post-Weld Heat Treatment
- Bypassing of hundreds of non-conforming conditions, without re-analysis of structural integrity
- Improper, uncertified design decisions and changes on the fly
- No root cause investigation of epidemic of QA violations
- Interference with QA audit, falsification of QA documentation
- NRC incompetence, or worse—collusion, complicity

Holtec Whistle-Blowers

Oscar Shirani, Commonwealth Edison/Exelon QA inspector

- Shirani said Holtec casks are “nothing but garbage cans” if they are not made in accordance with government specifications;
- He questioned Holtec casks’ structural integrity sitting still, at 0 mph, let alone going 60 mph+ (accident forces) on the rails

Dr. Ross Landsman, NRC Region 3 dry cask storage inspector (retired)

- Has compared NRC/Holtec decision making to NASA’s, that led to “Space Shuttles hitting the ground”
- Has served as environmental coalition expert witness; has provided insights re: NRC licensing proceeding re: Holtec/ELEA’s proposed CISF targeted at southeastern NM (which began 7/16/18, with NRC’s Federal Register Notice)
Need for Emergency Cask-to-Cask Transfer Capability

• Urgent need to empty irradiated nuclear fuel from vulnerable and leaking storage pools into HOSS, ASAP, but...

• Essential to maintain operability of empty pool, in order to have cask-to-cask transfer capability, if and when needed

• Science fiction/fantasy of NRC’s on-site or away-from-reactor “Dry Transfer Systems”
Dry Transfer Systems (DTSs) exist only on paper, but have never actually been built in the real world.

No source of funding for building them has been identified.

The ratepayer-funded Nuclear Waste Fund, with a current balance of around $37 billion, is already inadequate. It is intended for permanent geological disposal, not for on-site or away-from-reactor interim storage.

Breach of contract awards paid by the Dept. of Energy to nuclear utilities are funded by the U.S. Judgment Fund at the U.S. Treasury -- that is, federal taxpayers.
Risks of Off-Site Transport

• Severe accidents
• Attacks
• Mobile X-Ray Machines That Can’t Be Turned Off
High Burn-Up makes everything worse
(thermal heat, radioactivity)
But “lower burn-up” is plenty bad enough already in those regards!
Shipping Cask/Canister issues
Consolidated Interim Storage Facilities (CISFs): The Nearest-Term Mobile Chernobyl Threat

Waste Control Specialists, LLC, Andrews County, Texas (WCS) – 2021?!

Eddy-Lea [Counties] Energy Alliance, New Mexico (ELEA) – June 2022?!

Fire At Carlsbad Nuclear Waste New Mexico

WIPP creative commons
Why are these sites on the TX/NM borderlands being targeted for CISFs?

• WCS, TX is near or above the Ogallala Aquifer. WCS is already a national “low-level” radioactive waste dump.

• Holtec/ELEA, NM is just 16 miles from the Waste Isolation Pilot Plant (WIPP) for military plutonium contaminated waste disposal. In Feb. 2014, WIPP experienced an industrial fire in the underground, followed a few days later by a waste barrel burst, and radioactivity release to the environment, that had been previously deemed “impossible” by DOE officials
Sacrifice Zone?! 

The TX/NM borderlands are being treated by CISF proponents as an energy or nuclear sacrifice zone.

The environmental justice (EJ) violations of these CISF proposals are significant. The local area’s large Hispanic communities are already heavily polluted by fossil fuel (Permian Basin oil extraction, fracked natural gas) and nuclear industries (trans-uranic waste disposal at WIPP, national LLRW disposal at WCS, uranium enrichment at URENCO, proposed International Isotopes DuF6 de-conversion plant).
Near-term HLRW shipping campaign

- 2021 as a start date for a “pilot” CISF has been proposed
- 2024 as a start date for a full-scale CISF has been proposed
- Such near-term dates may have slipped at Holtec/ELEA, NM and WCS, TX, but the former licensing proceeding schedule is nonetheless well underway, and the latter about to begin
- Sept. 14, 2018 licensing intervention began against Holtec/ELEA, NM
- Nov. 13, 2018 licensing intervention began against WCS/Interim Storage Partners, TX
- ~June, 2019, Draft Environmental Impact Statement public comment period at NRC re: Holtec/ELEA, NM CISF
The two proposed CISFs are less than 40 miles apart (Nuclear Sacrifice Zone)
These two proposed CISFs violate environmental justice (EJ), amount to environmental racism or radioactive racism, in the context of Native Americans as well.

The Mescalero Apache Indian Reservation is not far from the Trinity atomic blast site. It was also targeted by DOE, and Private Fuel Storage, LLC, for a CISF two decades ago. However, Mescalero traditionals Rufina Marie Laws and Joe Geronimo led the successful campaign to block that CISF.
Rufina Marie Laws speaking at Prairie Island nuclear power plant, MN, June 2004
Terry Lodge, Esq., legal counsel for a national grassroots env’l coalition opposing CISFs & associated transports
CIS: De Facto Permanent, Surface Storage, Parking Lot Dump, or else Multiplying Transport Risks

“Just Keep Driving around - We may come up with a solution yet!”
• If “parked” at a CISF, would the HLRW ever move again? Would the vote in the U.S. House against moving it again be 434 to 1?! Likewise, would the U.S. Senate vote be 98 to 2 against?!
• “Interim” or “temporary” could be a bait and switch, and become de facto permanent.
• As former U.S. Senate Energy and Natural Resources Committee chairman, Jeff Bingaman of NM, advocated – the linkage between CIS and geological disposal must be maintained. Democratic members of Congress from NM have that same position today, and oppose – or else are skeptical of -- Holtec/ELEA’s CISF accordingly.
Yucca Mountain, Nevada; Geologic Repository (Permanent Burial)

(Be sure to count the toes!) $\text{himku}$ $\text{Tour}$
• The Western Shoshone Indian homeland, Newe Sogobia, is not a nuclear wasteland.

• Each Shimkus tour of the Yucca Mountain Project costs $10,000 or more of U.S. taxpayer money, just to open the gate. This waste of taxpayer money must end!

• The 6th toe on the Yucca dump mutant zombie is twitching, again!
HLRW

Transport Risks
Routes: Yucca Mountain, NV-bound
Highly radioactive irradiated nuclear fuel shipments have long been called “Mobile Chernobyls” by critics, due to their high risks. Similar slogans include: Floating Fukushima for barges; Dirty Bombs on Wheels; even Three Mile Islands in Transport.
Three Mile Island Unit 2
(March 28, 1979)
Kay Drey, St. Louis:  
MOBILE MELTDOWN –  
TMI TRAIN TROUBLES
Yucca-bound routes

Representative Transportation Routes to Yucca Mountain and Transportation Impacts (Cask Shipments by State)

This map depicts the representative routes and shipment numbers evaluated in the U.S. Dept. of Energy Final Supplemental Environmental Impact Statement. It shows the numbers of high-level nuclear waste shipments that would traverse each state en route to Yucca Mountain.
• Nation-wide, a total of 12,145 truck & train shipments, over the course of 24-48 years, would impact 44 states, under the current 70,000 metric ton Yucca Mountain scheme
• Scores of major cities would be impacted
• 330 of 435, or 75%, of U.S. congressional districts would be impacted
• Compare this with the few thousand, at most, irradiated nuclear fuel shipments that have taken place in the U.S. since the beginning of the Atomic Age

72 Reported Incidents

• 4 accidental radioactive material contamination release incidents beyond the vehicle
• 4 accidental radioactive material contamination releases confined to the vehicle
• 13 traffic accidents resulting in no release or contamination
• 49 accidental surface contamination incidents
• 2 other incidents mentioned but no available descriptions
Any mainline rail can be used. The condition of the rails in the U.S. is not good. Think of recent train derailments – as NIRS has often asked, “What if nuclear waste had been aboard?”

The irradiated nuclear fuel casks aboard trains bound for Holtec/ELEA, NM, combined with the rail cars, would weigh around 180 tons. These would be among the heaviest loads on the rails, and would risk further damaging them.
WCS, TX-bound routes
Holtec/ELEA, NM-bound routes (including exports to Yucca)
Holtec’s license application transport route map only shows 2 nuclear power plant origin points, amounting to 4 reactors. What about the other 121 reactors, at scores of other nuclear plants, across the U.S.?

Holtec’s “return to sender”/”start clean, stay clean” policy is nonsense. Is Holtec just trying to save money by not building a pool or DTS at its CISF?
Would a leaking or contaminated cask really be allowed to go back to where it came from in the first place? Is this legal? Is this wise?

Maine Yankee, with around 60 casks, is 2,300 miles away. Such a return trip would mean 4,600 miles round trip, through a dozen states in between ME and NM.

Note that a place like Fort Worth, TX would be clobbered, coming and going – coming to NM, and going to NV – under the Holtec/ELEA plan.
Highly Radioactive LIQUID Waste Truck Shipments?
(DOE is out of control!)
Dr. Gordon Edwards of Canadian Coalition for Nuclear Responsibility in Montreal has calculated that a mere 2 fluid ounces of this highly radioactive liquid waste would be enough to contaminate Washington, D.C.’s Georgetown Reservoir, in violation of EPA’s Safe Drinking Water Act Maximum Contaminant Level for Strontium-90.
Congress needs to exercise oversight! Thank you to U.S. Rep. Brian Higgins (Buffalo, NY), and U.S. Sen. Kirsten Gillibrand of NY, for taking action and speaking out in opposition to these high-risk, unnecessary highly radioactive liquid waste truck shipments!
H.R. 3053, Nuclear Waste Policy Amendments Act
(House Floor Vote, May 10, 2018: Yeas, 340; Nays, 72)

Sponsor John Shimkus (R-IL)

Co-Sponsor Fred Upton (R-MI)
Missouri’s Bad votes on H.R. 3053
(House Floor--May 10, 2018)

U.S. Rep. Vicky Hartzler (R-Missouri’s 4th)
Missouri U.S. congressional delegation votes on H.R. 3053

- AYES (bad votes):
  - Wm. Lacy Clay* (D-1\textsuperscript{st});
  - Ann Wagner* (R-2\textsuperscript{nd});
  - Blaine Luetkemeyer* (R-3\textsuperscript{rd});
  - Vicky Hartzler (R-4\textsuperscript{th});
  - Emanuel Cleaver (D-5\textsuperscript{th});
  - Sam Graves* (R-6\textsuperscript{th});
  - Billy Long* (R-7\textsuperscript{th});
  - Jason Smith* (R-8\textsuperscript{th});
  - *Co-Sponsors
Potential Barge Shipments: Missouri River, from Cooper into Port of Omaha

Barge Shipments of High-Level Radioactive Waste on the Missouri River
Proposed by U.S. Dept. of Energy under its Yucca Mountain Plan

Map taken from Figure J-9, Routes analyzed for barge transportation from sites to nearby railheads, page J-80.

<table>
<thead>
<tr>
<th>Nuclear Plant</th>
<th>Location</th>
<th>Number of Shipments Proposed</th>
<th>Barges offloaded at:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper Station</td>
<td>Brownville, NE</td>
<td>Up to 125</td>
<td>Port of Omaha, NE</td>
</tr>
</tbody>
</table>

Table taken from Table J-27, Barge shipments and ports, page J-83.

Floating Fukushimas

Barges from Indian Point, down the Hudson River, past Manhattan? Barges from CT Yankee on Long Island Sound? Barges from Oyster Creek, past Staten Island? Really? The security risks alone, let alone safety risks, argue against this!
But barge shipments are proposed on numerous surface waters:

- **The Great Lakes (Lake Michigan, bordering MI, WI, IN, and IL)**
- Rivers (in numerous states, impacting VA, LA, MS, TN, AL, NE, KS, IA, and MO, either directly or downstream, or along bordering riverbanks)
- Bays & Harbors (in DE, MA, and MD)
- Seacoasts (CA, FL)
MO Road and Rail Routes

![Map of Missouri with routes marked]
St. Louis Area Road and Rail Routes
Kansas City Area Road and Rail Routes
MO Shipment Numbers

Under the current Yucca scheme (70,000 MT):
• By road, Heavy-Haul Trucks carrying rail-sized casks from Callaway NPP to nearest railhead;
• By rail, 3,574 rail-sized casks on trains;
• Shipments would go on for 24-48 years.

An increase of the Yucca limit (up to 110,000 MT), or the opening of the NM (173,600 MT) and/or TX (40,000 MT) CISFs, would significantly increase the numbers of shipments crossing MO.
Other states’ trans-shipments through MO, versus MO export shipments

- “Mostly Rail Scenario”
- Legal Weight Truck (Originating/Total): 0/491 (0% originating in MO; 100% originating elsewhere)
- Train (Originating/Total): 71/4,069 (less than 2% originating in MO; more than 98% originating in other states)
Road and Rail Routes, D.C.
Close up

Figure 7: FSIS Routes through the District of Columbia
Too close for comfort
See the work of Rick Hind of Greenpeace, re: hazardous chlorine train car shipments through D.C. and Capitol Hill, as featured in the *Wall Street Journal*. 
Road and Rail Routes (Yucca-bound)

• [http://www.state.nv.us/nucwaste/news2017/pdf/States_Affected.pdf](http://www.state.nv.us/nucwaste/news2017/pdf/States_Affected.pdf) [44 states = 88 U.S. Senators!]

• [http://www.state.nv.us/nucwaste/news2017/pdf/Cities_Affected.pdf](http://www.state.nv.us/nucwaste/news2017/pdf/Cities_Affected.pdf) [scores of major cities]

• [http://www.state.nv.us/nucwaste/news2017/115th%20Congressional%20Districts%207252017.pdf](http://www.state.nv.us/nucwaste/news2017/115th%20Congressional%20Districts%207252017.pdf) [330 of 435 = 75% of U.S. House Districts!]
Or Heavy-Haul Truck?
As shown by this Big Rock Point, MI reactor pressure vessel shipment (290 tons), there is an alternative to barges.

However, this shipment itself, in Oct. 2003, experienced numerous incidents during the course of its journey to South Carolina – including damaging the tracks and causing derailments of other (non-nuclear) trains in its wake!
Transport Risk:
What if HLRW had been involved?
Underwater Submersion
(Interstate 40, Oklahoma, 2002)
Inadequate regulatory requirements means safety is threatened

Thanks to Public Citizen for its 2002 analysis:

The regulatory requirement (the design criteria) is that a cask that has undergone the puncture test (a cask must withstand a free-fall from 40 inches—3 ft., 4 in.--onto an 8-inch long spike), must then withstand submersion under 3 feet of water.

But many surface water barge transportation routes are much deeper than 3 feet.
An undamaged cask must withstand submersion under 200 meters (656 feet) of water for 1 hour.

But if there is an accident, how can the optimistic assumption be made that a cask would not be damaged? How would a mobile crane, capable of lifting 100+ tons, be brought in, set up, and operated, all in less than an hour?

What about depths greater than 656 feet, such as exist near proposed barge routes in Lake Michigan?
Public Citizen

Everyone knows that accidents happen: Nuclear Waste Transport Casks

Everyone knows that accidents happen...

The nuclear industry wants you to believe that shipping nuclear waste to a dump at Yucca Mountain is safe. But current nuclear waste transport casks have never been physically tested. The Nuclear Regulatory Commission’s performance requirements are outdated and dangerously underestimate today’s worldwide accident scenarios.

<table>
<thead>
<tr>
<th>NAME OF TEST</th>
<th>REGULATORY REQUIREMENTS</th>
<th>SAFETY THREATENED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop Test</td>
<td>Casks must withstand a 50 feet fall onto an essentially unpadded surface, simulating the impact of a crash.</td>
<td>In this test, casks opened at the moment of impact is only 30 inches per hour. Highway speeds limits typically 45-75 mph have increased since 1970. Regulators are now prepared. A crash like a bridge collapse or an oncoming heavy vehicle could exceed test conditions.</td>
</tr>
<tr>
<td>Roll Test (1 mph)</td>
<td>Casks must withstand an accelerating force of 1470 F for 90 minutes.</td>
<td>Other materials that closes safely burn at much hotter temperatures. Closed burn at 1522°F and for longer than 50 minutes. The 2011 fire in Baltimore burned for more than 5 days and probably reached temperatures hotter than 1522°F.</td>
</tr>
<tr>
<td>Puncture Test (45 mph)</td>
<td>Casks must withstand a force of 45 inches onto an 8-inch long spike.</td>
<td>Many of the bridges along transport routes are considerably lower than 60 inches. A spike delivered by truck cask or a bridge could cause puncture damage to the casks, child, and release radiation.</td>
</tr>
<tr>
<td>Water Submersion Test</td>
<td>A tank that has undergone the puncture test must withstand submersion in 5 feet of water for 30 minutes.</td>
<td>A damaged cask submerged in water deeper than 3 feet could contaminate water supplies. A cask can weigh as much as 120 tons and would be extremely difficult to retrieve in 1 hour, especially in remote areas. Water pressures over long periods of time could cause radiation to be released.</td>
</tr>
</tbody>
</table>

May 2012
Safety is threatened

A damaged cask submerged deeper than 3 feet could contaminate drinking water supplies.

Casks can weigh 150 tons or more, and would be extremely difficult to retrieve in 1 hour, especially in remote areas.

Water pressure over a long enough time period could breach a cask.

There is enough fissile material (U-235, Pu-239) still present in the irradiated nuclear fuel that if a critical mass were to form in an accident, and moderating water leaks into the shipping container, an inadvertent nuclear chain reaction could occur. Emergency response would then be a suicide mission in terms of the gamma and neutron radiation being emitted. Releases of radioactive gases, liquids, and particles out the breach into the surface water would be made all the worse.
Transport Risk:
What if HLRW had been aboard?
High-Temperature, Long-Duration Fire
(Howard Street Tunnel fire beneath downtown Baltimore, MD, July 2001)
Inadequate Regulatory Requirements of the Burn Test

...again leaves safety threatened. Casks must withstand an engulfing fire at 1,475 degrees Fahrenheit (800 degrees Celsius), for 30 minutes.

But other materials that share the roads, rails, and waterways burn at much hotter temperatures than that (diesel burns at 1,800 degrees F, for example), and for much longer than 30 minutes.
The 2001 train fire in Baltimore burned for more than 3 days, and probably reached temperatures hotter than 1,500 degrees F, for as long as 24 hours – 23 hours and 30 minutes longer than casks are designed to withstand!
Commissioned by the State of NV Agency for Nuclear Projects, Dr. Marvin Resnikoff of Radioactive Waste Management Associates studied this accident, and asked, what if a Holtec container had been involved? He published his results in “Radiological Consequences of Severe Rail Accidents Involving Spent Nuclear Fuel Shipments to Yucca Mountain: Hypothetical Baltimore Rail Tunnel Fire Involving Spent Nuclear Fuel.”
Resnikoff found that the Holtec container would have failed, and released a portion of its hazardous radioactivity with the smoke, to blow downwind.

Acute dose excess latent cancer fatalities would have numbered from around 10 to 50, unavoidably.

If an adjacent sports stadium was filled to capacity at the time of the release, 20 to 120 people would later have died from radio-genic cancer.
Dr. Resnikoff calculated that 10 square kilometers (nearly 3.9 square miles) of downtown Baltimore would have been moderately contaminated.

Another 10 sq. km (~3.9 sq. mi) would have been heavily contaminated.

The cleanup bill would have cost $13.7 billion (in Year 2001 dollars; adjusted for inflation, that’s $19.9 billion in Year 2018 dollars).
If the cleanup was not done, a 1-year dose from living in contaminated areas would have caused from around 250, to around 1,600, latent cancer fatalities.

A 50-year dose from living in contaminated areas would have caused around 5,000 to 32,000 latent cancer fatalities.

It cited security as a significant unresolved issue.
Truth be told, little to nothing has been done in this regard in the past dozen years.

TOW and other anti-tank missiles, shaped charges, sophisticated military grade explosives, and incendiaries, remain a risk to high-level radioactive waste shipments.
Dirty Bombs on Wheels

A June 1998 test of a TOW anti-tank missile, against a German CASTOR shipping cask, at the U.S. Army’s Aberdeen Proving Ground, blew a hole--several inches across--clean through the wall of a 15-inch die cast iron cask. This would, when combined with an incendiary, provide the pathway for disastrous amounts of hazardous radioactivity, such as volatile Cs-137, to escape into the environment.
Transport Risk: Attack
What if HLRW were involved?!
When I raised such risk scenarios at a 10/1/2015 subcommittee hearing, Rep. Shimkus (R-IL) responded that he’d personally fired a TOW, and that they are challenging to operate, making it difficult for an attacker to hit a moving high-level radioactive waste shipment.
But TOWs were designed to be used against Soviet T-72 tanks, capable of speeds of up to 37 mph. We have to assume HLRW shipments could well slow below speeds of 37 mph, as in the congested Chicago area, and that attackers in possession of TOWs would be trained to use them.

Rep. Shimkus (R-IL) did agree with me, however, that anti-tank weaponry has advanced since TOWs were developed, 40 years ago.

This means modern weaponry is an even bigger risk to HLRW shipments, if in the wrong hands.
Where the Radioactive Poisons Go/Concentrate/ Cause Harm in the Human Body

The reproductive organs are attacked by all radioactive isotopes emitting gamma radiation. In addition, the deadly Plutonium-239 is known to concentrate in the gonads. The radiation it emits can cause birth defects, mutations and miscarriages in the first generation after exposure and/or successive generations.

The times listed next to the type of ray emitted are the half-lives: how long it takes for half of the radioactive material to break down.

If you ingest alpha and beta emitters, they set up permanently next to the marrow of your bones, in your reproductive organs or elsewhere.

The effects of ionizing radiation are not immediate. Exposure to radiation can cause cancers many years later. Exposure to very low levels of radiation can be equally dangerous over time.
The preceding chart shows where in the human body various radioactive isotopes concentrate, to do their harm.

In case of a shipping cask breach and release of gases, volatiles, particles, liquids, and other radioactive materials from HLRW, this is how they can harm humans downwind, downstream, up the food chain, and down the generations (many are very long-lasting in the environment).
“Routine” or “Incident-Free” Shipments: Mobile X-Ray Machines That Can’t Be Turned Off
The phrase “mobile X-ray machines that can’t be turned off” was coined by Lauren Olson in 1997.

NRC regulations allow for 10 milli-Rem/hour dose rates at a distance of 2 meters (6.6 feet) from a cask. That’s 1 to 2 chest X-rays per hour.

At the cask surface, NRC allows 200 mR/hr, or 20 to 40 chest X-rays per hour.
But sometimes the exterior of shipping casks are contaminated, sometimes severely so.

Above, 49 such incidents of external contamination were documented in the U.S. from 1949-1996.

As revealed by Mycle Schneider of WISE-Paris in the mid- to late 1990s, Areva (now called Orano in the U.S., as at the WCS, TX CISF) experienced a very large number of externally contaminated HLRW shipments.
25 to 33% of all shipments bound for the La Hague reprocessing facility – many hundreds, over the course of many years – were externally contaminated beyond regulatory limits.

On average, they emitted 500 times the permissible dose rate.

One emitted 3,300 times the allowable dose rate.
U.S. Rep. Fred Upton (R-MI), shown on the previous slide, from the mid-1990s to the present, has advocated for the Yucca dump. He is the immediate past chairman of the U.S. House Energy & Commerce Committee, and is still a subcommittee chairman on that committee.

U.S. Rep. John Shimkus (R-IL), a subcommittee chair, is now the chief advocate for the Yucca dump, and hence sponsor of H.R. 3053.
The Nuclear Waste Policy Amendments Act of 2018

On 6/5/18, Robert Halstead published “Revised Comments on HR3053 to Nevada Commission on Nuclear Projects.”

Halstead reported that HR3053 would increase the amount of HLRW that could be buried at Yucca, from 70,000 metric tons to 110,000 MT, a major policy change.
Such an increase would accelerate waste container degradation, and hazardous radioactivity releases to the environment.
Halstead reported that HR3053 would eliminate the prohibition on opening an MRS (Monitored Retrievable Storage facility, another name for CISFs) in Nevada, risking de facto permanent surface storage.

HR3053 would also accelerate the NRC licensing process, by providing certain land and water rights to DOE, and expediting the NRC licensing proceeding, and changing licensing procedures.
This could effectively gut fair hearings on the State of Nevada’s more than 200 legal and technical contentions, already having won hearings based on their merits.
Halstead also reported that major, significant Yucca Mountain funding uncertainties remain, despite passage of HR3053 on the House floor on May 10, 2018.

HR3053 also violates the Blue Ribbon Commission Final Report, as via non-consent based siting, as well as retaining (even strengthening) Office of Civilian Radioactive Waste authority within DOE, rather than creating an independent nuclear waste management organization.
HR3053 also authorizes CIS, and allows DOE to take title and liability for commercial irradiated nuclear fuel at MRS facilities.

Consent-based siting is required for MRS facilities. However, ironically enough, consent-based siting is NOT required for permanent disposal at Yucca Mountain!

HR3053 limits MRS facilities to 10,000 metric tons.
An irony of Rep. Upton’s Yucca dump advocacy is the risk it would present to Lake Michigan. Lake Michigan is drinking water for 16 million people, and is headwaters for the Great Lakes downstream. They supply a total of 40 million people drinking water in the U.S. and Canada, and a large number of Native American First Nations.
The irony of Shimkus’s sponsorship of HR3053 for IL is the large number of shipments originating at reactors in other states that would pass through.

IL has more atomic reactors than any other state – 14 altogether, 11 still operating (3 are undergoing decommissioning).

But compare the number of IL HLRW exports, to the numbers of HLRW trans-shipments, originating at reactors in other states, headed to Western dump-sites.
Under the mostly rail shipment scheme analyzed in DOE’s Feb. 2002 FEIS for the Yucca repository, 861 rail casks originating at IL’s 14 reactors would be dwarfed in number, compared to the 6,166 shipments, originating at reactors in other states, that would pass through IL, bound for the Southwest.

Mostly rail still would mean 1,071 Legal Weight Truck (LWT) cask shipments via interstate highway. For IL, not a single one would have originated at an IL reactor!
The greater Chicago area would be hard hit, especially on the south and west sides, including within just several miles of the heart of downtown, due to such rail routing constraints.
Senate E&W Appropriations
Lamar Alexander (R-TN) is the chairman of the U.S. Senate Appropriations Committee subcommittee on Energy & Water Appropriations. Diane Feinstein (D-CA) is the Ranking Member. Both are more interested in CIS than in the Yucca dump. Feinstein could be responding to clamor from some near San Onofre to “get it out of here, we don’t care where it goes, nor how it gets there.”
But ironically enough, Sen. Feinstein and the NIMBYs in southern CA should care how it goes – study the large impacts shipments would have on the greater LA metro region.

Barge shipments from Diablo Canyon nuclear power plant, into Oxnard, could significantly increase the HLRW shipping impacts on LA.

In other words, be careful what you wish for...
The Western Shoshone do not consent to the Yucca Mountain dump

The State of NV does not consent to the Yucca Mountain dump

A growing groundswell in NM and TX do not consent to CISFs

Transport corridor communities in 44 states or more do not consent to Mobile Chernobyls, Floating Fukushimas, and Dirty Bombs on Wheels
It has been 76 years since Enrico Fermi generated the first HLRW of the Atomic Age, in his Chicago Pile-1 reactor during the Manhattan Project. And we still don’t know what to do with that first cupful!

It has been 61 years since the first “civilian” reactor was built – by the U.S. Nuclear Navy! – at Shippingport, PA. And we still don’t know what to do with the irradiated nuclear fuel from it!
Summary/Conclusion

• We oppose waste generation
• We oppose current risky pool and inadequate dry cask storage
• We oppose the Yucca Mountain dump and Centralized Interim Storage Facilities
• We oppose unnecessary, high-risk HLRW shipments
• We advocate for Hardened On-Site Storage, as close as possible to the point of generation. This is an urgently needed and long overdue safety, security, health, and environmental protection upgrade.