

Decommissioning Nuclear Power Plants: What Congress, Federal Agencies and Communities Need to Know

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

*Kevin Kamps, Radioactive Waste Specialist, Beyond Nuclear
Room HC-8, U.S. Capitol Building
Monday, July 16, 2018*

Shutdown of operating reactors, and their decommissioning, is the answer to the radioactive waste generation problem. We welcome the announced closure date of Oyster Creek, New Jersey on September 17, 2018.

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...

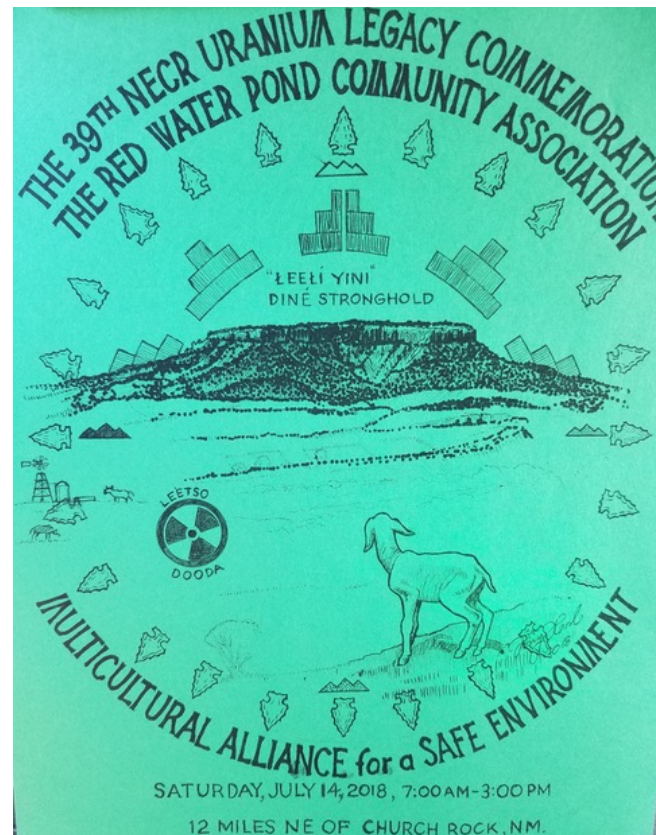
- We oppose current risky indoor “wet” pool storage, and inadequate dry cask storage.
- We oppose the Yucca Mountain dump and so-called “centralized interim storage” schemes, including their inherent, unnecessary, high-risk high-level radioactive waste shipments.
- We advocate for Hardened On-Site Storage (HOSS), as close as possible to the point of generation, as an urgently needed safety, security, health, and environmental protection upgrade.

July 16 – a date that will live in infamy

1945, Trinity atom bomb test blast, near Socorro, NM



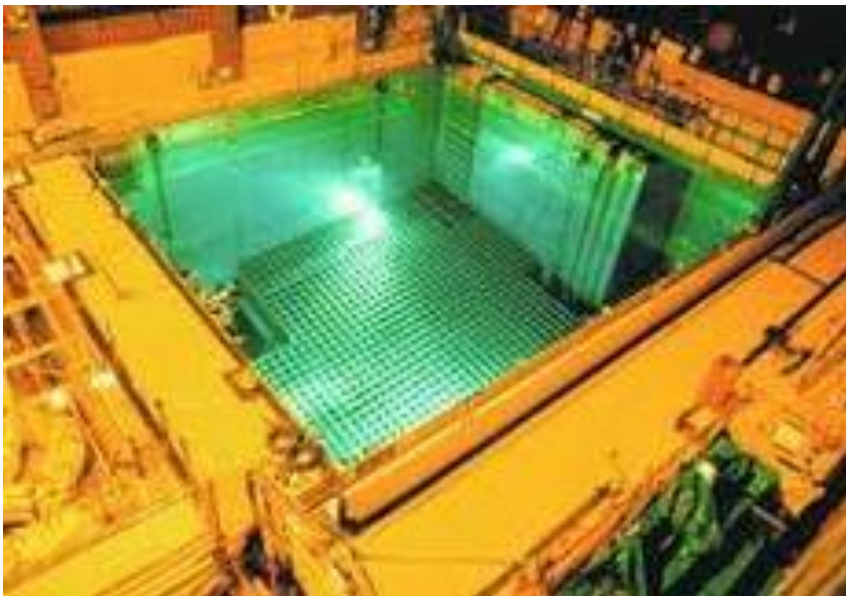
1979, Church Rock uranium mill tailings spill into Rio Puerco, near Gallup, NM



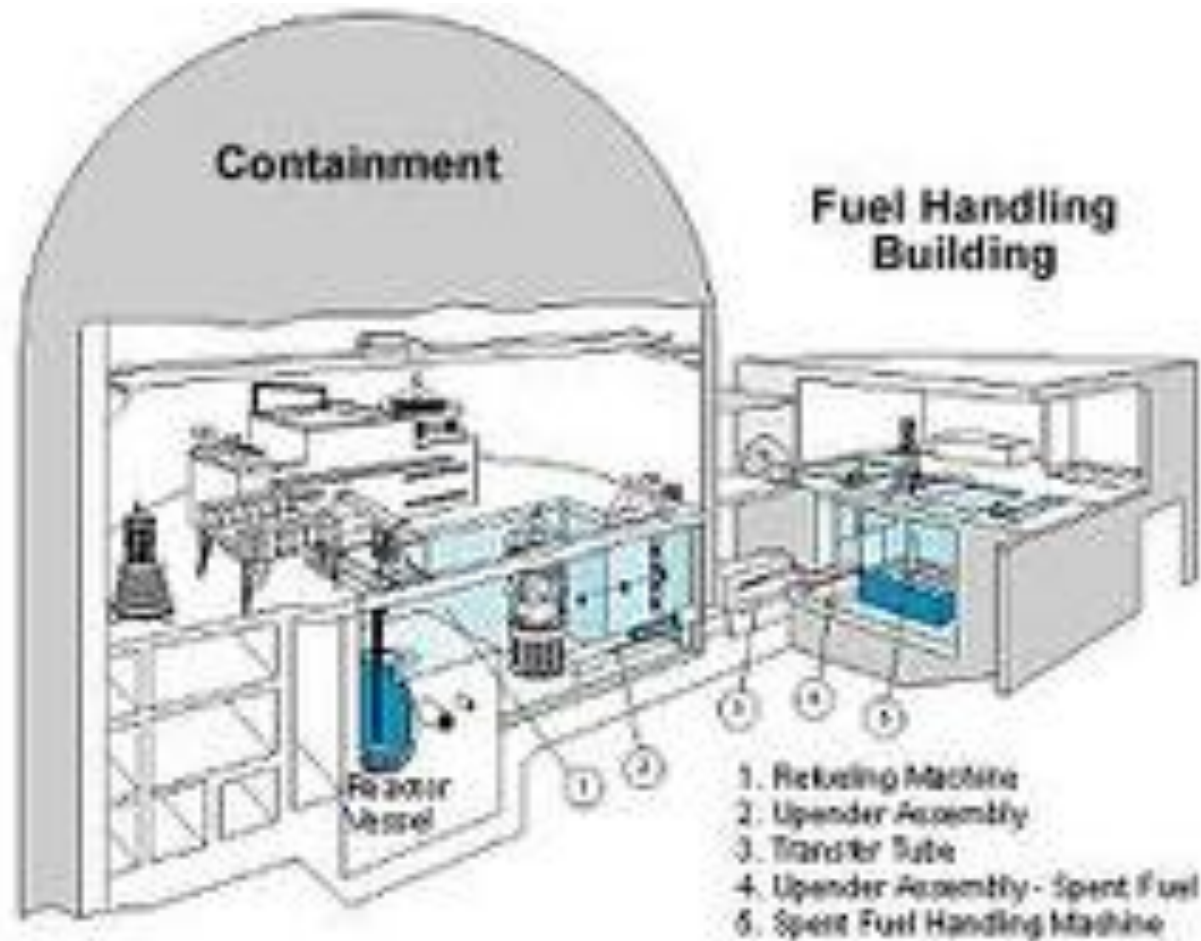
And in its tone deafness that borders on sociopathic – and even ghoulish – the NRC has also chosen today, June 16th, 2018, to issue its Federal Register Notice, announcing the licensing proceeding legal intervention deadline for the Holtec/Eddy-Lea [Counties] Energy Alliance centralized interim storage facility (CISF) for highly radioactive waste, targeted at New Mexico. The deadline is September 14. Our public comment deadline on environmental scoping is July 30.

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).

Close call with catastrophe

Fukushima Daiichi Unit 4



**Japanese Prime Minister
Naoto Kan**

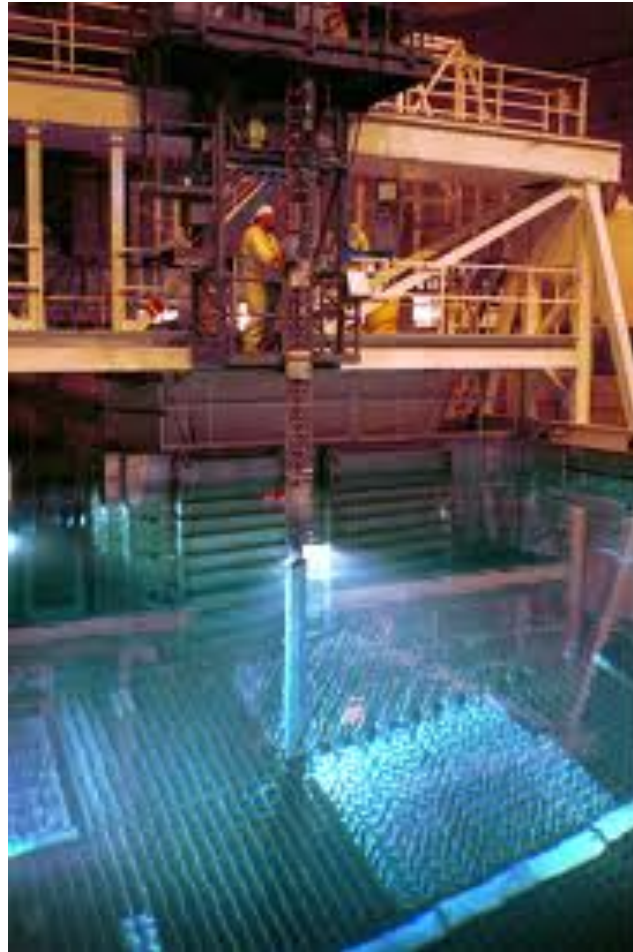


- The three reactor meltdowns, and associated containment breaches, at Fukushima Daiichi, resulted in 160,000 nuclear evacuees in Japan, beginning on 3/11/11.
- However, then serving Prime Minister Kan publicly revealed on the one year commemoration of the beginning of the nuclear catastrophe, that had 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

- IP'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)

Crane Risks



Independent Spent Fuel Storage Installation (ISFSI) Configurations

Vertical

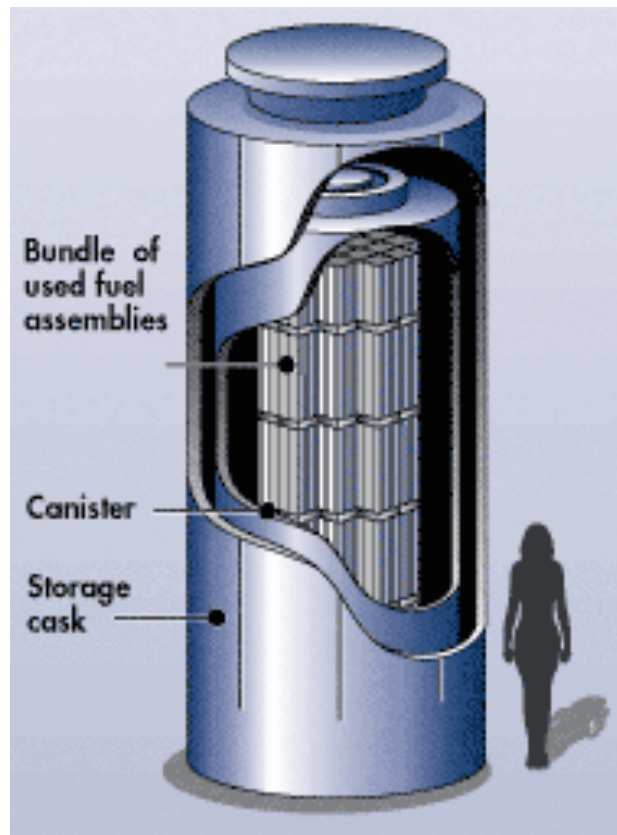


Horizontal

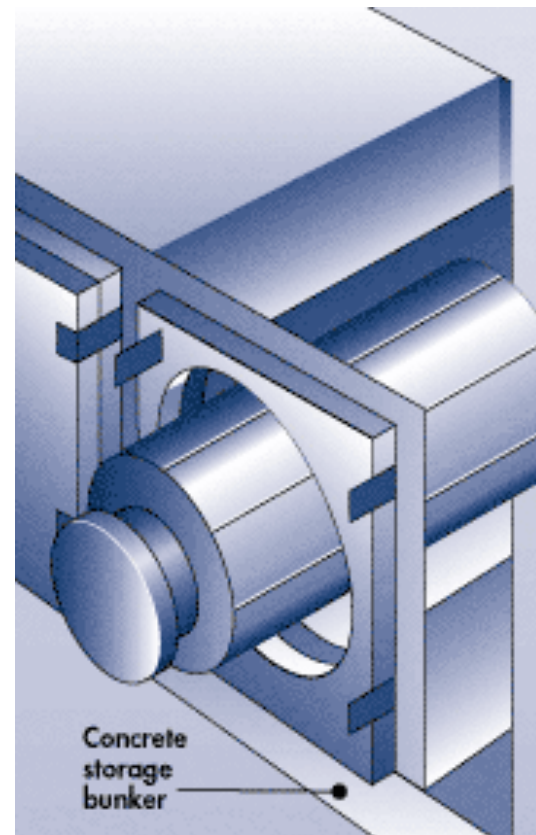


ISFSIs (Cask/Canister issues)

Vertical



Horizontal



Some examples of dry cask/canister failures

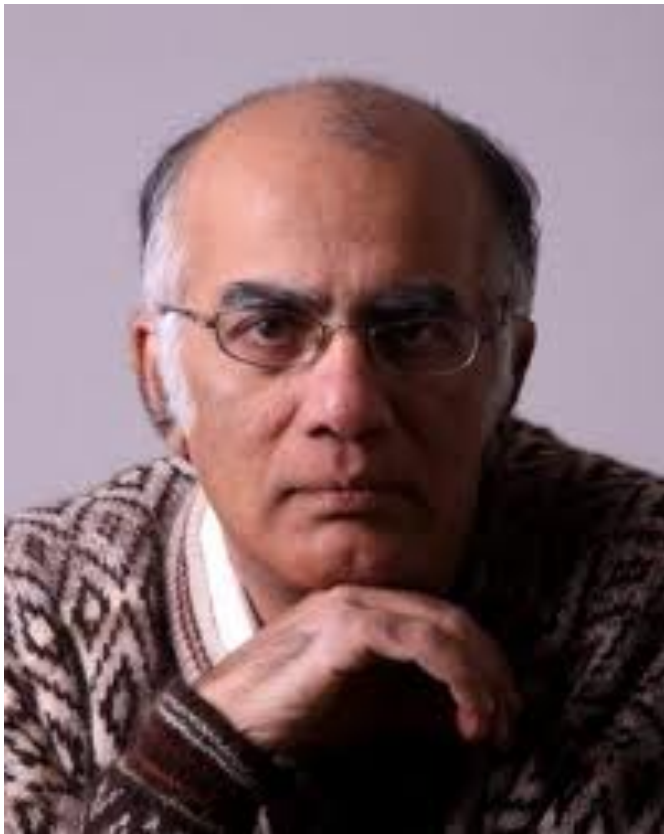
- Defective welds (Ventilated Storage Cask-24s, Palisades, MI)
- Inner canister wall thickness ground too thin, below technical specifications (TransNuclear/NUHOMS, Davis-Besse, OH)
- Hydrogen gas generation, explosion, and fires (VSC-24s, Palisades & Point Beach, WI)
- Vertical casks moved several inches out of position; horizontal casks' concrete structure and radiation shielding damaged by earthquake (accompanied by a week long coverup 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 inerting Helium gas, 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 in 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

- http://ieer.org/wp/wp-content/uploads/2010/03/HOSS_PRINCIPLES_3-23-10x.pdf
- Many hundreds of public interest and environmental organizations, representing all 50 states, including from NY State:

Coalition on West Valley Nuclear Wastes; Center for Health, Environment, and Justice; For a Clean Tonawanda Site (FACTS); Citizen's Environmental Coalition; Riverkeeper; Central New York Citizens Awareness Network; IPSEC (Indian Point Safe Energy Coalition); Public Health and Sustainable Energy (PHASE); Council on Intelligent Energy & Conservation Policy (CIECP); Hudson River Sloop Clearwater.

HOSS where appropriate/acceptable

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.

San Onofre, CA is on the edge of the Pacific, in an earthquake and tsunami zone.

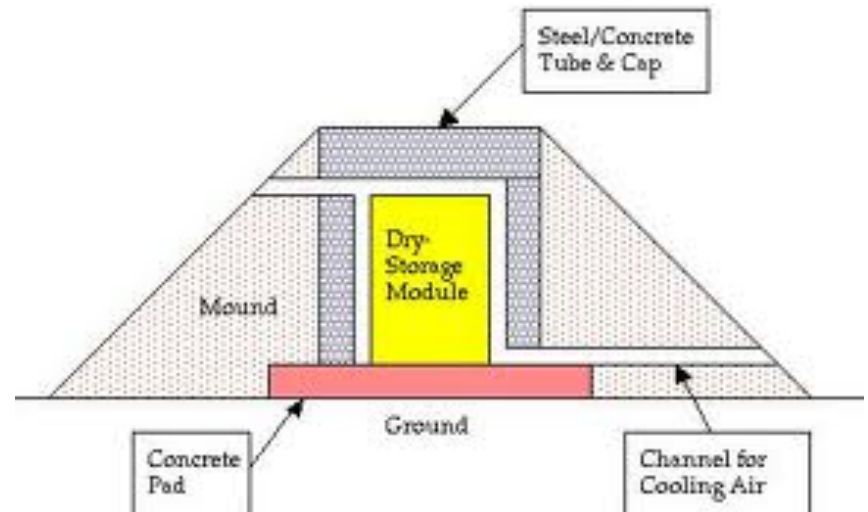
Dr. Mary Sinclair, a co-founder of Don't Waste Michigan, warned about such radioactive waste risks to the Great Lakes, as well as rivers – the drinking water supplies of our nation – and the coasts, at risk of rising sea levels, more than 20 years ago.

In those cases, hardened storage should still be implemented, as close as possible to the point of waste generation as is safely 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, are important elements of HOSS.

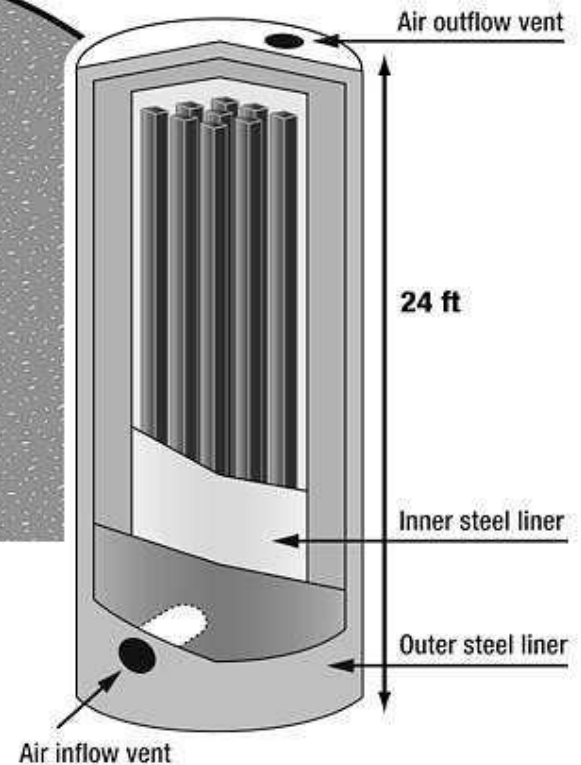
Schematic representation of HOSS

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.



Such earthen berms 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.

HOSS is needed even if the Yucca Mountain dump, or Centralized Interim Storage, 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

<<https://web.archive.org/web/20151020093217/http://www.nirs.org/radwaste//atreactorstorage/shiranialeg04.htm>>

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”
- Will serve as environmental coalition expert witness in impending NRC licensing proceeding for Holtec/ELEA’s proposed CISF targeted at southeastern NM (which began today, 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, that is, taxpayers.

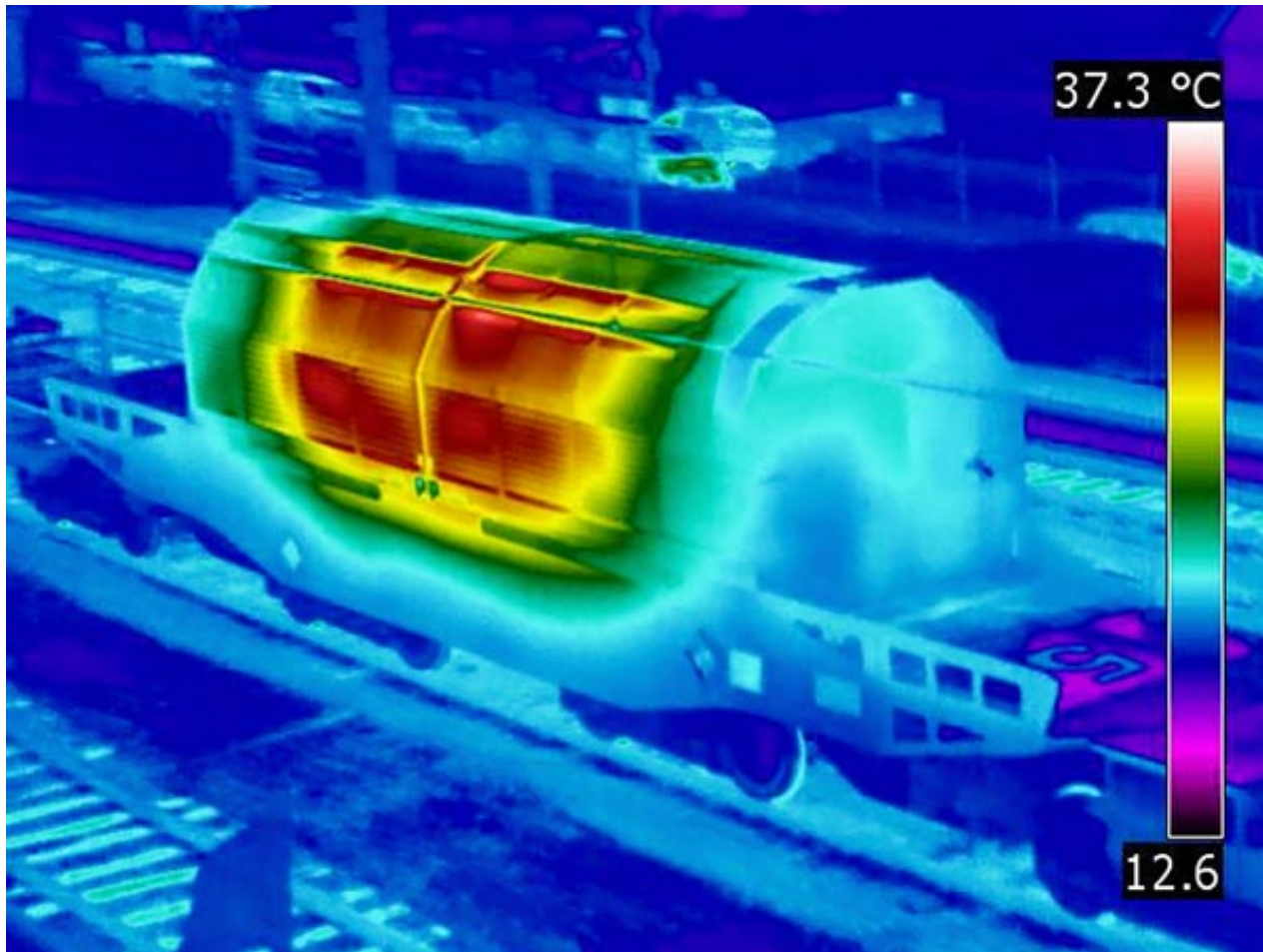
Risks of Off-Site Transport



- Severe accidents
- Attacks
- Mobile X-Ray Machines That Can't Be Turned Off

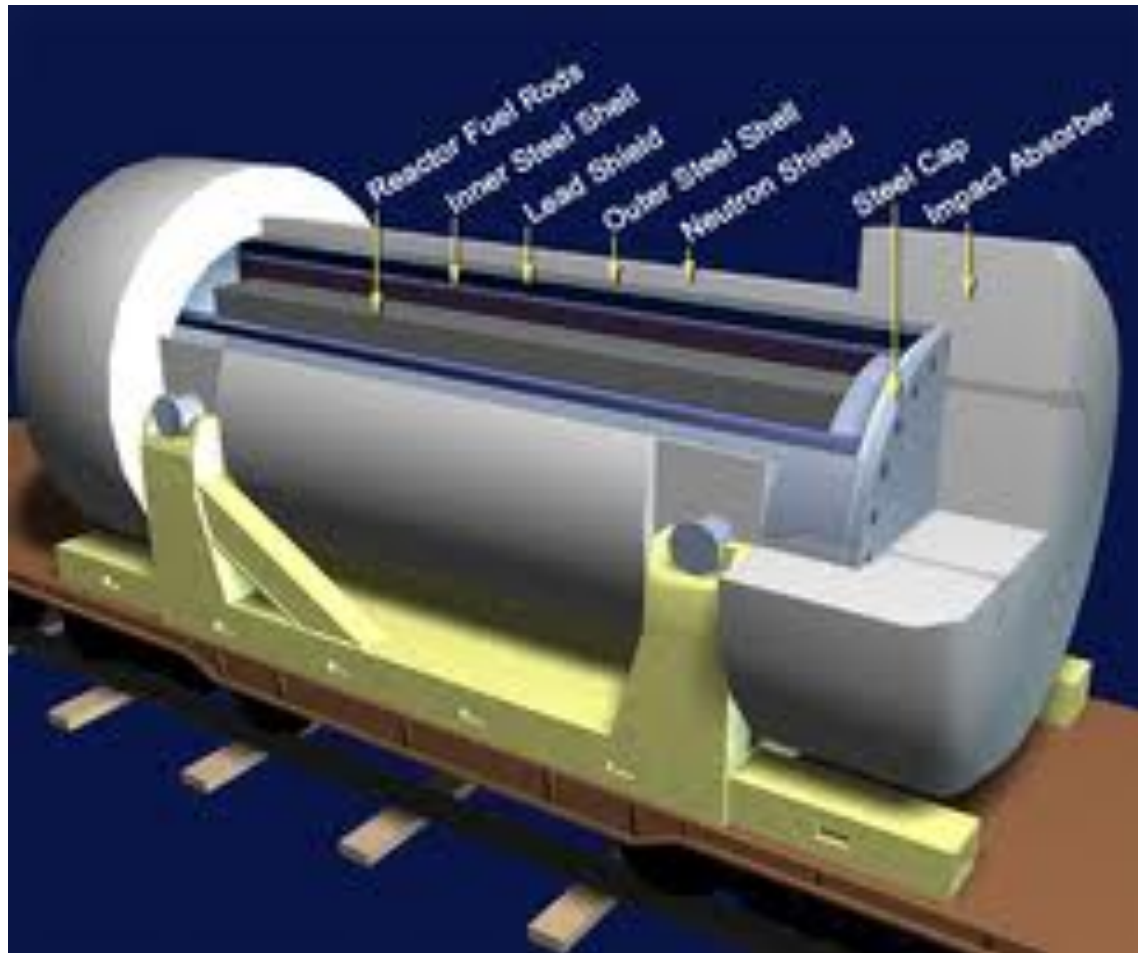


High Burn-Up makes everything worse (thermal heat, radioactivity)



But “lower burn-up” is plenty bad enough already in those regards!

Shipping Cask/Canister issues





Consolidated Interim Storage Facilities

**Waste Control Specialists, LLC,
Andrews County, Texas (WCS)**

**Eddy-Lea [Counties] Energy
Alliance, New Mexico (ELEA)**



www.youtube.com/watch?v=12fr6upEaow

WIPP creative commons



Fire At Carlsbad Nuclear Waste New Mexico

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?!

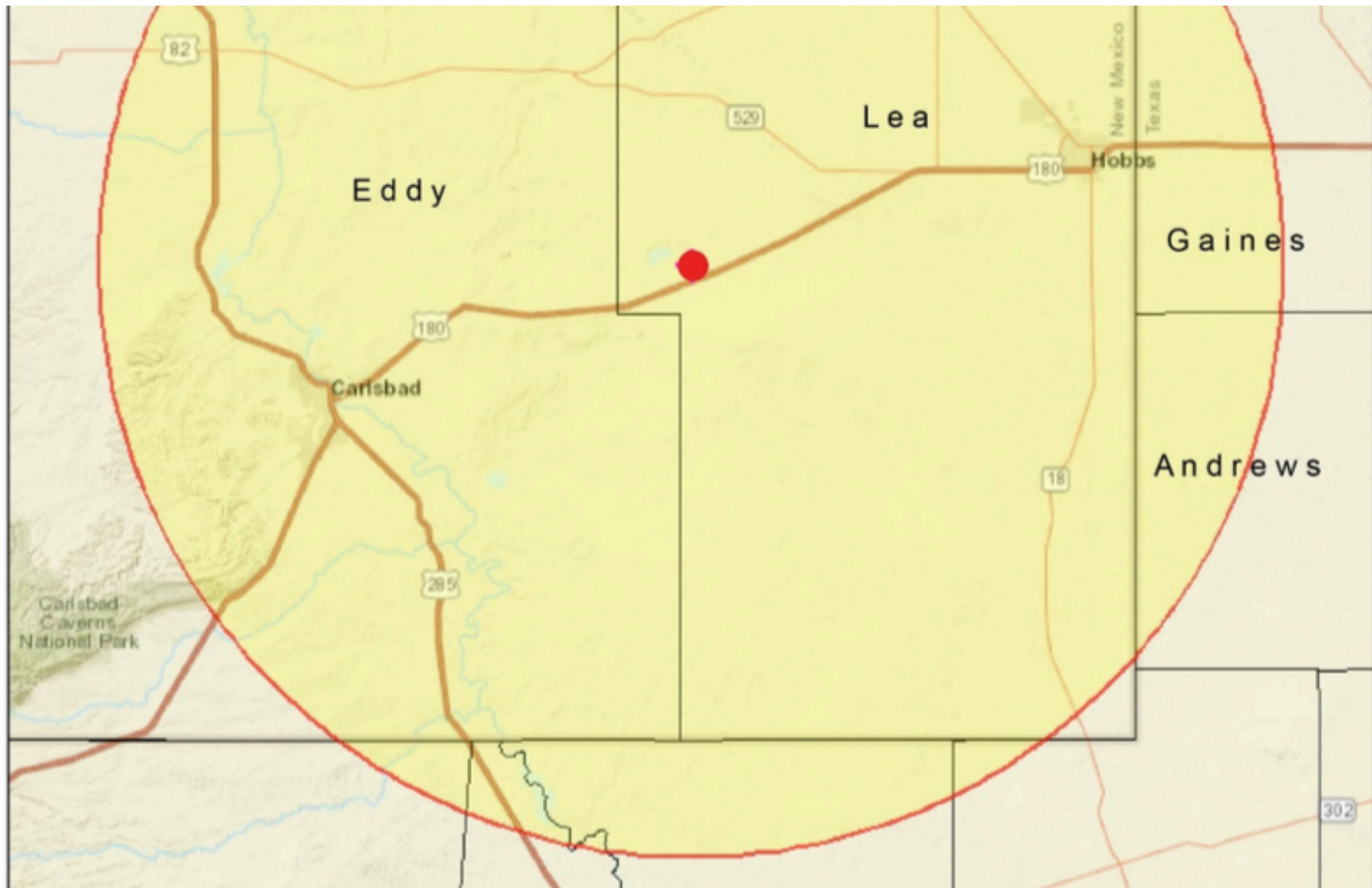
The TX/NM borderlands are being treated by CISF proponents as an energy or nuclear sacrifice zone.

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 (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 on a very fast pace: July 30th deadline for environmental scoping public comment, despite request by scores of environmental groups for a three month extension; and as of today, the announcement of a September 14, 2018 licensing intervention legal contentions submission deadline.

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, 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 traditionalists 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



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.

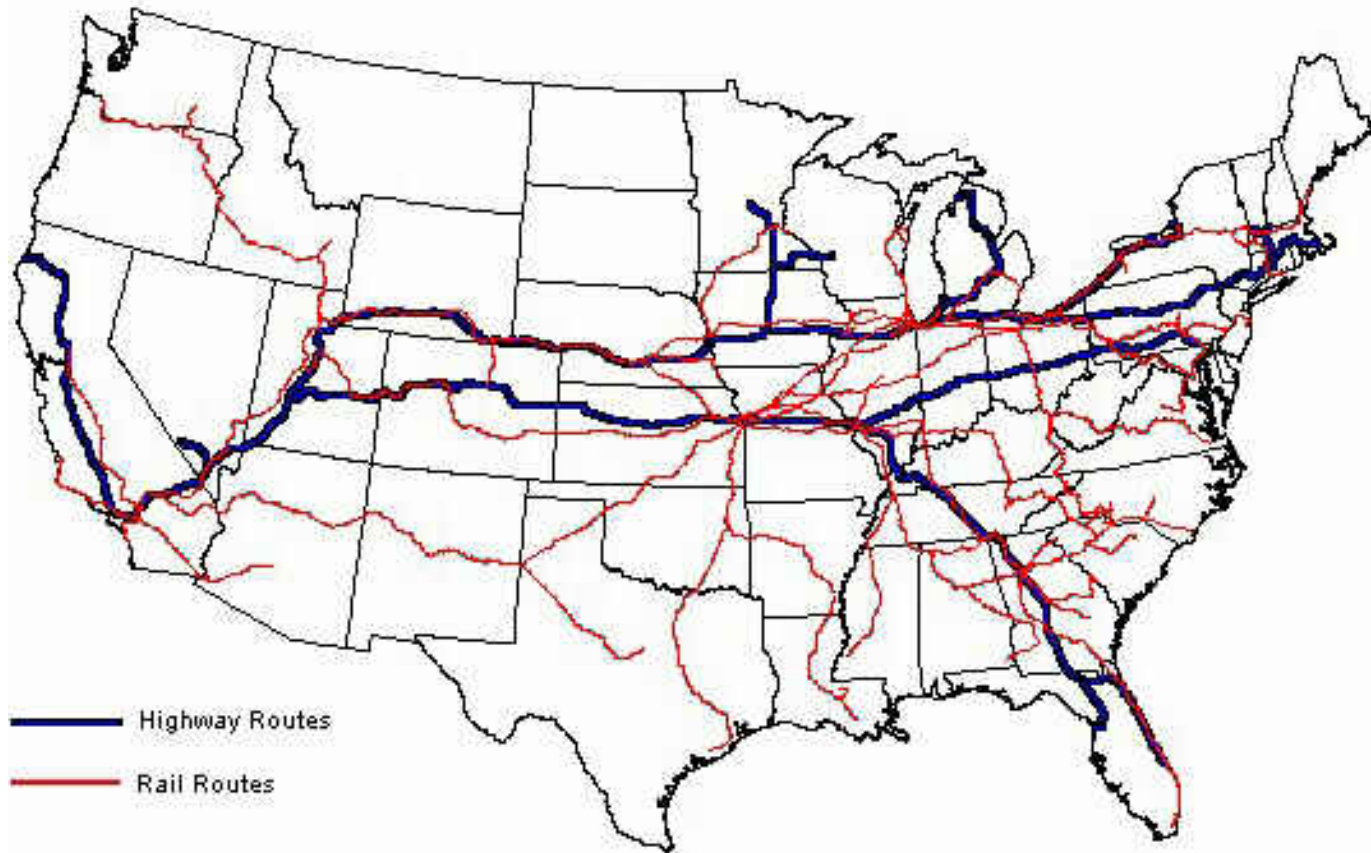
Yucca Mountain, Nevada; Geologic Repository (Permanent Burial)



- 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 must end!
- The 6th toe on the Yucca dump mutant zombie is twitching, again!

Routes: Yucca Mountain, NV-bound

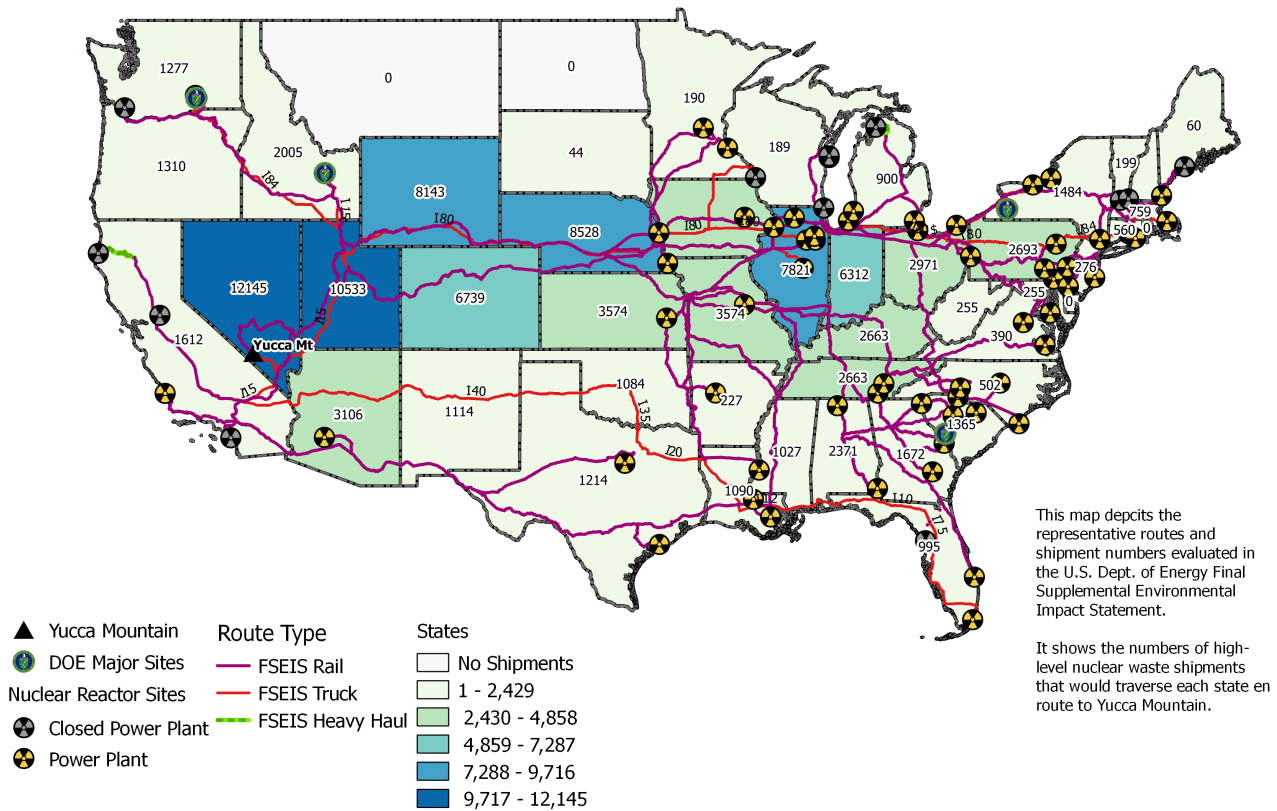
Nuclear Waste Shipment Routes



Highly radioactive irradiated nuclear fuel shipments have long been called “Mobile Chernobyls” by critics, due to their high risks.

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.

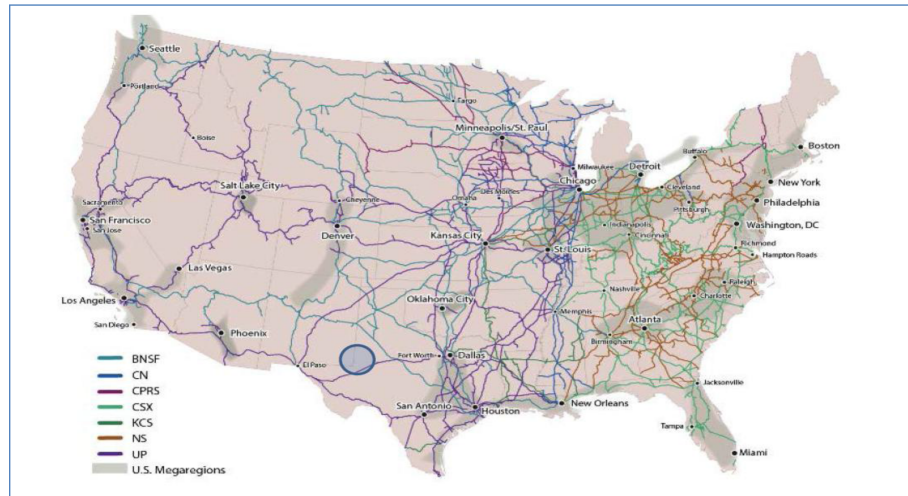
- 12,145 truck & train shipments, over the course of 50 years, would impact 44 states, under the current 70,000 metric ton Yucca Mountain scheme
- Scores of major cities would be impacted
- 330 of 435, or 75%, of U.S. congressional districts would be impacted


- 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
- State of Nevada Agency for Nuclear Project's director Robert Halstead published "Reported Incidents Involving Spent Nuclear Fuel Shipments, 1949-1996."

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

WCS, TX-bound routes

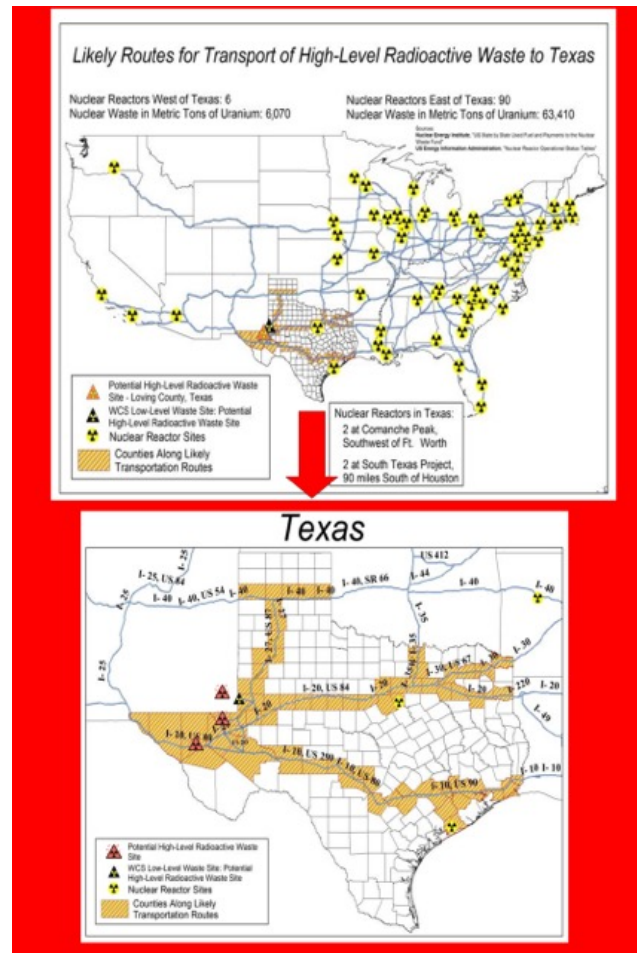


<p>Title:</p> <p style="text-align: center;">RAIL LINES MAP</p>	<p>Figure:</p> <p style="text-align: center;">2.2-4</p>	<p>Date:</p> <p>11/18/2015</p> <p>Scale:</p> <p>NONE</p>	
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Any mainline rail can be used. The condition of the rails in the U.S. 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)



Figure 4.9.1: TRANSPORTATION ROUTES FOR SNF

HOLTEC INTERNATIONAL COPYRIGHTED MATERIAL		
HI-2167521		Rev. 0
4-40		

Holtec's license application transport route map only shows 2 nuclear power plant origin points, amounting to 4 reactors. What about the 121 reactors, at scores of other nuclear plants?

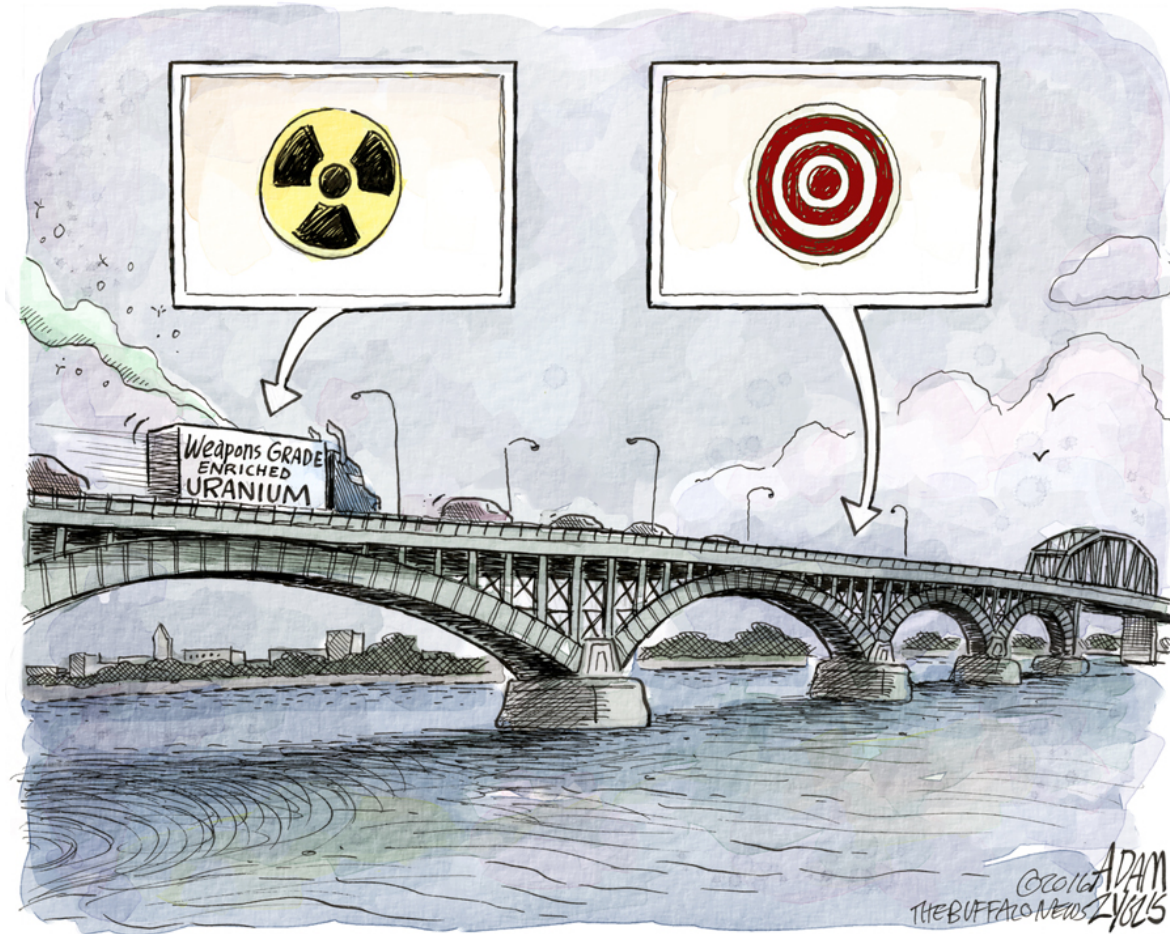
Holtec's "return to sender" / "start clean, stay clean" policy is nonsense. Is Holtec just trying to save money by not building a pool or DTS at its CISF?

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.

Highly Radioactive Liquid Waste Truck Shipments

A long haul

Highly radioactive material is being shipped from Chalk River to a reprocessing facility in South Carolina. Though the route is secret, it will also be long. The most direct route shown on the map is almost 1,900 kilometres.



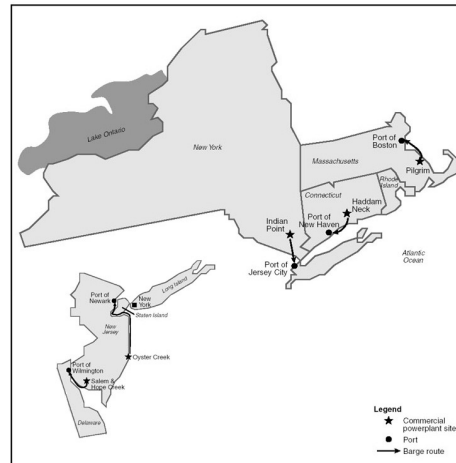
DENNIS LEUNG/OTTAWA CITIZEN

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!

Barge Shipments

Barge Shipments of High-Level Radioactive Waste on the Waters of NJ, NY, and CT Surrounding New York City

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-78 and J-81.

<u>Nuclear Reactor</u>	<u>Location</u>	<u># of Shipments Proposed</u>	<u>Barges offloaded at:</u>
Oyster Creek	Forked River, NJ	Up to 111, along NJ shore	Port of Newark, NJ
Indian Point	Buchanan, NY	Up to 58, down Hudson River	Port of Jersey City, NJ
CT Yankee	Haddam Neck, CT	Up to 42, on Long Is. Sound	Port of New Haven, CT
Total		Up to 211	

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

Map and table taken from U.S. Department of Energy, "Final Environmental Impact Statement for Yucca Mountain," Appendix J ("Transportation"), Feb. 2002.

Floating Fukushima

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, MO either directly or downstream)
- Bays & Harbors (in DE, MA, and MD)
- Seacoasts (CA, FL)

Road and Rail Routes

Main Index

Vol 2 Index

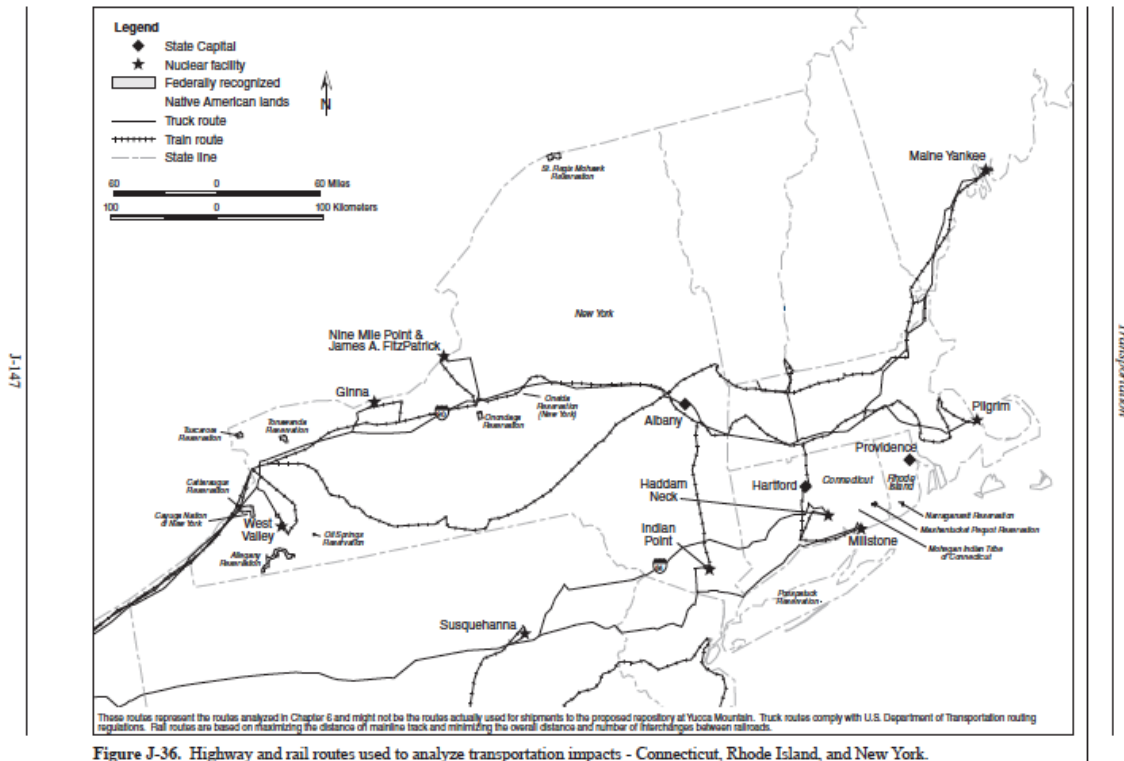


Figure J-36. Highway and rail routes used to analyze transportation impacts - Connecticut, Rhode Island, and New York.

Road and Rail Routes



Too close for comfort



See the work of Rick Hind of Greenpeace, re: hazardous chlorine train car shipments through D.C. and Capitol Hill.

Road and Rail Routes (Yucca-bound)

- 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 [scores of major cities]
- <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 trains in its wake!

Transport Risk: 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, 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?

Safety is threatened

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

Casks can weigh 125 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:
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.

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.

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 of downtown Baltimore would have been moderately contaminated.

Another 10 sq. km would have been heavily contaminated.

The cleanup bill would have cost \$13.7 billion (in Year 2001 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.

Transport Risk: Attack



See the Transportation Research Board and National Research Council's "Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the U.S.," published by the National Academies Press in 2006.

It cited security as a significant unresolved issue.

In fact, as Robert Halstead of the State of Nevada Agency for Nuclear Projects wrote on 6/5/18: “The Blue Ribbon Commission [on America’s Nuclear Future, in its Jan. 2012 Final Report] based on the NAS 2006 report, recommended that 13 specific measures be adopted before the commencement of shipments to federal facilities, for the purposes of enhancing safety, security, and public acceptance.”

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.

Transport Risk: Attack



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



When I raised such risk scenarios at a 10/1/2015 subcommittee hearing, Rep. Shimkus 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 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

IONIZING RADIATION
(radiation delivered to human cells from beta rays, x-rays, gamma rays or alpha particles)

THYROID
Iodine-131
beta (gamma), 8 days

SKIN
Sulfur-35
beta, 87 days

LIVER
Cobalt-60
beta (gamma), 5 yrs.

OVARIES
Iodine-131
gamma, 8 days
Cobalt-60
gamma, 5 yrs.
Krypton-85
gamma, 10 yrs.
Potassium-42
gamma, 12 hours
Cesium-137
gamma, 30 yrs.
Plutonium-239
alpha, 24,000 yrs.

MUSCLE
Potassium-42
beta (gamma), 12 hours
Cesium-137 (and gonads)
beta (gamma), 30 yrs.

LUNGS
Radon-222 (and whole body)
alpha, 3.8 days
Uranium-233 (and bone)
alpha, 162,000 yrs.
Plutonium-239 (and bone)
alpha, 24,000 yrs.

SPLEEN
Polonium-210
alpha, 138 days

KIDNEYS
Ruthenium-106
gamma (beta) 1 yr.

BONE
Radium-226
alpha, 1620 yrs.
Strontium-90
beta, 28 yrs.
and more.

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.

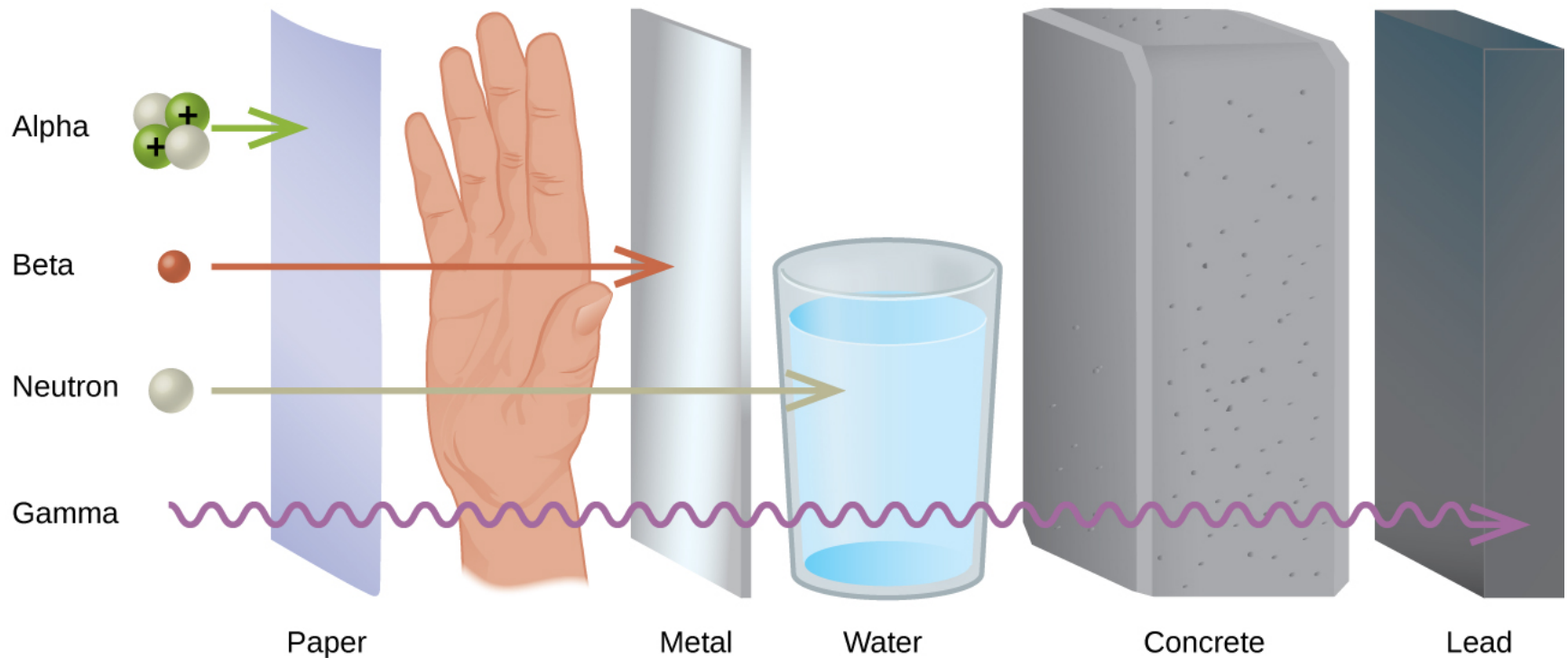
The effects of ionizing radiation are not immediate. Exposure to radiation can cause cancers many years later. Exposure to very low levels of radiation can be equally dangerous over time.

Authorship notes:
Based on a drawing by G. M. G. and illustrations by G. M. G. from the book "The Atomic Bomb" by G. M. G. and G. M. G. published by the United States Government Printing Office, Washington, D.C., 1945. The drawing is based on the work of G. M. G. and G. M. G. published by the United States Government Printing Office, Washington, D.C., 1945. The drawing is based on the work of G. M. G. and G. M. G. published by the United States Government Printing Office, Washington, D.C., 1945.

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.

H.R. 3053



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.

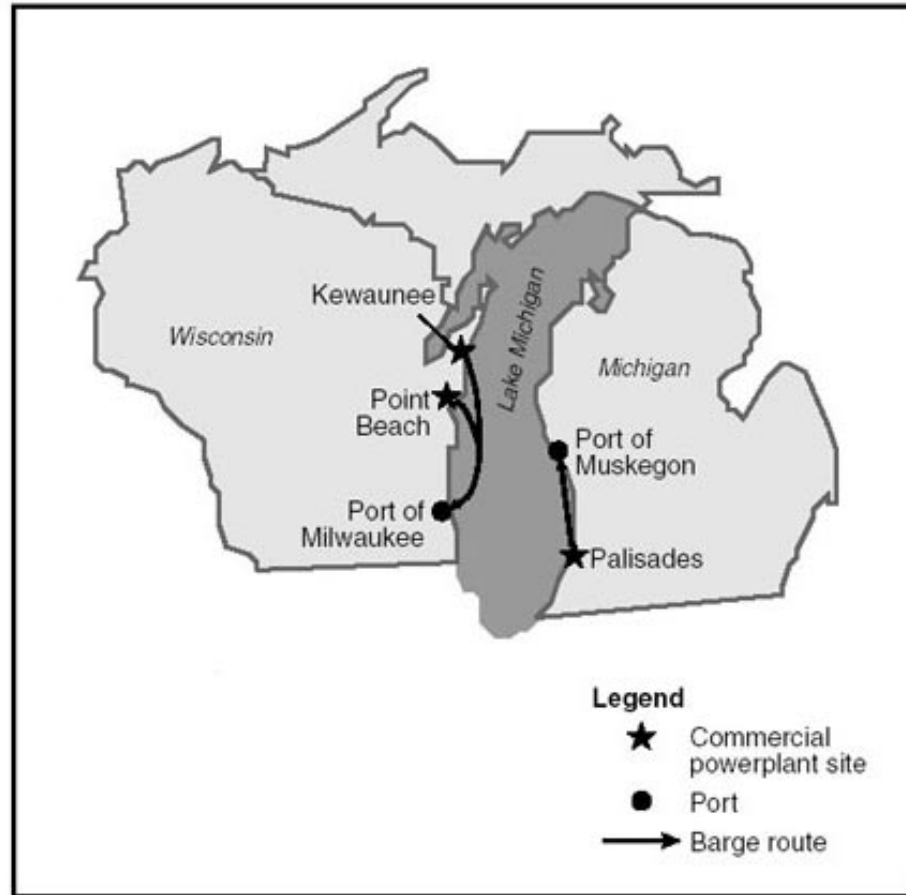
HR3053 also violates the Blue Ribbon Commission Final Report, as via non-consent based siting, as well as retaining (even strengthening) Office of Civilian Radioactive Waste authority within DOE, rather than creating an independent nuclear waste management organization.

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.

Lake Michigan barge shipments



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.

Dr. Gordon Edwards of CCNR has calculated that a mere 2 irradiated nuclear fuel assemblies, releasing their Sr-90 content into Lake Superior, would violate US EPA SDWA MCLs.

Lake Superior is significantly more voluminous than Lake Michigan. Thus, even less Sr-90 that is contained in a couple irradiated nuclear fuel assemblies could violate US EPA SDWA MCLs if release into Lake Michigan.

Each rail-sized cask on barges would hold 24 to 37 pressurized water reactor irradiated nuclear fuel assemblies.

IL road and rail routes

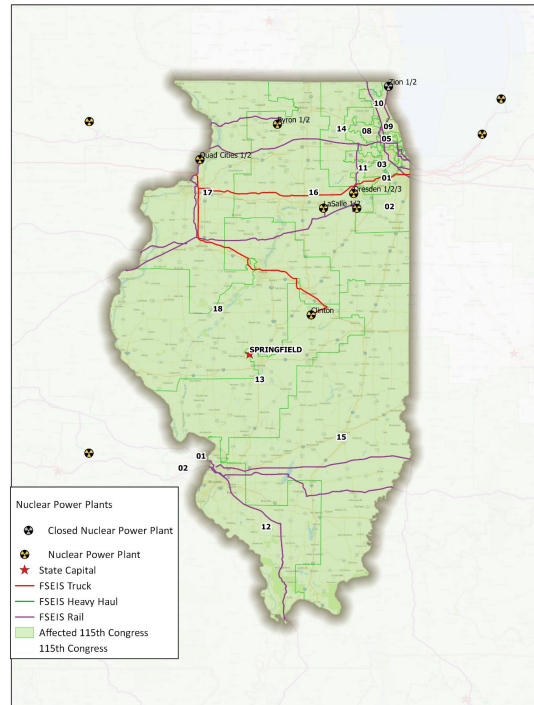


Figure 11 FSEIS Routes through Illinois

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

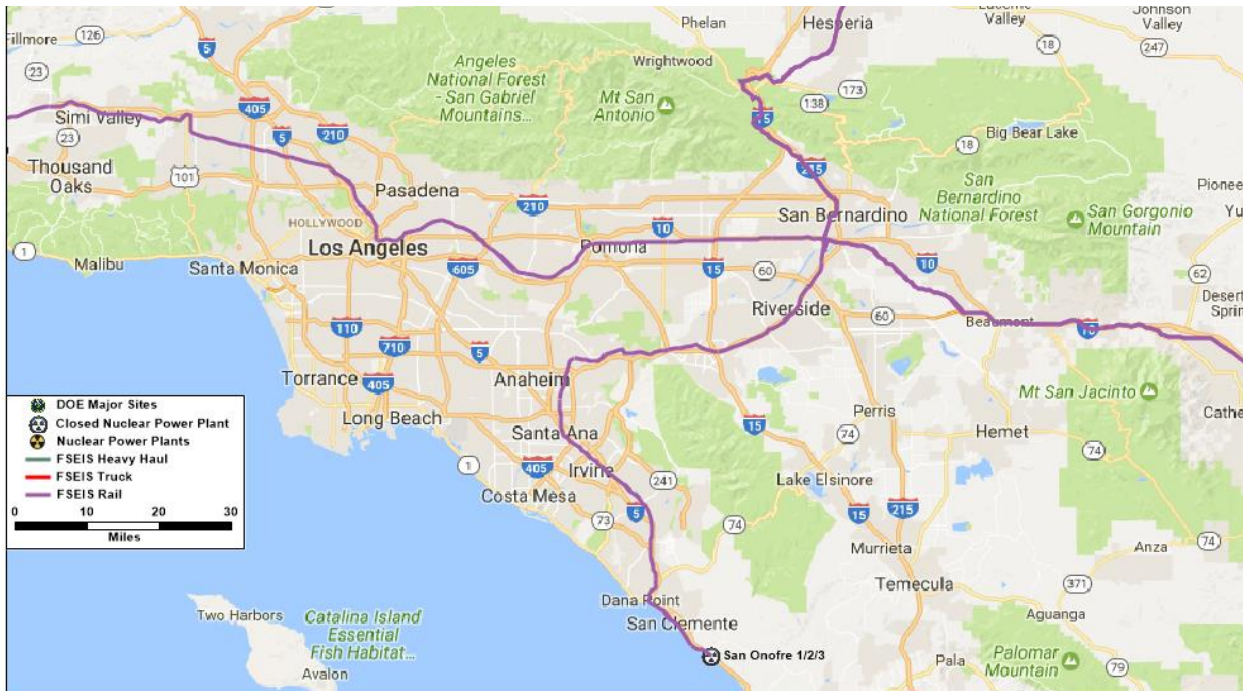


Lamar Alexander (R-TN) is the chairman of the U.S. Senate Appropriations Committee subcommittee on Energy & Water Appropriations.

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.”

LA road and rail routes



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...

We Do NOT Consent!



(Photo from late 2013 at NRC HQ, Rockville, MD, at a Nuclear Waste Confidence/Continued Storage of Spent Nuclear Fuel public comment meeting)

- 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.