

Diablo Canyon
Decommissioning Engagement Panel
Irradiated Nuclear Fuel
Workshop

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Overview

1. Continued reactor operations risks (including additional high-level radioactive waste (HLRW) generation)
2. Pool storage risks (fires, leaks)
3. Dry cask storage: Need for Robust, or Hardened On-Site Storage (HOSS), with QA (Quality Assurance)!
4. Consolidated Interim Storage (and CIS company reactor decommissioning takeovers)
5. Yucca Mountain
6. Transport risks

Continued reactor operations = Additional HLRW generation

Diablo Canyon Unit 1

- 2019 to 2024
- 5 years X ~20 MT/year =
~100 MT

Diablo Canyon Unit 2

- 2019 to 2025
- 6 years X ~20 MT/year =
~120 MT

(HLRW – High Level Radioactive
Waste
MT – Metric Ton)

Continued reactor operations = Additional HLRW generation

Additional 2019-2025 Total, from continued operations:

~220 MT

This would be in addition to 1,126 MT at Diablo Canyon by spring 2010 (per DOE, Yucca FEIS, Feb., 2002).

And ~360 MT generated from 2010 to 2019 (~20 MT/reactor, per year)

Grand total: More than 1,600 MT

(HLRW – High Level Radioactive Waste; MT – Metric Ton)

The first rule of holes:

When you're

in one,

stop digging!

Reactor risks (2019-2025)

- Safety: Pressurized thermal shock (reactor pressure vessel embrittlement); earthquakes (13 faults in vicinity, including 2 major ones); etc.
- Security (terrorist attack, à la SLOMFP 2006, 9/11, *Nuclear Power Plants as Weapons for the Enemy* by Bennett Ramberg, etc.)
- Environmental and public health: Planned, permitted/allowable (not safe), “routine” releases of hazardous radioactivity during regular operations -- let alone age-related degradation and other leaks, spills, and unplanned releases

RPV embrittlement/PTS risks

Five worst neutron-embrittled reactor pressure vessels in the U.S., at risk of pressurized thermal shock through-wall fracture:

Atomic reactor, State (Year by which PTS screening criteria is exceeded):

Point Beach Unit 2, WI (2017)

Palisades, MI (2017)

Indian Point Unit 3, NY (2025)

Diablo Canyon Unit 1, CA (2033)

Beaver Valley Unit 1, PA (2033)

Citation: <https://www.nrc.gov/docs/ML1310/ML13108A336.pdf>

RPV embrittlement/PTS risk Archive and timeline (1948-Present)

[http://www.beyondnuclear.org/safety/
2014/10/30/beyond-nuclear-warns-nrc-against-
weakening-rpv-embrittlement.html](http://www.beyondnuclear.org/safety/2014/10/30/beyond-nuclear-warns-nrc-against-weakening-rpv-embrittlement.html)

Reactor risks:

Three Mile Island, Unit 2 (3/28/1979-2019)



Pool storage risks: Fires & leaks

Fires:

- Alvarez, Macfarlane, Janberg, *et al.*, 2003
- National Academies of Science (NAS), 2004 (redacted), 2006 (public version)
- Alvarez, 2011
- Fukushima Daiichi nuclear catastrophe, Japan, 2011
- NAS, 2016
- von Hippel and Schoeppner, 2016 (case study, Peach Bottom Nuclear Power Plant, PA)

Alvarez, Macfarlane, Janberg, *et al.*, 2003

Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States; Robert Alvarez, Jan Beyea, Klaus Janberg, Jungmin Kang, Ed Lyman, Allison Macfarlane, Gordon Thompson, Frank N. von Hippel; *Science and Global Security*, 11:1–51, 2003

Abstract:

Because of the unavailability of off-site storage for spent power-reactor fuel, the NRC [U.S. Nuclear Regulatory Commission] has allowed high-density storage of spent fuel in pools originally designed to hold much smaller inventories. As a result, virtually all U.S. spent-fuel pools have been re-racked to hold spent-fuel assemblies at densities that approach those in reactor cores. In order to prevent the spent fuel from going critical, the fuel assemblies are partitioned off from each other in metal boxes whose walls contain neutron-absorbing boron. ***It has been known for more than two decades that, in case of a loss of water in the pool, convective air cooling would be relatively ineffective in such a “dense-packed” pool. Spent fuel recently discharged from a reactor could heat up relatively rapidly to temperatures at which the zircaloy fuel cladding could catch fire and the fuel’s volatile fission products, including 30-year half-life ¹³⁷Cs, would be released. The fire could well spread to older spent fuel. The long-term land-contamination consequences of such an event could be significantly worse than those from Chernobyl...(emphasis added)***

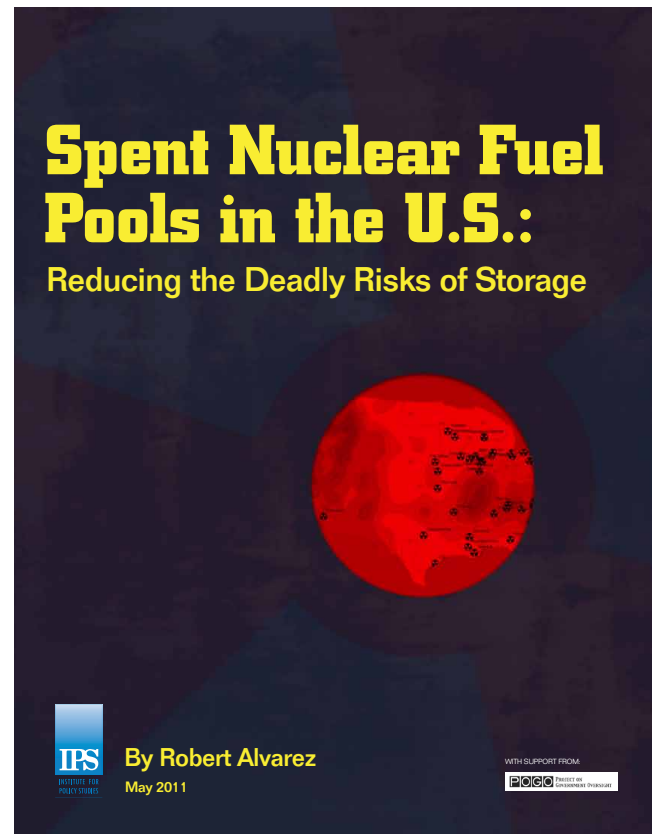
Alvarez et al., 2003

(Abstract, continued)

...No such event has occurred thus far. However, ***the consequences would affect such a large area that alternatives to dense-pack storage must be examined—especially in the context of concerns that terrorists might find nuclear facilities attractive targets. To reduce both the consequences and probability of a spent-fuel-pool fire, it is proposed that all spent fuel be transferred from wet to dry storage within five years of discharge. The cost of on-site dry-cask storage for an additional 35,000 tons of older spent fuel is estimated at \$3.5–7 billion dollars or 0.03–0.06 cents per kilowatt-hour generated from that fuel. Later cost savings could offset some of this cost when the fuel is shipped off site. The transfer to dry storage could be accomplished within a decade.*** The removal of the older fuel would reduce the average inventory of ¹³⁷Cs in the pools by about a factor of four, bringing it down to about twice that in a reactor core. It would also make possible a return to open-rack storage for the remaining more recently discharged fuel. If accompanied by the installation of large emergency doors or blowers to provide largescale airflow through the buildings housing the pools, natural convection air cooling of this spent fuel should be possible if airflow has not been blocked by collapse of the building or other cause. Other possible risk-reduction measures are also discussed...(emphasis added)

Alvarez, 2011

Robert Alvarez, IPS



Alvarez, 2011

From the Summary:

After more than 50 years, the quest for permanent nuclear waste disposal remains illusory.

One thing, however, is clear, whether we like it or not: ***the largest concentrations of radioactivity on the planet will remain in storage at U.S. reactor sites for the indefinite future. In protecting America from nuclear catastrophe, safely securing the spent fuel by eliminating highly radioactive, crowded pools should be a public safety priority of the highest degree.***

With a price tag of as much as \$7 billion, the cost of fixing America's nuclear vulnerabilities may sound high, especially given the heated budget debate occurring in Washington. But ***the price of doing too little is incalculable.*** *(emphasis added)*

Alvarez, 2011

Figure 9, Spent Fuel Inventories Greater Than
200 Million Curies

[In the U.S., there are] 28 reactor sites that have
generated spent fuel containing about 200-450
million curies of radioactivity

Diablo Canyon 1 & 2, CA: ~225 Million Curies

“In contrast, a large medical center, with as many as 1,000 approved laboratory areas in which radioactive materials are used, may have a combined inventory of only about two curies.”

Excerpt from “ROUTINE RADIOACTIVE RELEASES FROM U.S. NUCLEAR POWER PLANTS,” a pamphlet by Beyond Nuclear board of directors president Kay Drey of University City, MO.

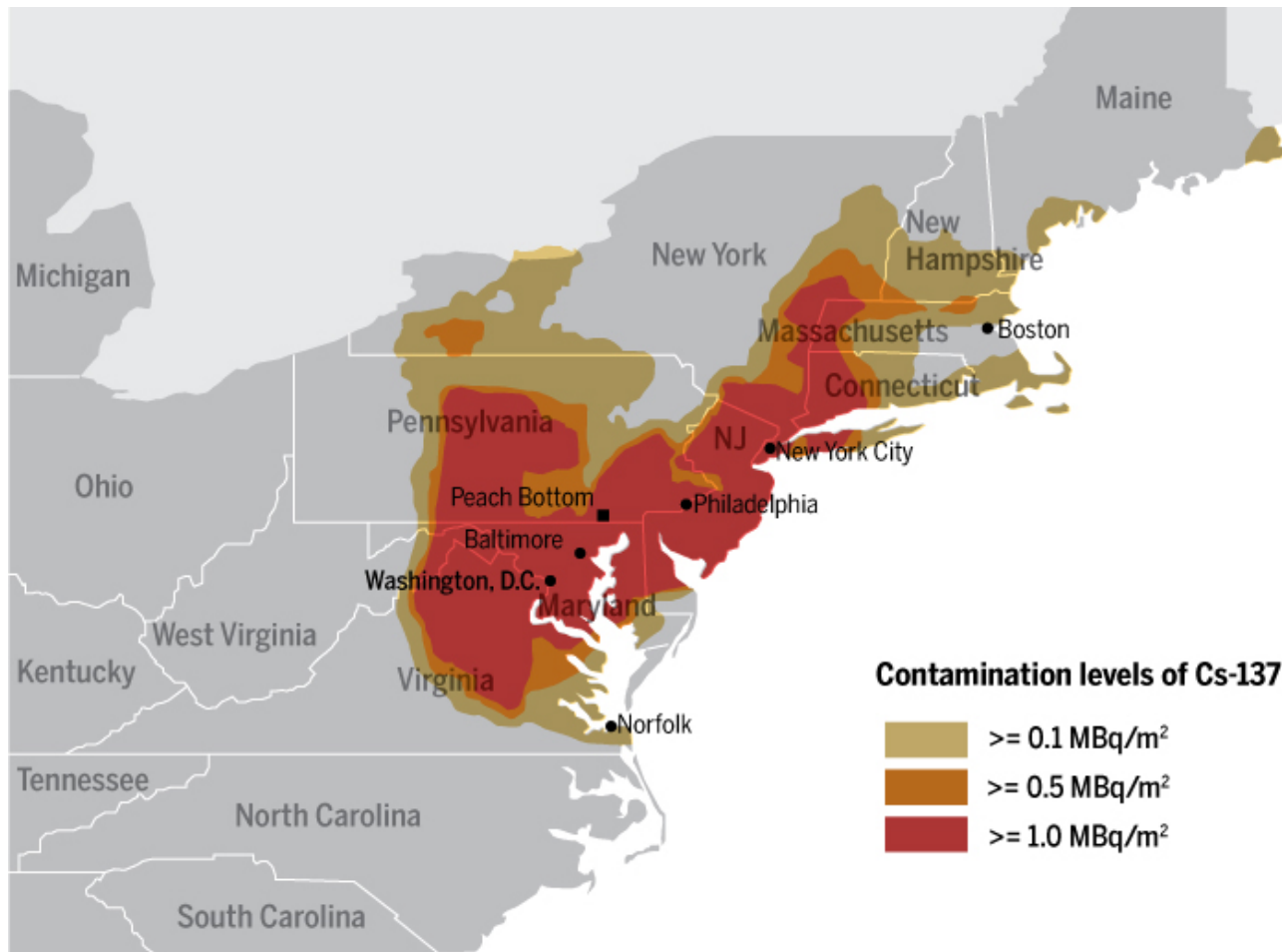
Re: von Hippel and Schoeppner, 2016 (case study, Peach Bottom Nuclear Power Plant, PA)

Science Magazine reported:

*In their simulations, the Princeton duo focused on Cs-137, a radioisotope with a 30-year half-life that has made large tracts around Chernobyl and Fukushima uninhabitable. They assumed a release of 1600 petabecquerels, which is the average amount of Cs-137 that NRC estimates would be released from a fire at a densely packed pool. **It's also approximately 100 times the amount of Cs-137 spewed at Fukushima.** They simulated such a release on the first day of each month in 2015.*

The contamination from such a fire on U.S. soil “would be an unprecedented peacetime catastrophe,”** the Princeton researchers conclude in a paper to be submitted to the journal *Science & Global Security*. In a fire on 1 January 2015, with the winds blowing due east, the radioactive plume would sweep over Philadelphia, Pennsylvania, and nearby cities. Shifting winds on 1 July 2015 would disperse Cs-137 in all directions, blanketing much of the heavily populated mid-Atlantic region. Averaged over 12 monthly calculations, the area exposed to more than 1 megabecquerel per square meter -- a level that would trigger a relocation order -- is 101,000 square kilometers [nearly 39,000 square miles]. **That's more than three times NRC's estimate, and the relocation of 18.1 million people is about five times NRC's estimates.

Image for July 2015 weather conditions, courtesy of F. von Hippel and M. Schoeppner



“Spent fuel fire on U.S. soil could dwarf impact of Fukushima,” by Richard Stone, *Science Magazine*, 5/24/16

A fire from spent fuel stored at a U.S. nuclear power plant could have catastrophic consequences, according to new simulations of such an event.

A major fire “could dwarf the horrific consequences of the Fukushima accident,” says Edwin Lyman, a physicist at the Union of Concerned Scientists, a nonprofit in Washington, D.C. “We’re talking about trillion-dollar consequences,” says Frank von Hippel, a nuclear security expert at Princeton University, who teamed with Princeton’s Michael Schoeppner on the modeling exercise. (emphasis added)

The revelations come on the heels of a report last week from the U.S. National Academies of Sciences, Engineering, and Medicine on the aftermath of the 11 March 2011 earthquake and tsunami in northern Japan. The report details how a spent fuel fire at the Fukushima Daiichi Nuclear Power Plant that was crippled by the twin disasters could have released far more radioactivity into the environment.

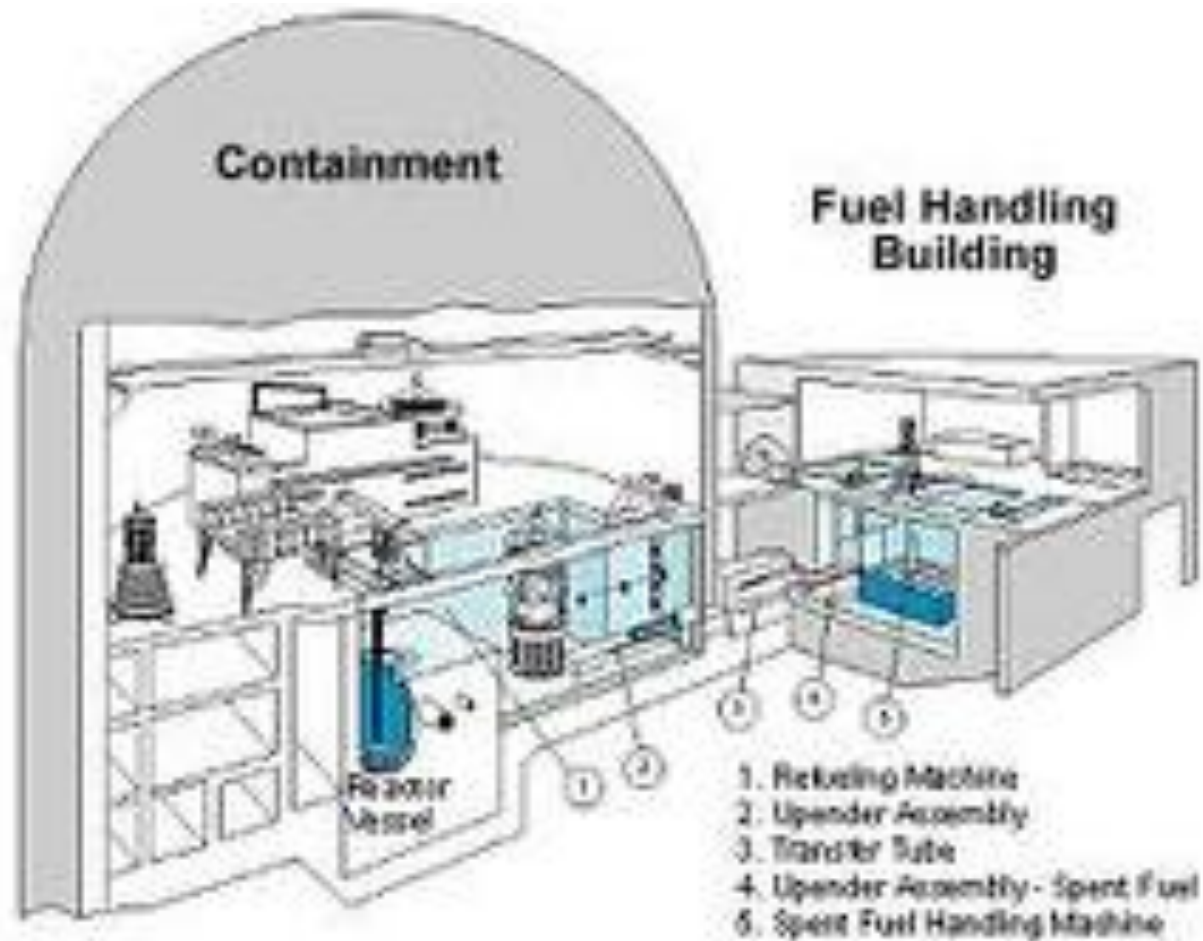
NAS, 2016

**Desperate, ineffective, and high-risk
Japan Self Defense Forces helicopter
water drops, St. Patrick's Day, 2011**

A pool fire at Fukushima
Daiichi Unit 4 was very
narrowly averted, by sheer
luck (or Divine Intervention?!)



Pools are outside “robust containment”



Close call with catastrophe, order(s) of magnitude worse than current one

**Fukushima Daiichi Unit 4, Japan
(pre-explosion)**

Prime Minister Naoto Kan



Fukushima Daiichi Unit 4, Japan Mid-March, 2011, post-explosion



Risks of Pool Storage & Transfers

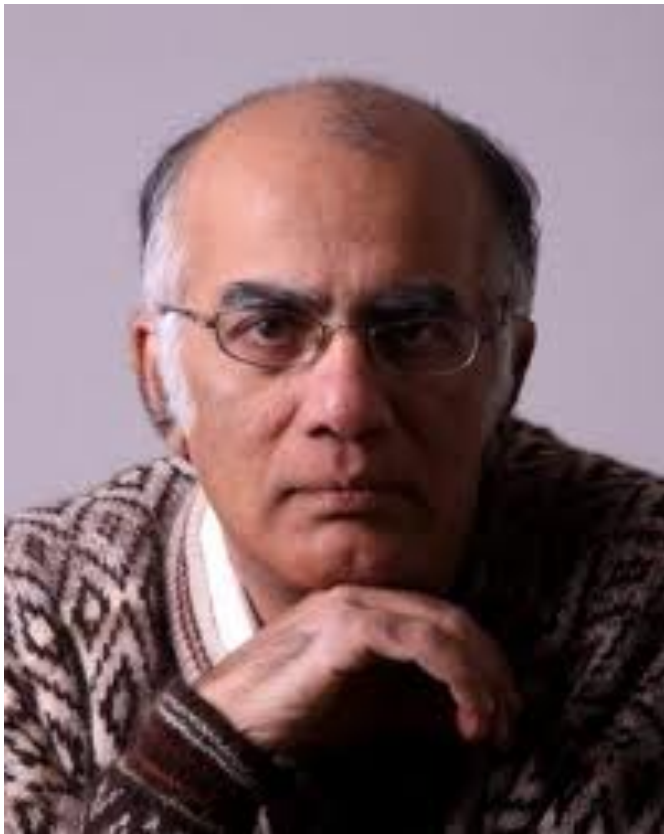
- Diablo Canyon Units 1 & 2, discovery of pool leakage in 2010, confirmed by routine surveillance; “Leaked spent fuel pool water was contained within spent fuel pool leakage-collection system”; Table E-4, Occurrence of Spent Fuel Pool Leakage at U.S. Nuclear Power Plants, Appendix E, Analysis of Spent Fuel Pool Leaks, Page E-23, Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel, Vol. 1, NUREG-2157, NRC, September 2014.
- Heavy load drop risk of pool drain down, zirconium fire (Prairie Island, MN & Palisades, MI transfer cask crane dangles; Vermont Yankee crane slip)
- Loss of grid power (boil down)
- Natural disaster
- Terrorist attack, sabotage, or act of war (pools as potential mega dirty bombs)

Crane risks



Dry cask storage: Need for Robust, or Hardened On-Site Storage (HOSS), with QA (Quality Assurance)!

Dr. Arjun Makhijani, IEER



Dr. Gordon Thompson, IRSS



Statement of Principles for Safeguarding Nuclear Waste at Reactors (2006; 2009-2010; 2018)

- Require a low-density, open-frame layout for fuel pools (to provide convection air current cooling);
- 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.

Statement of Principles for Safeguarding Nuclear Waste at Reactors (2006; 2009-2010; 2018)

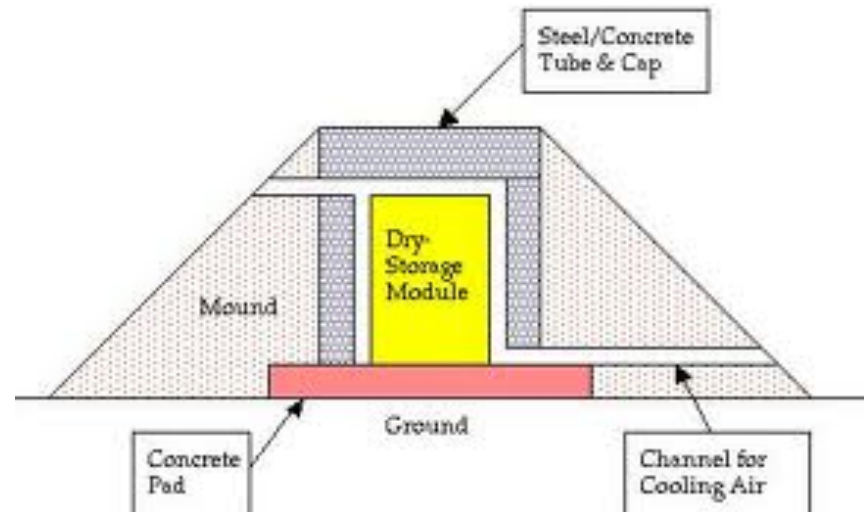
- https://www.eesi.org/files/Principles_for_Safeguarding_Nuclear_Waste_at_Reactors.pdf
- Many hundreds of public interest and environmental organizations, representing all 50 states, including these 16 from CA:

Alliance for Nuclear Responsibility; PEACEWORKERS; CA Communities Against Toxics; Desert Citizens Against Pollution; Ecological Options Network (EON); SAVE THE PARK; Western States Legal Foundation; Grandmothers for Peace-SLO County Chapter; Terra Foundation; SLO Mothers for Peace Action Committee; Tri-Valley CARES; Redwood Alliance; Center for Safe Energy; Healing Ourselves and Mother Earth (H.O.M.E.); Committee to Bridge the Gap; Atomic Mirror.

Dispersed/Concealed HOSS v. Plain View/Clustered Configuration

“Bowling pins”

Graphic from “Robust Storage” by Dr. Gordon Thompson, Jan. 2003



There is no magic wand...

**The waste will not move for years,
or even many decades**



The sobering realities:

- Operating reactors like Diablo Canyon 1 & 2 are at the very back of the line for export of waste
- Even relatively recently shutdown reactors like San Onofre 2 & 3 are a ways down the waiting list for export of waste
- HOSS is a necessary safety and security upgrade, even if off-site storage or disposal were available now (which it is not)

Cask/Canister Integrity (Or Lack Thereof)

Holtecs at D.C. Cook, MI, on the Lake Michigan shoreline

Widespread 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 (deceased), Commonwealth Edison/Exelon, lead Holtec Users Group QA inspector

- Asserted Holtec casks are “nothing but garbage cans” if they are not made in accordance with government specifications;
- Questioned Holtec casks’ structural integrity sitting still, at 0 mph, let alone going 60 mph, or faster (accident forces)

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

- Compared NRC/Holtec decision making to NASA’s, that led to “Space Shuttles hitting the ground”
- Had previously warned in Feb., 1994 at Palisades, MI: “[It is] the consequences that might occur from an earthquake that I’m concerned about. The casks can either fall into Lake Michigan or be buried in the loose sand because of liquefaction...It is apparent to me that NMSS [NRC’s Nuclear Materials Safety and Safeguards division] doesn’t realize the catastrophic consequences of their continued reliance on their current ideology.”

“Garbage Cans of Death”

Deb Katz, Ex. Dir., Citizens Awareness
Network of the Northeast



“Caravans of Conscience”



Need for Emergency Cask-to-Cask Transfer Capability

- Empty irradiated nuclear fuel from vulnerable (and in some cases leaking) storage pools into HOSS, but...
- Maintain operability of empty pool, in order to have cask-to-cask transfer capability
- Emergency transfer may be needed, from failed/failing “old” cask/canister, to new replacement cask/canister
- If no pool, then hot cell, or Dry Transfer System (DTS), is needed
- But...science fiction/fantasy of NRC’s Nuclear Waste Confidence [Game], on-site or away-from-reactor “Dry Transfer Systems” (NRC’s empty promise, and false assurance; what about loss of institutional control, here and now!)
- NRC simply assumed safety, and in 2016, the federal court fell for it -- hook, line, and sinker (including D.C. Circuit Court of Appeals Justice – now U.S. Supreme Court Justice -- Brett Kavanaugh)

Serious complications of returning INF to wet storage pool

- Elevated pools at GE BWRs;
- Overlap of systems, structures, and components between wet storage pool, and the rest of the nuclear power plant – dismantled during decommissioning;
- Disruption of convection air current cooling mechanism in dry cask (40-hour “race-against-the-clock” at Palisades, MI, for example, before overheating begins, in violation of technical specifications);
- Radioactive steam flash when thermally hot (750 degree F) dry cask waste canister enters 100 degree F wet storage pool water (radiation hazard; thermal shock hazard).

Retention of pools is needed, even after their emptying of INF

But, there is a growing list of decommissioned/
decommissioning sites with neither pool, nor
hot cell/DTS:

Big Rock Point, MI; Connecticut Yankee; Maine
Yankee; Yankee Rowe, MA; Zion, IL; etc.

That is, emergency response to any dry cask
failure will have to be *ad hoc*.

Consolidated Interim Storage Facilities (CISFs)

Waste Control Specialists, LLC, Andrews County, Texas (WCS) – recently renamed Interim Storage Partners (ISP): WCS (owned by J.F. Lehman & Co. since Jan. 2018) + Orano (Areva) + NAC = ISP

Holtec/ELEA (Eddy-Lea [Counties] Energy Alliance, New Mexico), just 16 miles from WIPP



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

WIPP creative commons

CURRENT-ARGUS

0:33 / 0:54

Fire At Carlsbad Nuclear Waste New Mexico



CISFs, A.K.A.

***De facto* permanent, surface
storage, “parking lot” dumps**

CISFs multiply transport risks, for no good reason whatsoever

cartoon-waste.jpg (JPEG Image, 1227 x 1872 pixels) - Scaled (42%)

<https://nouranium.files.wordpress.com/2009/03/cartoon-waste.jpg>



"Just Keep Driving around - We may
come up with a solution yet!"

Risks of decommissioning takeovers by CISF companies

- Holtec/SNC-Lavalin (Oyster Creek, NJ; Pilgrim, MA? Palisades, MI?)
- NorthStar (Vermont Yankee)
- EnergySolutions (Zion, IL – little to no financial auditing or accountability)
- Looting/raids of *billion dollar* decommissioning trust funds; lack of adequate radiological cleanup; safety & security shortcuts on irradiated nuclear fuel management; rush to release still-contaminated sites for “unrestricted reuse.”
- Who gets the “cash cow” at Indian Point, NY?!

Highly questionable corporate character

Holtec—bribery (attempted, as well as proven), racist remarks, QA violations.

SNC-Lavalin—bribery, human trafficking, barred by World Bank for 10 years, Justin Trudeau scandal.

NorthStar:

WCS--previously owned by Harold Simmons, “King of Superfund Sites” and funder of John Kerry’s 2004 “swift-boating”; now owned by J.F. Lehman & Co., of Tailhook scandal infamy.

Orano (Areva)—Niger uranium mining (Tuareg genocide), radioactive pollution of the Atlantic Ocean, externally contaminated HLRW shipments epidemic and cover up.

NAC (Nuclear Assurance Corporation)—HLRW shipping and handling incidents, as documented in Dr. Marvin Resnikoff’s book “The Next Nuclear Gamble” (1987).

EnergySolutions (formerly Envirocare)—Founded on a bribery/extortion scheme.

“State sounds alarm over sale of Pilgrim for decommissioning,” AP, Feb. 20, 2019

BOSTON--Massachusetts officials raised major concerns Wednesday about Entergy's proposed sale of the soon-to-be-closed Pilgrim nuclear power plant in Plymouth to another company for decommissioning.

In a motion filed with the U.S. Nuclear Regulatory Commission, Democratic Attorney General Maura Healey and Republican Gov. Charlie Baker's administration asked that the state be allowed to intervene in the federal review of the pending deal, citing health, safety and financial risks associated with the planned transfer of Pilgrim's license to a New Jersey-based subsidiary of **Holtec International**.

Specifically, Healey and state Secretary of Energy and Environmental Affairs Matthew Beaton argue that Entergy and ***Holtec have failed to demonstrate that sufficient financial resources exist to safely decommission the plant and provide for the long-term storage of spent nuclear fuel at the site...***

A citizen's advocacy group, Pilgrim Watch, also filed a motion to intervene on Wednesday, citing similar concerns as those expressed by state officials.

"The actual cost of decontaminating and restoring the Pilgrim site will be more, probably far more, than Holtec has estimated," the group wrote.

(emphasis added)

Yucca Mountain, Nevada; Geologic Repository (Permanent Burial)

[Be sure to count the toes!]

U.S. Rep. John Shimkus (R-IL) throws good money after bad down a rat hole -- \$10,000 to \$15,000 of taxpayer money, per site visit



Yucca Mountain

Non-Starters

- Illegal (U.S.-Western Shoshone Indian Nation “peace and friendship” Treaty of Ruby Valley of 1863; land title; water rights)
- Environmentally unjust (Nevada Test Site nuclear weapons testing fallout; LLRW dumping at NTS & Beatty, NV)
- Not consent-based, in violation of BRC 2012 Final Report recommendations

Western Shoshone Indian Nation (Corbin Harney, Raymond Yowell)



Western Shoshone Indian Nation (Ian Zabarte)



Yucca Mountain

Showstoppers

- “Screw Nevada” (Eastern site search “suspended”; granite geology excluded for political reasons)
- Double standard standards (per Dr. Makhijani: Disqualifying condition for fast-flow rate of water through site; C-14 releases to atmosphere)
- Intergenerational inequity (15 mR/yr standard, from present to 10,000 years; 23-fold increase, from 10,000 years to one million years)
- 11-mile buffer zone for groundwater “dilution”
- No accounting for traditional Western Shoshone lifestyle aggravated/exacerbated impacts
- Regional equity (East dumps on West)
- Maximized transport risks

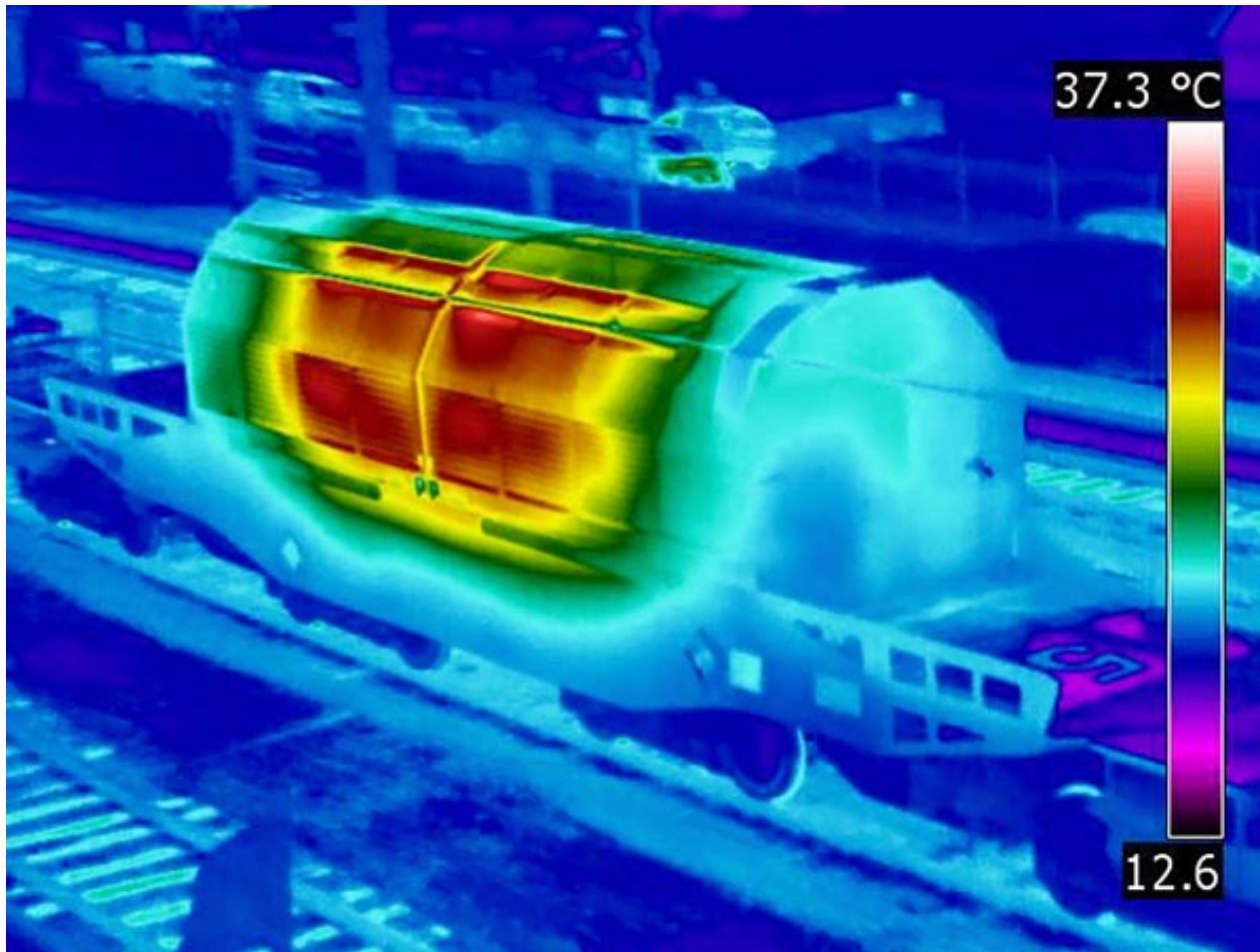
Export? Be careful what you wish for!
(Transport risks)



Risks of off-site transport

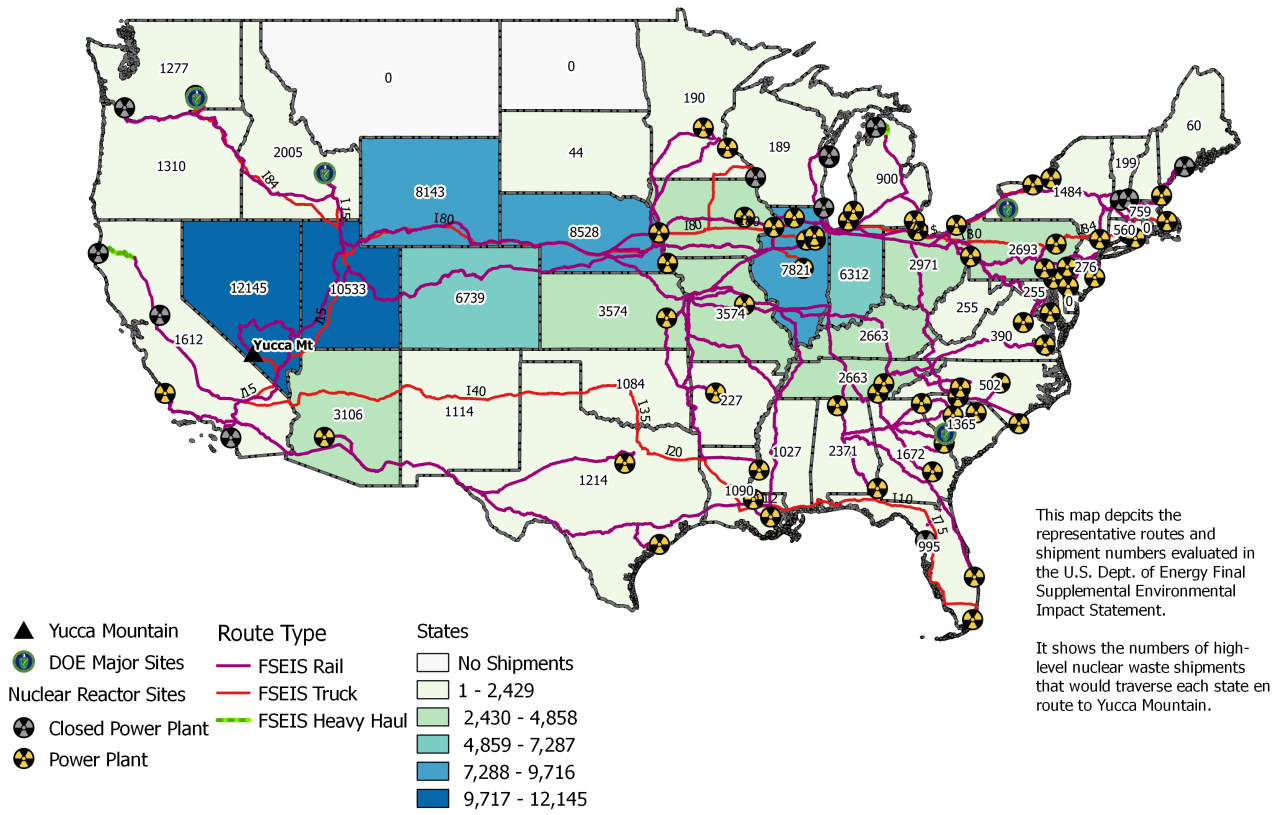
- Severe accidents
- Attacks
- Mobile X-Ray Machines That Can't Be Turned Off
- Impacts on infrastructure (rails, bridges, roads) due to very heavy loads (rail-sized casks weighing 100+ tons each)

High Burnup makes everything worse (thermal heat, radioactivity, fuel cladding brittleness)



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.

CA shipment numbers

Under current law (70,000 MT limit at Yucca)*

Rail Casks: 755

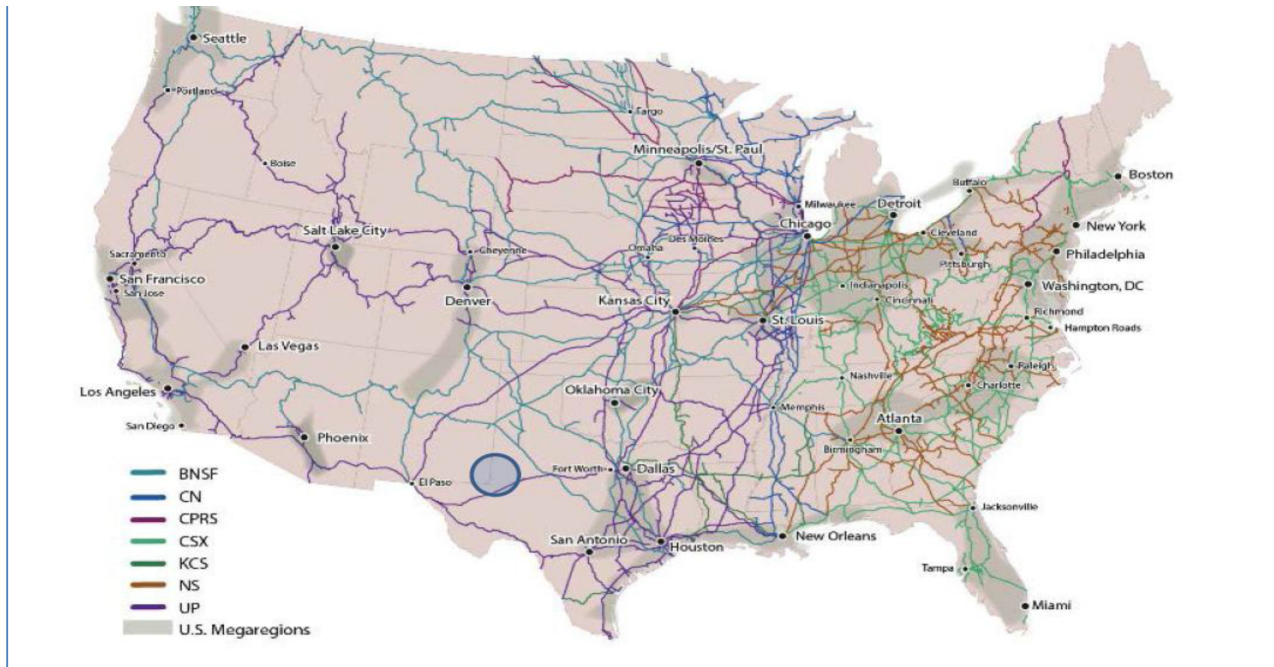
Truck Casks: 857


Total Casks: 1,612

*No CA reactors operating with extended licenses, so no additional waste generated in state after 2025

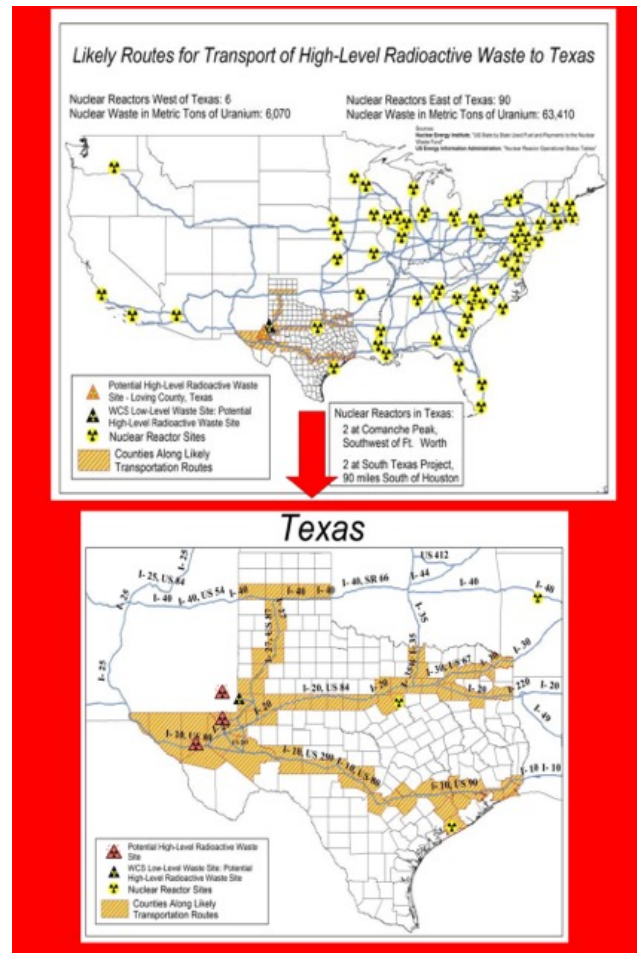
(BUT, beware of multiple other states' wastes passing through portions of s. and s.e. CA, as by rail, bound for Yucca Mountain, NV, immediately upstream of, and very near, the CA state line!)

WCS/ISP, TX-bound routes



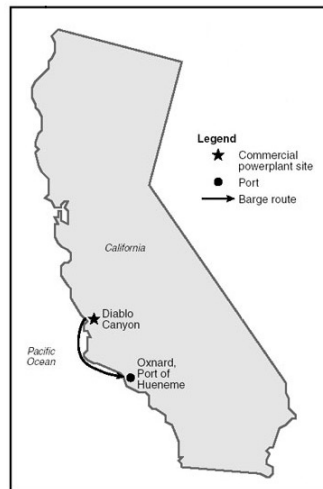
Title: RAIL LINES MAP	Figure: 2.2-4	Date: 11/16/2015	
		Scale: NONE	

WCS/ISP, TX-bound routes



CA barge shipment route (DOE, Yucca FEIS, App. J, Feb. 2002)

Barge Shipments of High-Level Radioactive Waste on the California Coast
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.

<u>Nuclear Plant</u>	<u>Location</u>	<u>Number of Shipments Proposed</u>	<u>Barges offloaded at:</u>
Diablo Canyon 1	Avila Beach	Up to 150	Oxnard, Port of Hueneme
Diablo Canyon 2	Avila Beach	Up to 162	Oxnard, Port of Hueneme
Totals		Up to 312	

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.

If not barges, then Heavy-Haul Trucks?!
Down Avila Beach Drive?!

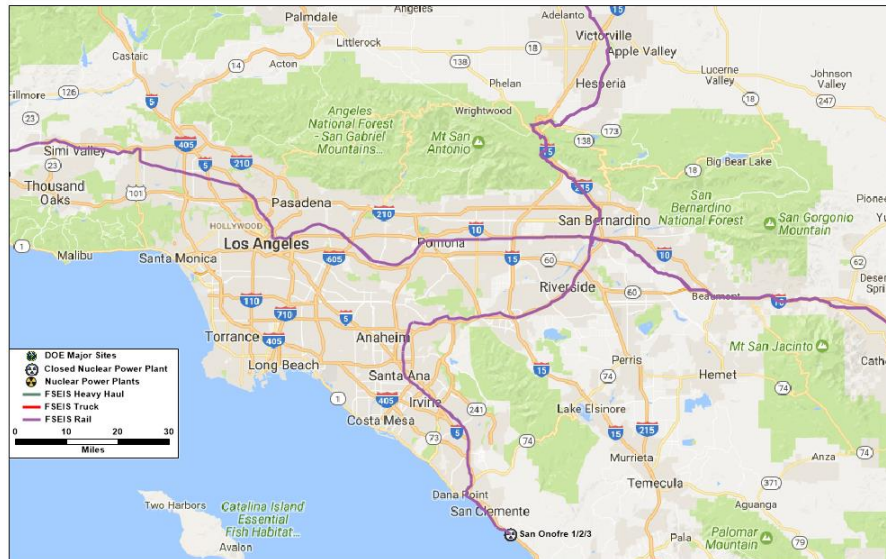


CA road and rail routes



Figure 4 FSEIS Routes through California

L.A. area road and rail routes close up view



Road and Rail Route Map Citations

CA state map:

http://www.state.nv.us/nucwaste/news2017/pdf/States_Affected.pdf [Page 4 of 45 on PDF counter]

L.A. area close up view:


http://www.state.nv.us/nucwaste/news2017/pdf/Cities_Affected.pdf [Page 9 of 20 on PDF counter]

Woefully inadequate shipping cask design criteria

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 worst-case accident scenarios.

NAME OF TEST	REGULATORY REQUIREMENTS	SAFETY THREATENED
Drop Test 	Casks must withstand a 30-foot fall onto an essentially unyielding surface, simulating the impact of a crash.	In this test, cask speed at the moment of impact is only 30 miles per hour. Highway speed limits typically 65-75 mph have increased since this regulation was written. A crash into a bridge abutment or an oncoming heavy vehicle could exceed test conditions.
Burn Test cask2	Casks must withstand an engulfing fire at 1475° F for 30 minutes.	Other materials that share roadways burn at much hotter temperatures (diesel burns at 1800° F) and for longer than 30 minutes. The 2001 train fire in Baltimore burned for more than 3 days and probably reached temperatures hotter than 1500° F.
Puncture Test cask3	Cask must withstand a free-fall from 40 inches onto an 8-inch long spike.	Many of the bridges along transport routes are considerably taller than 40 inches. A train derailment or truck crash on a bridge could cause puncture damage to the cask's shield and release radiation.
Water Submersion Test cask4	A cask that has undergone the puncture test must withstand submersion under 3 feet of water. An undamaged cask must withstand submersion under 200 meters (656 feet) of water for 1 hour.	A damaged cask submerged in water deeper than 3 feet could contaminate water supplies. Casks can weigh as much as 125 tons and would be extremely difficult to rescue in 1 hour, especially in remote areas. Water pressure over long periods of time could cause radiation to be released.

OPPOSE risky radioactive waste transport to Yucca Mountain.

Transport Risk: Underwater Submersion



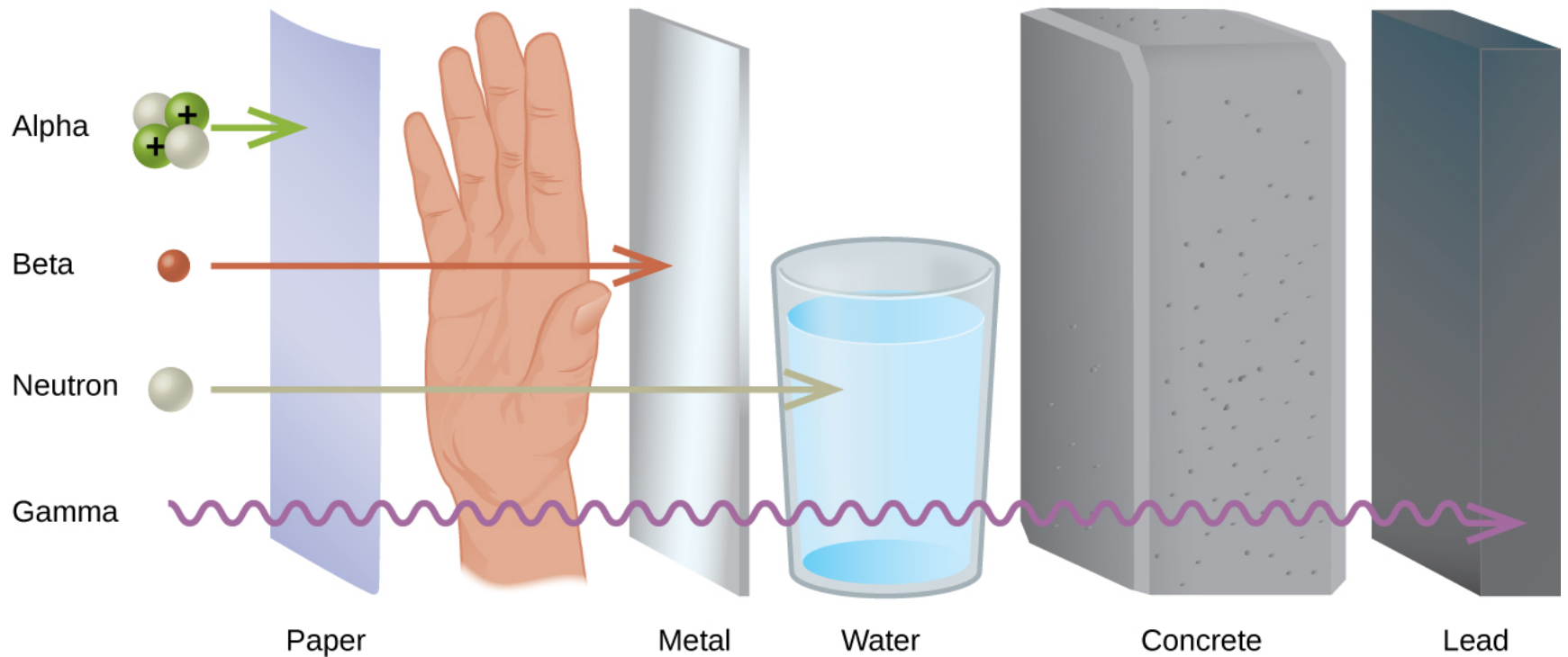
Transport Risk: High-Temperature, Long-Duration Fire



Transport Risk: Attack



Transport Risk: Mobile X-Ray Machines That Can't Be Turned Off



49 Exterior Surface Contamination Incidents in U.S. (1974-1992)

Documentation taken from: "Reported Incidents Involving Spent Nuclear Fuel Shipments, 1949 to Present," May 6, 1996, by Robert Halstead, State of Nevada Agency for Nuclear Projects, posted online at: <http://www.state.nv.us/nucwaste/trans/nucinc01.htm>

Surface Contamination, 49 Incidents (Date, Mode, Incident Description): 1/24/74, Truck, Surface contamination on shipping pallet; 2/26/74, Surface contamination on pallet and truck, empty cask; 4/29/74, Truck, Surface contamination on pallet; 12/11/74, Truck, Surface contamination on pallet; 12/23/74, Truck, Surface contamination on pallet; 1/13/75, Truck, Surface contamination on cask; 2/27/77, Truck, Surface contamination on lifting yoke, empty cask; 4/13/77, Truck, Surface contamination on trailer, empty cask; 5/3/77, Truck, Surface contamination on empty cask; 5/12/77, Truck, Surface contamination on empty cask; 5/16/77, Truck, Surface contamination caused by small crack in impact limiter; 7/26/77, Truck, Surface contamination on empty cask; 8/3/77, Truck, Surface contamination; 8/23/77, Truck, Surface contamination on cask; 2/16/78, Truck, Surface contamination caused by open drain valve, empty cask; 2/27/78, Truck, Surface contamination on empty cask; 5/16/78, Truck, Surface contamination on empty cask; 7/24/78, Truck, Surface contamination on empty cask; 7/29/78, Truck, Surface contamination on cask; 8/1/78, Truck, Surface contamination on cask; 8/7/78, Truck, Surface contamination on cask; 11/27/78, Rail, Surface contamination on empty cask, yoke, and rail car caused by defective valve or closure; 3/28/79, Truck, Surface contamination on empty cask and trailer; 4/2/79, Truck, Surface contamination on empty cask; 4/3/79, Truck, Surface contamination on tire chains, hold-down chains, and tighteners, caused by loading or unloading cask from trailer; 4/4/79, Truck, Surface contamination on empty cask; 4/5/79, Truck, Surface contamination on trailer, empty cask; 7/23/80, Truck, Surface contamination on empty cask; 8/25/80, Truck, Surface contamination on cask; 2/2/81, Truck, Surface contamination on empty cask and trailer; 5/30/81, Truck, Surface contamination on cask and trailer; 5/31/81, Truck, Surface contamination on empty cask; 6/2/81, Truck, Surface contamination on cask, Third consecutive instance of surface contamination, NRC suspends further shipments; 8/25/83, Truck, Surface contamination on empty cask; 9/30/83, Truck, Surface contamination on empty cask; 10/21/83, Truck, Surface contamination on empty cask; 1/7/84, Truck, Surface contamination on empty cask; 1/25/84, Truck, Surface contamination on empty cask; 2/24/84, Truck, Surface contamination on cask; 1/11/85, Truck, Surface contamination on trailer, empty cask; 2/3/85, Truck, Surface contamination on cask; 7/8/85, Truck, Surface contamination on empty cask; 2/28/86, Truck, Surface contamination on empty cask; 7/29/86, Truck, Surface contamination on cask; 7/29/86, Truck, Surface contamination on empty cask and trailer; 8/19/86, Truck, Surface contamination on cask; 10/15/91, Truck, Surface contamination on empty cask; 8/14/92, Truck, Surface contamination on cask.

Definitions for Contamination as used in transport event reports: CONTAMINATION: [10 CFR 71.87 (1)(1) and (1)(2), Routine determinations] refer to non-fixed (removable) radioactive contamination on external surfaces. These paragraphs prescribe specific limits for transport of radioactive materials. However, a formal definition is not provided. Although NRC's regulations do not provide a definition for contamination in 10 CFR 71, a definition is provided in NUREG-0770 (NRC, Glossary of Terms, Nuclear Power and Radiation, Washington, DC 20555, June 1981). Contamination. "The deposition of unwanted radioactive material on the surface of structures, areas, objects, or personnel."

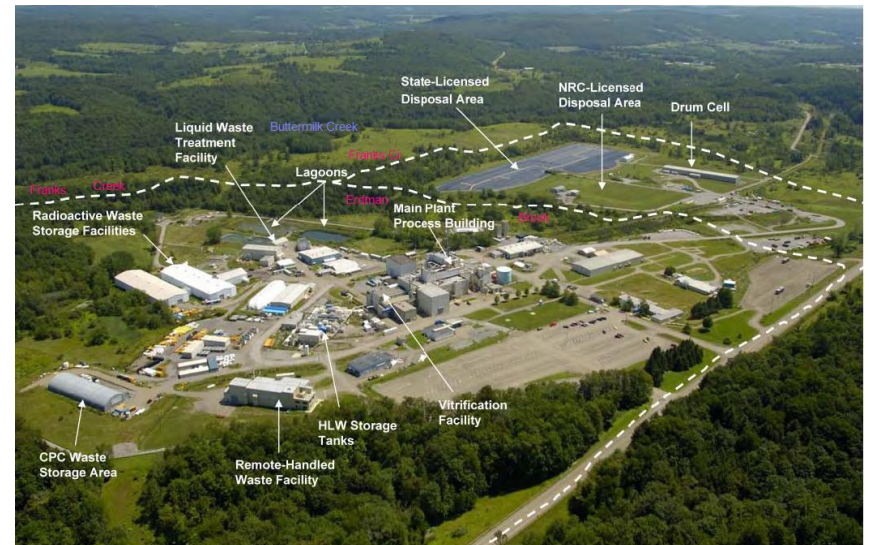
France: Hundreds of externally contaminated shipments (25-33% of all shipments)

BEWARE reprocessing! Holtec/ELEA wants to do it! West Valley, NY cautionary tale

La Hague (Areva/Orano, of WCS/ISP CISF)



(c) Greenpeace/Gleizes



Transport Risk: Infrastructure Collapse

- Impacts on infrastructure (rails, bridges, roads) due to heavy loads (rail-sized casks weigh 100+ tons each)
- [ASCE's 2017 Infrastructure Report Card | GPA: D+](#)
- Big Rock Point radioactive RPV shipment (290 tons), follow-on train derailments in s.e. MI and the Carolinas, due to track damage in wake of very heavy nuclear waste shipment

And we don't even know what to do
with the first cupful!

