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Beyond Nuclear aims to educate and activate the public about the connections between nuclear power and nuclear weapons and the need to abandon both to safeguard our future. Beyond Nuclear advocates for an energy future that is sustainable, benign and democratic.

Avoiding Radioactive Waste Wrecks: Just Say No to Unwise Irradiated Nuclear Fuel Transport, Storage, and Disposal Schemes

Dr. Mary Sinclair of Don't Waste MI warned 25 years ago that high-level radioactive wastes, piled up on the shores of the Great Lakes, and the other drinking water supplies of our nation, are an unacceptable threat that certainly can't stay there forever.

The same can be said of radioactive wastes stored on-site at ocean side reactors, as rising sea levels pose worsening risks as time goes on.

But even Dr. Sinclair recognized that such risks do not justify unwise high-level radioactive waste transportation programs on our nation's roads, rails, and waterways in most states. Bound for destinations that make no good sense, hasty and unnecessary shipments would only increase risks. Thus, she urged her Members of Congress to vote against the proposed Yucca dump in 2002.

Yucca Mountain: Unsuitable, Non-Consensual, Environmental Racism

As Dr. Arjun Makhijani of the Institute for Energy and Environmental Research (IEER) has said, Yucca Mountain, Nevada is the worst site ever studied for high-level radioactive waste geologic disposal. U.S. Department of Energy (DOE) studies more than 30 years ago showed the site's geologic unsuitability, a scientific conclusion that has been confirmed, and bolstered, time and again by Yucca's infamous "double standard standards": when Yucca can't meet the standards, they are either weakened, or gotten rid of altogether, in a desperate bid to keep the unsuitable dumpsite project alive.

If waste were ever buried in that corrosive earthquake and volcanic zone, it would leak massively into the groundwater (and air), creating a nuclear sacrifice zone over an extensive region downstream (and downwind), as well up the food chain, and down the generations.

Just as bad, Yucca fails the consent-based requirement set by the Blue Ribbon Commission on America's Nuclear Future (BRC) in 2012. The Western Shoshone Indian Nation, whose land Yucca is, as acknowledged by the U.S. government in the "peace and friendship" Treaty of Ruby Valley of 1863, certainly does not want high-level radioactive waste and irradiated nuclear fuel dumped there. As recently reported in the *Las Vegas Review Journal*, Western Shoshone Indians have accused U.S. federal agencies, such as NRC, of forcing radioactive waste dumping at Yucca Mountain, against the tribal nation's will, and being guilty of environmental racism.(1)

In a bipartisan way, the people and State of Nevada, and its congressional delegation, led by U.S. Senate Democratic Leader Harry Reid, has also made it very clear, for three decades now, that they do not consent to being screwed.

And many folks in the 45 states, as well as the District of Columbia, that would see high-level radioactive waste trucks, trains, and barges roll through, bound for the unsuitable Yucca dump, have come to realize that when it comes to nuclear waste transportation, we all live in Nevada.

(1) http://www.reviewjournal.com/politics/american-indians-accuse-nrc-environmental-racism

Regional Equity, Versus East Dumps on West

Too many politicians have joined the nuclear utilities and their lobbyists in embodying NIMBY-ism (Not In My Back Yard), by advocating YIYFY-ism (Yes In *YOUR* Front Yard). Nevada, after all, has no atomic reactors, and hence no high-level radioactive waste, within its borders.

Why is it that 90% of the atomic reactors are east of the Mississippi, but most of the targeted dumpsites have been west of the Mississippi? Where's the regional equity in that? One nation, under God, indivisible – until it comes to radioactive waste, then it's East versus West, every state for themselves!

The Rush Toward De Facto Permanent Parking Lot Dumps, for No Good Reason

The BRC and DOE's calls for a consolidated interim storage pilot site as early as 2021, for storing so-called orphaned or stranded waste, and a full-scale centralized interim site by 2024, are bad ideas, especially if those interim sites are entirely uncoupled from a permanent repository. That risks turning consolidated interim storage sites into *de facto* permanent parking lot dumps.

First of all, long time watchdogs living in the shadows of the high-level radioactive waste still stored at permanently closed, and even decommissioned, atomic reactors – such as Big Rock Point, Michigan and Yankee Rowe, Massachusetts – have said not "not in our name." The high-level radioactive waste risks should not be transferred onto trucks, trains, and barges, and relocated to other communities, for no good reason.

It seems that some ulterior motive is driving this process. Could it be that nuclear utilities' desire to offload liability for the high-level radioactive wastes they have generated, onto taxpayers, could be the real underlying motivation, not public health, safety, security, environmental protection, or returning radioactively contaminated, decommissioned nuclear power plant sites back to "unrestricted reuse."

But another serious risk is that high-level radioactive waste would be shipped to a parking lot dump, only for it to have to be shipped back in the direction from which it came in the first place, if and when a permanent repository is finally opened. This risk is not far-fetched.

Private Fuel Storage, LLC, targeted at the Skull Valley Goshute Indian Reservation in Utah, came the closest yet to opening a parking lot dump. If opened, PFS would have shipped 4,000 rail casks, containing 40,000 metric tons of commercial irradiated nuclear fuel, to the tiny Native American community (with just over 100 adult members), over a 20-year period, for surface storage. PFS was intended to serve as a stepping-stone to Yucca, located right next door in Nevada. But being merely interim storage, PFS planned to "return to sender" if Yucca never opened. Thus, if PFS had ever operated, Yucca's cancellation would have meant that 50 high-level radioactive waste casks from Maine Yankee would have travelled 2,500 miles west, only to turn around and return to the New England. 50 risky rolls of the dice, 5,000 round trip miles, accomplishing absolutely nothing. Thank goodness that senseless risk taking didn't happen.

Just Say No to Radioactive Racism

PFS also raises the serious issue of environmental justice, as does Yucca. PFS targeted the Skull Valley Goshutes Indian Reservation.(2) The Yucca dump targets Western Shoshone Indian land.

Before Skull Valley, the Nuclear Waste Negotiator at DOE targeted Mescalero Apache in NM, after having sent letters of inquiry to every single federally recognized tribe in the U.S., and then focusing on 60 in particular.(3)

But Grace Thorpe (daughter of "Athlete of the Century" Jim Thorpe, and later a NIRS board member) made short shrift of any notion that her Sauk and Fox Indian Reservation in Oklahoma would become a high-level radioactive waste parking lot dump. Just days after her tribal council expressed interest in DOE's proposal, Thorpe led the effort to oust them from office. She then toured the country, helping other targeted tribal communities fend off parking lot dumps.

Most appropriately, President Obama honored her, right up there with the likes of Rachel Carson, in his "Women Taking the Lead to Save Our Planet" Women's History Month Proclamation of March 2009:

(2) http://www.nirs.org/radwaste/scullvalley/skullvalley.htm
(3)http://www.nirs.org/radwaste/scullvalley/historynativecommunitiesnuclearwaste06142005.pdf

"…Grace Thorpe, another leading environmental advocate, also connected environmental protection with human well-being by emphasizing the vulnerability of certain populations to environmental hazards. In 1992, she launched a successful campaign to organize Native Americans to oppose the storage of nuclear waste on their reservations, which she said contradicted Native American principles of stewardship of the earth. She also proposed that America invest in alternative energy sources such as hydroelectricity, solar power, and wind power."(4)

The honor should be extended to Rufina Marie Laws and Margene Bullcreek as well, the leaders of the successful efforts at Mescalero Apache, NM and Skull Valley, UT, respectively, that fended off radioactive waste parking lot dumps targeted at their communities.

Tragically, however, President Obama's own BRC and DOE continue to contemplate parking lot dumps on Native American reservations.(5) Such environmental injustice is unacceptable, and must be stopped.

"Whoops" at WIPP: Billion-Dollar Barrel Burst?!

But DOE sites are also being targeted for parking lot dumps, including the Waste Isolation Pilot Plant (WIPP) in New Mexico.

(4) https://www.whitehouse.gov/the-press-office/womens-history-month-2009
(5) http://www.beyondnuclear.org/radioactive-waste-whatsnew/2012/1/26/brc-report-continues-shameful-history-of-targeting-native-am.html

It's ironic that the subcommittee included the following paragraph in its Background Memo about this hearing today:

DOE disposes of transuranic (TRU) waste, which consists of contaminated items such as clothing, rags, or tools, in the Waste Isolation Pilot Project (WIPP). Since 1999, DOE has overseen over 90,000 cubic meters and 12,000 shipments for disposal at WIPP. The experience of WIPP demonstrates key aspects of a system to transport nuclear materials, including coordination with the Department of Transportation (DOT) on hazardous cargo regulations and cooperation with State, local, and tribal governments on emergency responder training and route identification.

After all, WIPP has been effectively shut down since an underground fire, and a barrel burst, within days of each other in February 2014. The barrel burst contaminated not only the underground, but also caused a radioactive release into the surface environment, which fell out downwind, contaminating the soil. Around two-dozen workers were exposed to hazardous alpha-emitting radioactive particle inhalation doses, increasing their risk of latent lung cancer. DOE has estimated the recovery cost for the barrel burst will be $500 million; the *L.A. Times* has predicted that cost will double.

But the barrel that burst underground at WIPP had been transported there in the first place from Los Alamos National Lab. Thank goodness the barrel didn't burst during the shipment, or during transfer operations at WIPP's surface, or else the environmental radioactivity release could have been even worse.

(A collision involving a transuranic waste shipment from Idaho National Lab (INL) to WIPP several years earlier resulted in airborne plutonium contamination inside the transport container. Even though the shipment had already travelled nearly a thousand miles, and was very close to WIPP when the accident occurred, the decision was made to "return to sender" at INL, so as not to risk radioactively contaminating the WIPP surface facilities by opening the internally-contaminated shipping container there. The 1,000-mile return trip to Idaho had the increased risk of involving an internally-contaminated shipping container.)

Other Private, DOE, and Commercial Nuclear Power Plant Targets for Parking Lot Dumps, and Unprecedented Liquid High-Level Radioactive Waste Transport Proposals

Another top contender for the country's first commercial irradiated nuclear fuel parking lot dump is Waste Control Specialist (WCS) in Andrews County, Texas. The dumpsite already puts the Ogallala Aquifer at risk from shallow disposal of so-called "low" level radioactive wastes. Compounding the risks is the fact that, after the barrel burst at WIPP, Los Alamos rushed a large number of barrels, potentially containing similar reactive ingredients, to WCS for surface storage. If one or more of those barrels were to burst, adjacent to commercial high-level radioactive waste centralized interim storage, the hazardous contamination repercussions could be very serious, as well as costly.

As with the national transportation impacts associated with the Yucca dump proposal, a parking lot dump at WCS would initiate high-level radioactive waste shipments through many states.(6)

Another DOE site being targeted for centralized interim storage is Savannah River Site (SRS), South Carolina. But this site is already heavily burdened with radioactive waste and contamination, including the adjacent, leaking Barnwell "low" level radioactive waste dump, and numerous SRS underground storage tanks containing high-level radioactive waste sludge that will, if abandoned, someday likely leak their contents into the Savannah River, in violation of the Safe Drinking Water Act.(7)

Astoundingly, DOE is also seriously considering importing *liquid* high-level radioactive waste from Chalk River, Ontario, Canada to SRS. Solid high-level radioactive waste transport is already risky enough. Liquid high-level radioactive waste shipments – unprecedented in North American history – would be significantly more risky still. This dangerous precedent should be nipped in the bud. DOE has done little to no meaningful environmental assessment on the proposal. If it had, the realization would be quickly reached that re-solidification of the liquid high-level radioactive waste on-site at Chalk River, is the most sensible first step, before undertaking the risks of transport.

(6) See projected transport routes for high-level radioactive waste bound for centralized interim storage at WCS, by viewing the map posted at:
http://www.nirs.org/radwaste/hlwtransport/mobilechernobyl.htm
(7) http://ieer.org/resource/reports/nuclear-dumps-riverside-threats/

But commercial nuclear power plants are also on the target list for BRC and DOE's parking lot dumps. An Oak Ridge study has singled out Exelon's Dresden nuclear power plant in Morris, IL as a top target. But Dresden is already heavily burdened with one of the single largest concentrations of high-level radioactive waste in the entire continent. Already, around 3,000 metric tons of irradiated nuclear fuel is stored at Dresden's three atomic reactors, as well as the General Electric ISFSI (Independent Spent Fuel Storage Installation) storage pool next door. Morris has also suffered a childhood cancer cluster, with deep concern amongst impacted local residents that Dresden could have contributed. (Unfortunately, the NRC-commissioned NAS study on cancer incidence at Dresden, and six other nuclear power plant and nuclear fuel fabrication sites around the U.S., was just cancelled by NRC.)(8)

Risky Radioactive Waste Transportation Should Not Be Entered into Lightly(9)

As Dr. Sinclair warned decades ago, high-level radioactive waste cannot remain stored next to the fresh drinking water supplies of our country forever, nor can it remain vulnerable to rising sea levels. However, radioactive waste transportation cannot be entered into for the wrong reasons, nor rushed.

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(8) http://www.beyondnuclear.org/home/2015/9/11/nuclear-agency-squandered-350-million-on-redundant-building.html

(9) This section is adapted from a selection from "RADIOACTIVE WRECK: The Unfolding Disasters of U.S. Irradiated Nuclear Fuel Policies," by NIRS nuclear waste specialist Kevin Kamps, published in *NUCLEAR MONITOR* No. 643 (March 17, 2006), a publication of World Information Service on Energy (WISE) and the Nuclear Information & Resource Service (NIRS) (Pages 5-6; posted online at: http://www.nirs.org/mononline/nm643.pdf)

Along with making sure that radioactive waste can be monitored and retrieved, a long held consensus of the national environmental movement has been storage of high-level radioactive waste, as safely as possible, as close to its point of generation as possible.

At various points in time, the Yucca Mountain Project proposed launching over 50,000 truck shipments, and/or 10,000 rail shipments, and/or 1,600 barge shipments, of high-level radioactive waste.(10) Such proposals dwarf the total number - 2,500 to 3,000 - of irradiated fuel shipments that have taken place in the U.S. since the dawn of the Atomic Age 63 years ago. Even the limited experience of such shipments in the U.S. has seen numerous incidents and accidents, including radioactive leaks beyond the vehicle, as well as over 50 instances of shipments radioactively contaminated on the exterior of the shipping container, endangering not only workers, but also the general public.(11)

Shipping is one of the weakest links in the entire chain of irradiated nuclear fuel management. Waste going zero miles per hour in pools or dry casks is dangerous enough, but waste going 60 miles per hour or faster on the roads and rails introduces new and greater accident risks. Severe crashes, or long-lasting, high-temperature fires - all too common in real world accidents - could breach the shipping containers, releasing catastrophic amounts of radioactivity. Underwater submersion - involving a sunken barge or a shipment plunging off a bridge - could lead to contamination of drinking water, or

(10) DOE, FEIS for Yucca, Appendix J, Transportation, Table J-27 (Barge shipments and ports) and Table J-93 (Estimated transportation impacts for the State of Nevada), February 2002.
(11) Robert Halstead, "Reported Incidents Involving Spent Nuclear Fuel Shipments, 1949 to Present," May 6, 1996, at http://www.state.nv.us/nucwaste/trans/nucinc01.htm

even an accidental nuclear chain reaction due to leakage of neutron-moderating water into the fissile radionuclides still present in the waste.(12) The National Academy of Sciences has advised that fiery accident scenarios need more study.(13)

In addition, while irradiated fuel is almost never stored in downtown metropolitan areas (with the exception of a small number of research reactors at certain universities), during transport high-level atomic waste would travel right through the heart of hundreds of cities. This presents would-be attackers with a high profile opportunity to cause a catastrophic radiation release in a population center.

A 1998 test at the U.S. Army's Aberdeen Proving Ground in Maryland showed that high-level radioactive waste shipping casks are vulnerable to anti-tank weapons. A TOW anti-tank missile, fired at a German CASTOR storage/transport cask, blew a sizable hole through the cask's 15-inch thick die-cast iron wall.(14) Combined with an incendiary, such a breach could release disastrous amounts of volatile Cesium-137 from irradiated nuclear fuel within a high-level radioactive waste shipping container in a major metropolitan area.

Conservative estimates (accounting for only the five radioactive cesium isotopes alone; nearly 300 additional radioactive isotopes exist in high-level radioactive waste) reveal

(12) http://www.nirs.org/radwaste/hlwtransport/caskfactsheet.pdf
(13) NAS, "Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States," Committee on Transportation of Radioactive Waste, National Research Council January 2006.
(14) http://www.nirs.org/factsheets/nirsfctshtdrycaskvulnerable.pdf

that each truck cask on the highways would carry up to 40 times the long-lasting radioactivity released by the Hiroshima atomic bomb. Rail and barge casks, six times larger, would carry over 200 times the long-lasting radiation released at Hiroshima.(15) Release of even a fraction of this cargo would spell unprecedented radiological disaster.

A study of a real world transport accident - a train fire in a tunnel beneath downtown Baltimore that burned, initially at very high temperatures, for several days in July 2001 - revealed that if just one train car load of irradiated nuclear fuel had been aboard, its shipping container would have failed and large amounts of radioactivity would have escaped for miles downwind in the billowing smoke clouds. Hundreds of thousands of Baltimore residents would have been exposed to the escaping radioactivity. Nearly $14 billion would have been required for clean up, or else thousands would have died from cancer after living amidst the contamination for just one year; living amidst the fallout for 50 years would have resulted in over 30,000 latent cancer fatalities.(16)

Thus, given the potential for severe accidents or attacks, these shipments represent "Mobile Chernobyls" and "dirty bombs on wheels" and “Floating Fukushimas” rolling through our communities. These risks are made all the worse because emergency responders nationwide - especially volunteer fire departments along vast stretches of the

(15) These figures have been provided by Dr. Marvin Resnikoff of Radioactive Waste Management Associates.
(16) Matthew Lamb and Marvin Resnikoff, "Radiological Consequences Of Severe Rail Accidents Involving Spent Nuclear Fuel Shipments To Yucca Mountain: Hypothetical Baltimore Rail Tunnel Fire Involving SNF," Radioactive Waste Management Associates, September 2001, viewable at: http://www.state.nv.us/nucwaste/news2001/nn11459.htm.

interstates and railways across the country - are neither adequately trained nor equipped to deal with radiological releases. Although the federal Yucca Mountain plan involved a token, inadequate funding mechanism to pay for such emergency preparedness, the industry's PFS plan did not even contain that.

But even "incident-free" shipments are like mobile x-ray machines that cannot be turned off. NRC regulations allow for irradiated nuclear fuel shipping containers to emit 10 millirems per hour of gamma radiation (the equivalent of a chest x-ray) to persons standing six feet away; casks are permitted to give off 200 mrem/hr (equal to 20 chest x-rays) at their surfaces.(17) Thus, nuclear workers, truck drivers, locomotive engineers, railroad workers, inspectors, toll booth attendants, gas station employees and customers, innocent bystanders at rest areas, residents living along transport routes, and unsuspecting passersby on the highways all face radiation doses if they come too close to such shipments. If casks are externally contaminated with radioactivity, as has been documented scores of times in the U.S., and hundreds of times during shipments in Europe, then "routine" doses to the general public will be even worse. In 1997 and 1998, activists and investigative reporters revealed that 20-37 percent of all shipments into France's reprocessing facility were externally contaminated above regulatory limits - many emitting 500 times the permissible dose, and one emitting 3,300 times the permissible dose!(18) The National Academies of Science's BEIR VII report (Biological

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(17) 10CFR71.47, Title 10 (Energy, Chapter I Nuclear Regulatory Commission) Code of Federal Regulations Part 71.47 "External radiation standards for all packages."
(18) Mycle Schneider, WISE-Paris, Bulletins, Newsletters, "Transport Special - Plutonium Investigation n°6/7," News! Figure of the Month, June 1998, 16 pages, viewable at http://www.wise-paris.org/; Robert Halstead, "Reported Incidents Involving

Effects of Ionizing Radiation) in 2005 re-affirmed that any dose of radiation, no matter how small, could inflict a negative health impact.(19)

Due to such shipping dangers, as well as resistance to proposed dumps, large-scale popular protests have erupted against irradiated fuel shipments. In Germany, tens of thousands have come out to block transports, sitting in roads and locking themselves to train tracks. In 1997, the German government deployed 30,000 police to guard a convoy of just six casks, costing US$100 million.(20) Such protests are likely in the U.S. should proposed high-level waste dumps be opened and large-scale waste transports begin.

Findings and Recommendations by NAS in 2006

In response to the 2006 publication of the National Academy of Sciences (NAS) report *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States*, Public Citizen published an analysis entitled "Challenging Prerequisites for Safe Transport of Irradiated Nuclear Fuel Identified in NAS Study."(21)

The analysis helpfully digested the 339-page long, dense NAS study. Public Citizen

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Spent Nuclear Fuel Shipments, 1949 to Present," May 6, 1996, at http://www.state.nv.us/nucwaste/trans/nucinc01.htm; Francois Harari, Director of Transnucleaire at COGEMA's La Hague reprocessing facility in France, oral presentation at the Packaging and Transportation of Radioactive Materials (PATRAM) conference in Chicago, Illinois, September 2001 (notes taken by Kevin Kamps, NIRS).

(19) NAS, "Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2," Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation, National Research Council, 2005.

(20) See http://www.nirs.org/mononline/germanwastetransport.htm.

(21) Posted online at: http://www.citizen.org/documents/NASTransportStudy.pdf

highlighted NAS's emphasis that significantly more research is needed before an unprecedented, large-scale transport program is launched, including: full-scale crash testing of transport packages under severe accident conditions; a study of security issues; and a study of very-long-duration, high-temperature fires.

Public Citizen highlighted NAS's conclusion that DOE may not be up to the task (a position later taken by BRC in 2012, when it called for the establishment of a new entity). NAS found that DOE should avoid an extended truck transportation program and should not begin large-scale transport of waste until measures for mostly rail shipments are in place. NAS found that DOE should make public its preferred routes for transporting waste as soon as possible to support state, tribal, and local planning, especially for emergency response. NAS found that DOE should fully implement its decision to use dedicated trains before beginning the large-scale shipment of waste. NAS urged DOE to negotiate with utilities to ship older fuel first. And NAS concluded that DOE should immediately carry out its emergency responder preparedness responsibilities required by the Nuclear Waste Policy Act, including technical assistance and funding to states and tribes.

Public Citizen reported that other government bodies must also be involved, in addition to DOE, and "in strict adherence to regulations." For example, DOE, DHS, DOT, and NRC should promptly develop consistent and reasonable criteria for protecting sensitive information about waste shipments and commit to publicly sharing and providing timely access to information that does not require protection.

Although NAS warned that "Implementation of DOE's transportation program for Yucca Mountain will be a daunting task," and that "the challenges of sustained implementation should not be underestimated," remarkably, DOE has largely to entirely failed to act on NAS's recommendations in the past decade.

As the Subcommittee on Environment and the Economy's notice for today's hearing itself acknowledged, "Expert reports, including a 2006 National Academy of Sciences report, have found DOE must take steps to adequately plan for a national spent fuel transportation campaign and engage with stakeholders. ***But nearly a decade later, many of the report's recommendations have yet to be implemented.***" (emphasis added)

Risks to Our Surface Waters from High-Level Radioactive Waste Barges

A major flaw in the NAS 2006 study, in my opinion, was its arbitrary conclusion in footnote #12 on page 60, which stated: "Package immersion is not discussed at much length in this chapter because the committee judges it to be of a lower concern than the thermomechanical conditions generated during truck and train accidents."

Perhaps the BP Gulf of Mexico oil spill catastrophe of 2010; the Kalamazoo River Enbridge Tar Sands crude oil disaster of 2010; the ongoing Fukushima Daiichi nuclear catastrophe's radioactivity releases to the Pacific Ocean from 2011 till now, with no end in sight; 2014's shut off of drinking water supplies in West Virginia due to a toxic spill, and in Ohio due to artificially enhanced toxic algae blooms; and the 2015 Animas River toxic spill -- would now, in 20/20 hindsight, better sensitize NAS to the importance of toxic chemical and radioactive contamination of surface waters?

High-level radioactive barge shipment risks are very significant. Consider these aspects of DOE's Yucca Mountain Project transport proposals, contained in its 2002 Final EIS: up to 312 high-level radioactive barge shipments on California's Pacific coast, from Pacific Gas & Electric's Diablo Canyon nuclear power plant to the Oxnard's Port of Hueneme;(22) up to 453 barge shipments of high-level radioactive waste on the waters of Lake Michigan, from Wisconsin's commercial atomic reactors, as well as Entergy Nuclear's Palisades atomic reactor in southwest Michigan, into the ports of Milwaukee and Muskegon;(23) and up to 211 barge shipments of high-level radioactive waste on the waters of NJ, NY, and CT surrounding New York City.(24)

DOE also proposed barge shipments of high-level radioactive waste on the Chespeake Bay; Virginia's James River; Delaware Bay; Cape Cod Bay, Massachusetts Bay, and

(22) Table J-27, Barge shipments and ports, page J-83: Figure J-9, Routes analyzed for barge transportation from sites to nearby railheads, page J-80. Map and table taken from U.S. Department of Energy, "Final Environmental Impact Statement for Yucca Mountain," Appendix J ("Transportation"), Feb. 2002. Posted online at: http://www.nirs.org/factsheets/cabargefactsheet92804.pdf
(23) Table J-27, Barge shipments and ports, page J-83. Figure J-9, Routes analyzed for barge transportation from sites to nearby railheads, page J-80. Posted online at: http://www.nirs.org/factsheets/mibargefactsheet92804.pdf
(24) Table J-27, Barge shipments and ports, page J-83. Figure J-9, Routes analyzed for barge transportation from sites to nearby railheads, page J-78 and J-81. Map and table taken from U.S. Department of Energy, "Final Environmental Impact Statement for Yucca Mountain," Appendix J ("Transportation"), Feb. 2002. Posted online at: http://www.nirs.org/factsheets/nybargefactsheet92804.pdf

Boston Harbor; the Mississippi River; the Tennessee River; the Missouri River; and Florida's Atlantic sea coast.(25)

The concern with high-level radioactive waste barge shipment is that accidents happen. But what if high-level radioactive waste is involved? U.S. Nuclear Regulatory Commission (NRC) design criteria for atomic waste transport containers are woefully inadequate. Rather than full-scale physical safety testing, scale model tests and computer simulations are all that is required. The underwater immersion design criteria are meant to "test" (on paper, at least) the integrity of a slightly damaged container submerged under 3 feet of water for 8 hours. An undamaged cask is "tested" (on computers, at least) for a 1 hour submersion under 656 feet of water. But if a cask were accidentally immersed under water, or sunk by terrorists, is it reasonable for NRC to assume that the cask would only be slightly damaged, or not damaged at all? Given that barge casks could weigh well over 100 tons (even up to 140 tons), how can NRC assume that they could be recovered from underwater within 1 hour, or even within 8 hours? Special cranes capable of lifting such heavy loads would have to be located, brought in, and set up. (And what about the fact that Lake Michigan is deeper than 656 feet at locations not far from DOE's proposed barge shipment routes?)

The dangers of nuclear waste cask submersion underwater are two fold.

(25) See the corresponding figures and tables, posted online at http://www.nirs.org/radwaste/hlwtransport/mobilechernobyl.htm, under the chronological entry September 28, 2004.

First, radioactivity could leak from the cask into the water. Each container would hold 200 times the long lasting radioactivity released by the Hiroshima atomic bomb. Given high-level atomic waste's deadliness, leakage of even a fraction of a cask's contents could spell unprecedented catastrophe in the source of drinking water for tens of millions of people – Lake Michigan – or other sources of drinking water for millions of people, such as the rivers listed above. (Even ocean ecosystems could be ruined by such a radioactive release: radioactivity bio-concentrates up the food chain, as in sea food, for example.)

Second, enough fissile uranium-235 and plutonium is present in high-level atomic waste that water, with its neutron moderating properties, could actually cause a nuclear chain reaction to take place within the cask.

Such an inadvertent criticality event in Sept. 1999 at a nuclear fuel factory in Japan led to the deaths of two workers; many hundreds of nearby residents, including children, received radiation doses well above safety standards. The Tokai-mura fatal nuclear accident was considered the worst commercial nuclear power disaster in Japanese history, before the Fukushima Daiichi nuclear catastrophe that began on 3/11/11.

Given all this, the 2006 NAS study's flippant disregard of such significant barge shipment risks is inexplicable.

Public Citizen concluded its analysis of the 2006 NAS study by emphasizing that "public concerns are legitimate":

The study clearly states that opposition to a transportation program and questions about its safety and competence are completely rational and cannot be dismissed as an unreasonable fear of radiation. According to the report, "most people recognize that transportation programs are run by fallible institutions and that institutional and human error play a large role in determining transportation risks." The committee concluded that an important failing of DOE is its lack of understanding about the social impacts that could result from a transportation program.

QA Meltdown

NAS advocated for "strict adherence to regulations," which includes safety-significant quality assurance (QA). However, Commonwealth Edison/Exelon whistleblower Oscar Shirani showed, as early as 2000, that Holtec storage/transport casks violated QA in numerous ways, from their design, to their fabrication and deployment. Shirani questioned the structural integrity of Holtec casks sitting still at reactor sites, let alone traveling 60mph or faster on railways.(26) Shirani was backed up in his criticism of Holtec QA adherence by the top dry cask storage inspector in NRC's Midwest "Region 3," Dr. Ross Landsman.(27) The Holtec's QA violations have never been corrected, despite the courageous whistleblowing of Shirani and Landsman. The episode serves as a cautionary tale for other high-level radioactive waste transport cask models, for QA

(26) http://www.nirs.org/radwaste//atreactorstorage/shirianlleg04.htm
(27) http://www.nirs.org/radwaste/atreactorstorage/nrc_holtec.pdf

violations are blatant amongst other dry cask systems, such as the VSC-24 design (Ventilated Storage Casks holding 24 pressurized water reactor irradiated nuclear fuel assemblies, as deployed at Palisades, MI, Point Beach, WI, and Arkansas Nuclear One). QA violations with VSC-24s were so bad, that fires and explosions resulted.(28) NRC's QA safety regulation enforcement seems to have been broken for a very long time, whether due to agency incompetence, or outright collusion with industry.

In 2012, the Japanese Parliament concluded that collusion between nuclear regulator, nuclear industry, and government officials was the root cause of the Fukushima Daiichi nuclear catastrophe, the reason the atomic reactors were so catastrophically vulnerable to the natural disasters that destroyed them.

Some Solutions: Stop Making Irradiated Nuclear Fuel; for What Already Exists, Hardened On-Site Storage

Dr. Judith Johnsrud, founder of Environmental Coalition on Nuclear Power, NIRS, and Beyond Nuclear, posited that high-level radioactive waste may very well be a "trans-solutional problem" – that is, ironically, a man-made dilemma, beyond human technical capacity to solve.

As Beyond Nuclear board member Kay Drey of St. Louis has written regarding the "lethal legacy of the Atomic Age":

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No permanent, safe location or technology has ever been found to isolate even the first cupful of radioactive waste from the biosphere. And yet we continue to generate more and more – a mountain of waste 70 years high. It's time to stop making it.(29)

Or, as Michael Keegan of the Coalition for a Nuclear-Free Great Lakes put it in 1993: "Electricity is but the fleeting byproduct from nuclear power. The actual product is forever deadly radioactive waste."

That said, it may very well be that the only safe, sound, moral solution to the radioactive waste problem is to not make it in the first place. It's creation is a curse on all future generations, an intergenerational injustice.
So what's to be done in the interim, with the high-level radioactive wastes that hav already been created?

In 2002, at a national event organized by Citizens Awareness Network of the Northeast, held at Wesleyan University in Middletown, CT, as an alternative to the unsuitable Yucca Mountain geologic proposal, Dr. Makhijani of IEER coined the phrase and concept of HOSS, short for Hardened On-Site Storage.

In Jan. 2003, Dr. Gordon Thompson of the Institute for Resource and Security Studies (IRSS), put "flesh on the bones" of the HOSS concept, with his CAN-commissioned

(29)http://static1.1.sqspcdn.com/static/f/356082/16107103/1326916854883/Waste_70YearsHigh_2012.pdf?token=taXXIucu7d6cjpWRqsz8pTI8x68%3D

study entitled “Robust Storage of Spent Nuclear Fuel: A Neglected Issue of Homeland Security.”(30)

“The Statement of Principles for Safeguarding Nuclear Waste at Reactors” was first hammered out in September 2006, and unveiled at a U.S. House Energy and Commerce Committee, Subcommittee on Energy and Air Quality hearing by Michele Boyd of Public Citizen, on behalf of well over 100 environmental and public interest organizations, representing all 50 states.(31)

In 2010, the Statement was updated, with additional signatories joining, bringing the number of endorsing organizations to well over 200.(32)

The HOSS principles were presented to the BRC at each and every public meeting between 2010 and 2012. However, the BRC only agreed to apply HOSS at consolidated interim storage sites, thereby entirely missing the point. HOSS is meant to safeguard and secure irradiated nuclear fuel where it is stored now – at the reactor sites – not to serve as window dressing, or a bargaining chip, in an attempt to persuade the national environmental and public interest movement to support unnecessary and unwise parking lot dumps.

(30) http://www.nirs.org/reactorwatch/security/sechossrpt012003.pdf
(31) http://www.citizen.org/documents/TestimonyHouseWasteSept2006.pdf
(32) http://ieer.org/wp/wp-content/uploads/2010/03/HOSS_PRINCIPLES_3-23-10x.pdf