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Yucca Mountain Site Characterization Office
U.S. Department of Energy

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Dear Dr. Summerson:

These comments refer to the Department of Energy's "Supplement to the Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada," May 2001. It is my understanding that the DOE, in this Supplement, is primarily addressing only those environmental effects that would result from changing the proposed Yucca Mountain repository operating modes to reflect flexible thermal load scenarios (for higher and lower temperatures and related humidity conditions).

Therefore, the only analyses of transportation you have chosen to include deal with the transport of workers and of nonradioactive materials that would be used for the flexible design, such as the titanium drip shields and the steel emplacement pallets.

1 You mention on page 1-3 of the Supplement that you will address the transportation of spent nuclear fuel and high-level radioactive waste in the Final EIS, and on page 3-16 you say: "Transportation of spent nuclear fuel and high-level radioactive waste to the repository would not be affected by the repository design evolution and is not evaluated in this Supplement." But as a person who lives in a community whose roads and rails would be destined to host a sizable proportion of these shipments --- in fact, on the average, quite possibly a shipment as often as every other day for an estimated thirty years --- I object to the DOE's decision to defer its assessment of the environmental and human resources that could be affected by the shipment of these lethal materials.

2 The potential for an accident during the transport of the irradiated fuel rods should not be ignored. It was noted, in a compilation entitled "Reported Incidents Involving Spent Nuclear Fuel Shipments, 1949 to Present (May 6, 1996)," that radioactive contamination had spread beyond the vehicle in four incidents, and surface contamination was found on fuel casks and/or on parts of a truck trailer in 48 incidents. (I'm sorry I do not know the source of this compilation. The earlier data came from the Atomic Energy Commission; the data from 1971 to 1996 were from the Radioactive Material Incident Report Database of Sandia National Laboratories. I might add that I was distressed to learn that funding for RMIR will be canceled as of October 2001.)

Not only would surface contamination pose a threat to people who live and work in corridor communities, but people who share the same roadways could be affected, as well. Gamma radiation penetrating from the inside, plus gaseous and liquid leakage from defective welds,

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valves and seals (e.g., O-rings!) could also affect residents and travelers. Accidents, of course, are possible. Of particular concern would be a collision that would result in a long-duration (longer than 30 minutes), high-temperature (hotter than 1475 degrees) fire. Or a head-on or sideways collision that would result in a puncture of the cask.

Taking note of the fact that seventy-six commercial nuclear power reactors are currently operating to the east of the Mississippi River (and twenty-seven to the west), it would be highly plausible that a train or truck carrying spent fuel could derail on a Mississippi River bridge, resulting in the fuel cask's underwater submersion in the river. Or perhaps there could be an accident on a bridge over the Missouri, Meramec or other river in our state. Having watched the problems that faced the large crew of emergency workers here in St. Louis County (Webster Groves) when 14 coal cars derailed and dumped their freight on May 31, I absolutely cannot imagine how an immersed spent fuel cask could be removed from the river after falling from one of our high, heavily traveled bridges. It would seem that enough water inleakage could occur to make the fissile material in the cask subject to a criticality accident. (I would refer you to the Code of Federal Regulations, Title 10, Part 51 -- Section 52 (Table S-4) and Part 71 regarding the packaging and transport of radioactive materials.)

In addition to the operating nuclear power plant sites, irradiated fuel and high-level waste are also stockpiled at decommissioned commercial reactor sites, at operating and decommissioned research reactors, and elsewhere. All of these wastes will someday, somehow have to be isolated from the biosphere --- in perpetuity. (Some Administration officials apparently are considering, instead, the possibility of sending our irradiated fuel rods to Russia. That would, of course, be one way to reduce the threats to our Midwest roads, rails and rivers --- especially if we all agree not to be concerned any longer about nuclear weapons proliferation and terrorism.)

Although fortunately no spent fuel transport accident has occurred as yet that has resulted in a massive breach of a rail or truck cask, the more the federal government places irradiated fuel in motion on our roads and rails, the greater will be the risk of a major accident. To quote Sue Gagner, a spokesman for the Nuclear Regulatory Commission in yesterday's Wall Street Journal: "There has not been a whole lot of experience with these" waste shipments, "because there isn't any place for it to go." Obviously, many of us recognize that the DOE is hard at work, preparing to announce its support of the Yucca Mountain site. If and when that happens, the trains and trucks will start rolling in an endless caravan.

Those of us who live in a corridor community or state deserve a thorough estimate and evaluation of the potential environmental impacts that could result from an act of radiological sabotage or theft (as per 10 CFR Part 73). To withhold a discussion of the hazards of this massive, decades-long transport campaign to Yucca Mountain until after the Final EIS is published would be to deprive the public of the opportunity, guaranteed by law, to study and perhaps challenge the DOE's findings and predictions. I realize that federal agencies have prepared few, if any, environmental impact statements (concerning a major federal action that could significantly affect the human environment) that have concluded that their projects are unsafe. Everyone expects that the FEIS for Yucca Mountain will be similarly optimistic.

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6 cont. By deferring the public input, you have eliminated our only opportunity for a meaningful,
7 effective dialogue. I believe the DOE should prepare and release for public comment a Supplement to the DEIS that would compare an analysis of the transportation impacts of consolidating the wastes at Yucca Mountain with the impacts from "No Action" --- that is, from the alternative of storing the wastes at the sites where they have been generated, at least until the time when research will have yielded a technology that can vastly reduce or even eliminate the threats of these wastes to the human environments that lie en route to the interim parking lot and permanent repository, wherever they may ultimately be located.

As mere mortals --- and even more specifically, as mere citizens --- we are supposed to have faith in the assurances handed down to us by the DOE and by the contract scientists and engineers who have authored the "Yucca Mountain Science and Engineering Report --- Technical Information Supporting Site Recommendation Consideration," May 2001. (DOE/RW-0539) But even those authors themselves leave troubling questions unanswered. For example:

- If the deep geologic repository is so safe, why would control rods be needed in the double-cylinder waste packages for "additional long-term criticality control"? (S&ER, p. 3-14)

- "Uncertainties associated with the long-term performance of the waste package are the subject of a peer review." The reason a third closure lid is needed at the loading end of each cylinder is to provide "an extra barrier against a potential release [of radioactive waste] caused by cracks and corrosion in the closure weld areas." (S&ER Executive Summary, p. 10)

I remember quite well the DOE revelations just a few years ago about the unexpected migration of radioactive waste within and beyond the vadose zone at the Hanford, Washington, facility --- only decades after the wasters had spilled or been dumped into the ground. How can we be expected to give much credence to the current predictions about the water movement expected through and beyond Yucca Mountain over the ten-millennia duration mandated by the U.S.
8 Waste Policy Act? It's almost amusing, if it weren't so disturbing, to think about making predictions over time spans that extend beyond human imagination. For example, some of the reactor byproducts (from fissioning, activation, etc.) that have extremely long half-lives include: technetium-99 = 213,000 years; cesium-135 = 2.3 million years; iodine-129 = 17 million years; and another of my favorites, zirconium-96 = two times ten to the 17th years. Please remember to multiply those half-lives by at least ten, to figure out how long radioactive particles and rays will continue to be released! (The reference for the half-lives is the CRC Handbook of Chemistry and Physics, 82nd Edition, 2001-2002, "Table of the Isotopes.")

While some high-level radioactive waste would be expected to arrive at Yucca Mountain in a vitrified (glassified) form, the S&ER acknowledges that this "waste form could undergo devitrification at temperatures above 400 degrees Centigrade (750 degrees Fahrenheit)." (S&ER, p. 3-28) I would remind you that DOE engineers found that the molten mass of fuel at the Three Mile Island accident reached 5000 degrees. (New York Times, April 24, 1990) We were lucky that the TMI fuel was virtually fresh; that is, even though the reactor had initially

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become operable a year before the accident began, in March 1979, the uranium fuel had only fissioned for about three months at the time the accident began. Because a criticality accident (a spontaneous, uncontrolled nuclear chain reaction) could also occur at Yucca Mountain --- before, during or after the emplacement of the wastes underground --- the vitrified waste could get hot enough to crack and disintegrate, adding to the source term (the volume) of radioactivity that could be released to the environment.

9 I cannot understand how the DOE can possibly make an informed estimate of the contents or risks of any given waste package or truck- or trainload of spent fuel when the operational history of the irradiated fuel rods is so varied. Shipments would come from 103 commercial reactors currently in operation; from decommissioned commercial reactors; from reactors used for weapons production, submarines and other naval vessels; from research reactors and from high-level waste sites.

These temporary storage sites are located in 38 states and, if Yucca Mountain is chosen as the first national repository, irradiated fuel and other high-level waste could conceivably be shipped through 47 states.

How can this massive shuffling of permanently radiotoxic materials on our roads and rails, complete with armed escorts, possibly be safe for the physical or mental health of the nation? (Please see the map on page 3 of the S&ER Executive Summary.)

How can the buildup of radioactive gases, internal pressure AND THE SAFETY of any specific waste cask be predicted when the contents are so varied? This question is relevant to the transportation, storage and disposal of the wastes.

10... Even the operating history of the fuel rods of a single reactor will have varied from year to year, including such parameters as fluctuating temperatures, pressures and water chemistries – resulting in a range in the volume and curie content of (1) the gaseous and solid fission products and transuranics within the fuel rods, and (2) the activation and corrosion products on the inside and outside of the rods. The varied operating history would also have affected the integrity of each fuel rod's cladding (the rod's hollow metal tubing in which some 250 uranium pellets are stacked) and the rod's top and bottom welds, which in turn would affect the leakage rate of the fission products during the rod's submersion in the fuel pool (a period of at least 20 or 30 years) and during the rest of the life of the rod. That's forever.

A typical thousand-megawatt pressurized reactor, like the Callaway plant here in Missouri, will have approximately 50,000 fuel rods fissioning in its reactor vessel at any one time. The history of one rod, and hence its radioactive contents, will differ from every other rod. For example, the history of the cladding of the rods near the center of the fuel core in the reactor will have been vastly different from the history of assemblies of rods near the periphery.

Other contents of the casks are also worrisome. Because of the probable presence of pyrophoric zirconium and zirconium hydride from the fuel rod cladding in the spent fuel casks, an explosion

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10 cont from inside the cask would be possible during transport, storage, or disposal.

11 **Why does the DOE continue suggesting that the transport casks have a proven design and safety record?**

In a film made by the DOE's Sandia National Laboratories in New Mexico, and distributed widely by the nuclear industry, a shipping cask allegedly built for irradiated fuel rods is transported on a locomotive which is crashed at 81 mph into a wall. Another cask, transported on a trailer truck, is also smashed into a concrete wall.

The DOE claims the casks withstood the crashes, but I believe the film is misleading. The internal pressure within the filmed cask was less than the pressure of a normal shipment of irradiated fuel. The cask in the film contained fresh, unused nuclear fuel which contains about one-millionth the amount of radioactivity present in irradiated fuel. (The amount available for leakage following the filmed crash was less.) If a cask were to strike a wall or bridge abutment sideways – even if traveling at only 12.5 mph, its pressure relief valve would open, causing the release of radioactive gases and particulate material. Nuclear Regulatory Commission regulations only require that a cask withstand a fire of 30 minutes, and yet it is known that some accident fires burn for hours. The temperature resulting from a collision between trucks carrying flammable chemicals can reach an average of 1850 degrees, while the NRC requires that an irradiated reactor fuel cask needs only to withstand a fire of 1475 degrees. (The lead casing of the cask in the film cracked after the cask burned for 100 minutes.)

I hope you will find the following excerpts from a series of news broadcasts of interest, from KVBC-TV in Las Vegas:

(1) From the first night's segment – June 30, 1992:

> The Sandia National Laboratories' tests, from 15 years ago [that is, from 1977], were never designed to test the safety of the casks. Bob Luna was the project manager when the fuel casks were tested in 1977.
>
> **Luna:** The only breach that occurred really was in the outer shell of one of the casks in the fire test. There was a crack opened after a hundred minutes in the fire, and some of the lead from the cask squirted out through the hole into the fire.
>
> **TV Announcer:** That lead squirting out is part of the cask's radiation shield. The six-inch crack is ignored in the commercial.

(2) The second night – July 1, 1992:

> **TV Announcer:** . . . 15 years ago a young scientist who conducted the crash tests, Richard Yoshimura . . . the tests were set up to check predictions on computers,

not cask safety.

Is it fair to say that the tests that were done were not set up to show that these casks can safely transport nuclear waste?

Yoshimura: Yes, it is fair to say that. The purpose of the test program was to test the validity of the [computer] modeling methods that we had.

(3) The third night – July 1, 1992:

TV Announcer: [a terrorism test produced a failure in the cask]:

Luna: It was determined that it was possible to penetrate the cask.

TV Announcer: Scientists shot a cask with some kind of cannon or rocket.

Luna: A hole was produced in the cask about an inch in diameter that would have let out some very small fraction of the contents of the cask.

TV Announcer: Whatever the scientists shot into the cask ripped through the fuel rods inside. #

A few additional questions follow that I hope you will address in your response to the public comments on the "Supplement":

12 1. Is the DOE claiming that the only radioactive gaseous releases from the repository would be the naturally-occurring radon that would emanate from the exposed rock surfaces surrounding the repository? ("Supplement," pp. 3-3, 3-4) What estimates has the DOE developed for the amount of radioactive fission gases that will continue to be generated from the fuel rods and that may be released from the aging waste packages as they corrode and disintegrate --- such as tritium, xenon, krypton, argon and perhaps other fission gases?

13 2. The estimated projected annual radiation dose for the maximally exposed individual (from 0.8 to 1.8 millirem) seems to be incredibly low. Is the DOE basing that dose on exposure only to naturally radioactive radon gas --- that is, to none of the manmade radionuclides created in the reactor and present in the fuel rods?

14... 3. Is the DOE estimating fatalities only from cancer? Were no assessments made of the fatalities and serious health effects from other illnesses caused by exposure to those radioactive gaseous and liquid wastes that will enter into the biosphere as the containers corrode and collapse over time, and their contents leach and leak out? For example, were computer calculations made of impacts of radiation on the reproductive, immune,

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14 cont circulatory and nervous systems, for example, and on the DNA (genetic blueprint), muscles and other parts of the human body?

15 4. What analyses were made of the potential impacts of escaped radioactivity on humans and other animals, and on plants and other living creatures if a lower-temperature operating mode is chosen that would defer the emplacement of the fuel into the repository for some decades and instead store the casks above ground?

In conclusion: it is absolutely incomprehensible to me that any scientist, engineer, politician, educator or other citizen could possibly read through the "Supplement to the DEIS" or the "Yucca Mountain Science and Engineering Report" (or access the information on the accompanying CD-ROMs) and then continue to advocate nuclear power as a viable energy source.

If nothing else, the Supplement and S&ER make it crystal clear that our nation is already contaminated coast to coast by long-lived, high-level radioactive waste.

16 When will our national leaders call a moratorium on the generation of additional nuclear wastes until a solution may be found to the wastes we have already accumulated in the first 59 years of the Atomic Age? When will our leaders admit that no safe solution may ever be found?

Sincerely,

Kay Drey

Kay Drey

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