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Dr. Lake H. Barrett, Acting Director
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Waste Management
Yucca Mountain Site Characterization Office
P. O. Box 30307
North Las Vegas, NV 890136-0307

Dear Dr. Barrett,

I've followed the dialogues in the press concerning the Yucca Mountain Nuclear Waste Storage question since arriving in Nevada in 1992. It appears there are two concerns: industry does not know enough to safely transport nuclear waste and two, that once transported, and especially if it is transported to Nevada, the government engineers do not have enough knowledge to devise a way to store the material for some 10,000 years.

The press is absolutely wrong on the first question and probably wrong on the second because we will never have to answer that ten millennia question. Other things will be done with that waste long before even a small fraction of that ten millennia passes. Let me explain.

Without question the transport industry is safe. I was the vice-chairman of the Local Emergency Preparedness Committee for the five northern or panhandle counties of North Idaho and in that position, I had knowledge of the many hazardous materials that passed right through Coeur d'Alene, Idaho, a town of then about 25,000 persons, on Interstate 90 and on the railroad. We had to have knowledge of those materials to develop our county disaster plans. I'm sure the same or similar hazardous materials pass right through the heart of Las Vegas each day on Interstate 15 and Highways 93 and 95 plus on the rail lines. I can recall several spectacular disasters happening in this area including the MGM Hotel fire and the explosion of the ammonium perchlorate factory in Henderson but I can't really recall any sensational transport accidents. Occasionally there are train derailments that result in chemical fires or toxic releases but the containers used in those industries are not built to the same standards the nuclear transport casks are.

The risks associated with those fires or releases are evidently in the range of public acceptance or the transport containers could and would be built to a higher standard. On the nuclear side, nuclear bombs have been accidentally released in air accidents and nuclear missiles lost in submarine mishaps but to date there has never been a loss of life involving nuclear weapons or nuclear accidents. There have been loss-of-life accidents in chemical processing of nuclear materials but never in transport.

The military moves nuclear weapons systems on a routine basis around the country and the world by air, ship, rail and road without problems. It appears that the public is somehow trained or programmed to react only to the movement of nuclear waste. I think the foregoing demonstrates the daily transport of nuclear materials is a non-event. They are being transported someplace even as you read this letter and perhaps on the freeway close by your office.

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Money rules. The reason spent reactor rods are piling ever higher at the nuclear utilities is it is not economic to recover and reprocess them. Only about 5% of the uranium in each fuel rod is consumed in the reactor. Fuel rods quit producing power when the fission products build up and poison the fission process just as a car engine would stop working if it were required to run on its own exhaust. The current price of uranium is too low. If uranium prices cross over $20 per pound, the nuclear industry would have a very big interest in recovering and recycling uranium, plutonium and other fissionable or potentially fissionable transuranic elements from those spent rods. That interest will happen long before this century is over. Australia and US are about the only countries in the world that do not reprocess their fuel rods.

Reactor technology is old. Practically, it is more than 50 years old and theoretically, it's between 60 and 70 years old. It's almost insane in application and it's a wonder it was ever developed. Consider: A critical mass of fissionable material has to be brought together in a moderating environment and the process controlled with neutron adsorbing materials such as carbon or cadmium rods or an actable gas such as argon so the system doesn't go completely out of control and melt-down. There are other methods to bring about nuclear fission that do not require the process to operate on the ragged edge of meltdown.

The Energy Amplifier, described by Professor Carlo Rubbia Nobel Prize winner and former director of CERN, is a high current, high-energy accelerator -- either a cyclotron or a linac-- producing a proton beam. It is a fast-neutron, not-critical source, and is the offspring of a mature cross-fertilization between modern accelerators and nuclear power, in particular the technologies of fast neutron breeders, reprocessing and MOX technology.

In operation, the proton beam is directed to the core of the device, which contains the fissionable material, e.g., plutonium, uranium, or thorium and other actinide nuclear wastes. Rather neatly, the lead in the core region acts as a heat-transfer medium and also acts as a built-in spallation neutron source. Protons from the accelerator are beamed into the spallation region of the core, producing large amounts of neutrons. These neutrons generate heat through nuclear cascades rather than by the self-sustaining chain reaction of a conventional nuclear reactor. The beam current controls the amount of power produced, and if the beam is interrupted, power generation ceases.

The basic principle of "Energy Amplification" was demonstrated in an experiment at CERN in 1994 in which a net heat gain was recorded when 3.6 tons of natural uranium were irradiated with a high-energy proton beam.

This concept is still a work in progress. It is not an out-of-the-box solution to the nuclear waste problem. However, the preliminary work is credible. Much more work will need to be done such as electrodeposition of transuranics and the control of the spallation products in the lead target but these problems and others will be overcome in much less than a score of years. Technology exists for each step but not all these have been combined to make a complete system. Additional work to create the complete Energy Amplifier system will be funded from a variety of European governmental sources with a target date of 2015 for completion. (See "*A European Roadmap for Developing Accelerator Driven Systems for Nuclear Waste Incineration*" http://itumagill.fzk.de/ADS/TWG/ADS%20ROADMAP%20REV.pdf, April 2001) A similar American program is underway but not as advanced as the European one.

Since the Energy Amplifier creates more energy than that required running the accelerator and associated equipment, it will be a source of income through electricity production.

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The last point to be addressed in the Nuclear Waste Isolation Project is that of the integrity of the Yucca Mountain Storage Site for ten millennia. Assuming every process fails at reducing the storage time required for the nuclear waste the question is then "... can we safely store such material for the decay-time required?" Ten millennia is very long time. We take some comfort in knowing the Egyptians, some 6,000 years ago, were able, with no formal training and very little construction knowledge and equipment, to construct the Giza Pyramids, which still stand today. It is likely they will continue to exist in recognizable form for another four millennia. If such primitive people, as the ancient Egyptians, could build such structures, there is absolutely *no doubt* our trained engineers can construct a facility that will safely store radioactive wastes for at least ten millennia or even more.

I'd hate to see Nevada shoot itself in the foot again. There were certainly billions if not trillions of dollars going through the Nevada Test Site over the last 50 years. What did Nevada get out of all that money? Why virtually nothing!

It's really rare when an opportunity repeats itself-- and it is right now in the form of the Nuclear Waste Isolation Program. That program is coming to Nevada whether Nevada is ready for it or not. The outcome of that program is in our hands to control for our benefit or to turn our backs on it and allow California to reap the benefits again!

If we had had the foresight to tap into that unimaginable cash flow like California did, we'd have the best schools and universities in the world, a living standard second to none, and Silicon Valleys everywhere.

In the 1950s, Nevadans were young and naive and in a position of obeisance to the Californians. Our state was used as the place Los Angeleans and San Franciscans went for cheap food, booze, entertainment; legal slot machines, and legal houses of prostitution. Nevada was and is a low labor rate area where California businesses escape to until the tax situation in California moderates. With such a reputation as Nevada now has, the becoming of the site of nuclear waste storage has to be an improvement on our image.

With that program in place and the right political management, I can see a much brighter future for Nevada. We may become the "Energy State" and the envy of our neighbors. The outcome and our future incomes are up to us. Let's grab the ring!

Finally, I have been a chemist for 39 years with 20 years experience in the Nuclear Chemistry Division of Lawrence Berkeley Laboratory. In addition, I worked setting up cyclotron facilities for Nuclear Medicine in Riyadh, Saudi Arabia at the King Faisal Specialist Hospital and again at the Royal Prince Alfred Hospital in Sydney, Australia. I have worked as a public advocate. If I can be of further help in promoting the Yucca Mountain project, please do not hesitate to call.

Regards,

Sincerely yours,

Ray G. Clem

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