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Honorable Co-Chairmen Chuck Hagel and Jonathan Lash

Thank you for giving me this opportunity to present my perspective on the issue of the geological disposal of civilian and defense used nuclear fuel, high level waste, and materials derived from nuclear activities. I have worked in the field of nuclear waste disposal since 1979, mostly on the Waste Isolation Pilot Plant (WIPP) project in New Mexico, but also on the Yucca Mountain Project in Nevada and the Hanford Site in Richland, Washington. I was a consultant to the Environmental Evaluation Group (EEG) from 1979 to 1982 and became a full time member of it in 1982 and remained so until 2000. EEG was an independent group of scientists and engineers established by the State of New Mexico under New Mexico Tech to provide scientific evaluation of the WIPP project. Federal funds for EEG's operation were authorized by U.S. Congress. Since 2001, I have worked as a consultant to the Technical Adviser to the DOE WIPP Field Office. During 2004 to 2007, I worked as a member of a Sandia National Laboratories technical review group to review the license application for the Yucca Mountain project. Since 2006, I am also serving as a member of another technical review group to review the development of Environmental Impact Statement (EIS) for the Tank Closure and Waste Management at the Hanford Site. These experiences have helped form my views on this subject; however, the views I am expressing today are entirely my own and do not represent any organization that I have worked for in the past or consult with at present.

I will present my views on the three broad questions that this meeting plans to explore and, as requested, will do so in light of my experience at the WIPP.

1. Is a disposal facility (or facilities) needed under all foreseeable scenarios?

From what I know, permanent geological disposal in carefully sited repository is the best solution to the problem of civilian and defense used nuclear fuel, high level waste, and materials derived from nuclear activities. Geological repository or repositories will be needed to dispose spent nuclear fuel and defense high level waste even if large scale reprocessing (plutonium producing or "proliferation resistant") is undertaken, because "closed fuel cycle" remains a mirage.

2. If so, what are our alternative approaches for disposal?

There are no realistic, long-term "alternative approaches" to deep geological disposal. One has to find a suitable location for an underground repository, go through the process of getting it licensed by Nuclear Regulatory Commission (NRC), excavate it, and start emplacing waste in it. I have watched the process of locating a high level nuclear waste repository in USA since the 1982 Nuclear Waste Policy Act and its 1987 amendment were passed. There were some flaws in the process as it unfolded. For example, the sudden abandonment of all other locations in favor of Yucca Mountain and abandonment of generic standards in favor of developing a set of standards specifically for the Yucca Mountain site were, in my opinion, flaws in the process. Nevertheless, having professionally reviewed the license application before it was submitted to NRC in 2008, I think the site had a good

chance of receiving the NRC license and becoming the first high level nuclear waste repository. Potentially negative aspects of the site, seismicity and volcanism, were compensated by a very robust design of the waste container and the performance assessment demonstrated compliance with the NRC/EPA standards. The project did not have adequate public support, however, and therefore failed. Now that the project has been cancelled and the license application has been withdrawn, the only alternative is to find another suitable location. The search for a new site should begin as soon as possible and this time a great deal of attention has to be paid to ensure public support for the new site.

3. What should the disposal system development process look like?

The process should start and proceed in partnership with the States and local communities; should use the information collected in the past; should be transparent, fair and based on technical merits; and should involve the regulator (NRC) from the outset.

The primary lesson from the cancellation of the Yucca Mountain project is that public support for complicated large projects is paramount and therefore the new selection process should follow the model of Sweden and Finland in involving States and local communities from the beginning of the process. Of course, the site should have robust geological features, i.e., favorable hydrology, stable tectonics, low exploitable mineral resources, etc. Other factors, such as an arid climate and low population density are also desirable. There is a great deal of literature available from work that was done in 1980s and 90s regarding the attributes of various potential sites in the USA. Old files from the Office of the Nuclear Waste Negotiator (1987 to 1995) may also contain useful information.

I will now provide my perspective gained from my work at the WIPP project and what lessons can be learned from that experience. As you know, WIPP is a success story and the only operating nuclear waste repository for waste rich in long-lived radionuclides such as Plutonium-239. It was, however, originally promoted as a “demonstration project” and a “pilot plant” when, in fact, a permanent repository was needed and planned. This concept that the public would accept it if it appeared that the waste was only going to be emplaced temporarily led to the plan to conduct “experiments” with waste underground. At the direction of the Department of Energy (DOE), Sandia National Laboratories developed a series of plans between 1988 and 1992 to conduct a five year period of underground experiments with waste that would demonstrate the long-term safety of the WIPP site. As a matter of fact, none of the plans were successful in demonstrating the need for conducting any experiments with waste. The DOE abandoned the pursuit of that strategy in 1993 and accepted the idea of showing compliance with the radiation protection standards (40 CFR 191, first promulgated by the Environmental Protection Agency in 1985) through probabilistic risk analyses (also known as “performance assessment”) before attempting to bring any waste to WIPP. The scientific work required geological and hydrological data from the field, data from chemical and rock mechanics experiments, and computational analyses of risk assessment. Only after the results of these analyses were submitted in a certification application to the EPA in 1996 and the EPA certified the site in 1998, was WIPP able to open to accomplish its mission as a repository for defense transuranic waste. Now, WIPP has successfully operated for 11 years and has disposed more than 130,000 containers of nuclear waste underground. The lesson in the WIPP story is that transparency of purpose is essential in pursuing such projects.

As stated above, the future geological repository should be selected on the basis of favorable geological and hydrological characteristics, and such other pertinent factors as mineral resources, archeological treasures, transportation routes, etc. After the site is selected, in partnership with and with concurrence of the State and local governments, more detailed site characterization program will have to be carried out. This would also require some excavation for in situ rock mechanics and hydrological testing. Simulated experiments for studying the effect

of heat on the mechanics and hydrology of the host rock may also need to be conducted. I do not see a need for conducting any experiments with actual waste in a repository before the repository has been licensed to start receiving waste.

Finally, I would like to share with you my thoughts on the idea of locating another repository in the vicinity of WIPP. While the WIPP area has strong support from local communities, this may be balanced by the feeling in the State that New Mexico has done its part in solving the nuclear waste problem by allowing WIPP to open. I am skeptical about the idea of considering the WIPP area for a high level waste repository for three technical reasons:

First, the WIPP area is a high mineral resource rich area. WIPP's four mile by four mile land withdrawn area is surrounded by intense production and exploratory wells activity for oil and natural gas. This activity existed while WIPP was being considered to be a transuranic waste repository, but it has mushroomed during the past 15 years. The only areas around WIPP where oil and gas wells have not been drilled are the ones underlain by potash leases because the Bureau of Land Management requires potash leases to be mined before allowing drilling for oil and gas that are found at deeper depths. I have no doubt that if the WIPP site had not been withdrawn for WIPP by federal legislation, there would have been intense drilling activity at the WIPP site. The certification application for WIPP assumed future drilling to be the same as in the last 100 years, as required by the EPA standards. Projecting that rate of drilling in the future, probabilistic scenarios for inadvertent drilling into the repository during the next 10,000 years were analyzed. The consequences were found acceptable in meeting the EPA standards. However, with an intense drilling activity in the area in recent years, it may not be possible to find sufficient real estate where the integrity of the salt beds has not already been breached by deep oil and gas wells. And, even if a piece of land with no prior drilling were to be found, licensing by NRC for a repository in the middle of an active oil field would be exceedingly difficult.

Second, salt beds were found desirable for long-term (10,000 years) containment of non-heat producing transuranic waste in the WIPP repository. The waste containers at WIPP are expected to physically break down under the load of creeping salt, and chemically degrade in the briny corrosive salt environment, well before 10,000 years. The salt itself, and the magnesium oxide backfill around the waste, then is expected to keep the waste entombed for 10,000 years. In the Yucca Mountain license application, however, much reliance was put on the integrity of the waste containers, which were designed to be corrosion resistant for tens of thousands of years. Placing high level waste containers in salt where the heat of the waste would provide an additional gradient for the water found in the intergranular space in salt beds to be drawn around the containers would create a very corrosive environment for the containers. It may therefore not be a good idea to put high level waste in salt beds if very long-term container integrity is desired.

Third, retrieval from a repository in salt beds would be much more difficult and expensive compared to a repository in hard rock like Yucca Mountain. If retrievability of waste for 100 years or so after disposal is to be maintained, then salt beds would not be a good choice as a host rock.