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Subject: Response from "Comment on NRC Documents"

Below is the result of your feedback form. It was submitted by

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Document_Title: NUREG-1768, United States Nuclear Regulatory Commission Package Performance Study Test Protocols

Comments: Citizen Alert's comments to the Nuclear Regulatory Commission
on and related to NUREG-1768, "United States Nuclear Regulatory Commission Package Performance Study Test Protocols"
May 30, 2003
Prepared by John Hadder

Tone and Intent

The Nuclear Regulatory Commission (NRC) appears to have initiated an open process for the examination of test protocols of full-scale high level waste (HLW) transportation cask testing by facilitating a series of open, although poorly advertised, public meetings. The use of a roundtable format for discussion of various long-time interested parties with frequent opportunity for open public comment is welcome by Citizen Alert. We encourage this type of process in the future, and we a glad to see the NRC show some comitment to full-scale testing.

The tone and character of the Package Performance Study (PPS) report for public comment, NUREG-1768, is distinctively different than the public meetings. At the very beginning the report states " Despite the excellent safety record achieved to date and general improvements in cask design and analysis, some stakeholders have voiced concerns regarding transportation safety and the lack of full-scale testing of SNF casks" (pg. 1), which Citizen Alert finds condescending to the public. To Citizen Alert this second paragraph the makes it clear that the NRC fully believes that no reform of cask testing is necessary, and that the public is operating in a climate of fear regarding the transportation of spent nuclear fuel (SNF) and HLW, since the public is clearly overlooking the "excellent" safety record of SNF transport. Further, that the public should be grateful that the NRC is bending over backwards to accommodate the irrational requests and demands of the public.

The third paragraph goes on to state that the public (stakeholders) "...desire[s] to further validate the computer models used to evaluate the safety of cask transportation..."(pg.1) Validate is a key word as it is seen throughout the report, and does not capture the full measure of public concern over the use of computer modeling. Citizen Alert has been listening to public concerns over the transportation SNF for well over ten years, a common theme being "We want to see transportation casks full-scale tested, period!" Our interpretation of the validation language in the context of this report is that NRC staff fully believes that the licensing criteria for the transportation casks is fully adequate and without need of revision. Beyond that, there appears to be an almost religious faith within the NRC in the integrity of the transportation casks. It is incumbent upon the NRC to servatively examine this faith.

NUREG-1768 appears to be trying to hold steadfast to the NRC's faith in existing licensing standards - " ...the PPS is not intended to involve the development of new standards for transportation casks."(pg.1), while appearing to be open to reform - "Initiation of the PPS is wholly consistent with NRC's commitment to continually assess the regulations governing and safety of the transport of spent nuclear fuel." (pg.1). The NRC makes it clear that the PPS may involve tests that are "extreme and improbable," hence " extra-regulatory." The implication being that there is no reasonable accident event that is not

encompassed by the NRC licensing criteria (10 CFR Part 71).

Thus, going into this report and subsequent process Citizen Alert is very wary that the NRC is involved in a public relations campaign. Repeatedly during the roundtable discussion on March 11, 2003 in Las Vegas, Nevada, and within the body of the report the NRC expressed the need to improve public confidence. However, there appears to be little commitment to progressive principles with a open door to reform. During the 3/11/03 roundtable discussion NRC staff expressed some openness to examine existing regulations, but none of this is seen in the report. Citizen Alert is disturbed about the Dr. Jekyl/Mr. Hyde behaviour of the NRC in this process, where the public sees the responsive and respectable NRC (Dr. Jekyl) in open meetings only to discover too late that the arrogant and dismissive Mr. Hyde is writing the protocols and deciding the real work of the NRC in private.

Nature of the Approach

The non-conservative and non-progressive approach is clearly delineated on the top of page 4 of the PPS report with the statement of objectives:

- "Confirm finite element analyses as a valuable tool to accurately capture cask and fuel response to extreme mechanical and thermal environments.

- Demonstrate the inherent safety in spent fuel cask design – Public outreach is a significant element.

- Provide data to refine dose risk estimates to the public and workers by replacing conservative assumptions with empirical data and new or updated transport statistics." (pg. 4)

These statements can be easily interpreted to mean that the tests will be designed to achieve a public relations goal and to quiet HLW/SNF transportation critics who say that the casks have not been full-scale tested. The words "inherent safety" is at odds with the role of the NRC to examine cask designs critically looking for points of failure that will ultimately lead to better designs.

Alternatively, a conservative approach will determine any points of failure in terms of impact, fire, and deep immersion, and compare those points of failure with existing knowledge of real world accidents. If the stresses applied that result in a point of failure lies within the realm of a real world accidents then the cask design is inferior and changes to the licensing criteria are in order. The licensing criteria need to be more stressful than the most severe credible accident but within the point of failure, and without the above analysis the safety of the transportation of SNF/HLW will be in question.

Licensing Regulations

It is the Nuclear Regulatory Commission that has the responsibility to protect the public by ensuring that the integrity of the transportation casks would not be compromised during even the most severe credible accident. The mechanism for assuring the health and safety of the public in advance of such an accident during any shipment of HLW/SNF is the licensing criteria codified in Title 10 Code of Federal Regulations Part 71 (10 CFR 71). The intent of these licensing rules is to demonstrate, through a series of tests, that any cask design will to be able to withstand any credible real world accident without releasing radioactivity. Thus, to this end any action taken by the NRC regarding the transportation casks should address the validity of the licensing regulations.

The public has repeatedly asked for full-scale testing of all transportation cask designs that will be used for HLW/SNF shipments. For the NRC to proceed with any full-scale testing and not connect them to the licensing rules does the public a disservice and undermines the NRC's primary mission:

"to help ensure that the public health and safety are protected in the many different peaceful uses of

nuclear energy." (Citizen's Guide to U.S. Nuclear Regulatory Information - NUREG/BR-0010, Rev. 3)

Any full-scale testing should inform existing regulations with the possibility that the regulations may need to change. Especially given the nature of the cargo, critical analysis is required and a conservative approach expected. The NRC needs to draw a clear connection between cask licensing requirements and the proposed tests conducted; how do they compare? If the test is extra regulatory, then to what extent does it exceed the regulations, and how does the test compare to credible severe accidents? Citizen Alert would like to see the NRC "draw the triangle" from the licensing criteria to real world accidents to the computer simulations and back; what is the relationship between these three items? Ideally, the NRC should be able form the mapping from one to another to complete the triangle to give a full understanding of how each is related to each other. If this relationship triangle cannot be created then Citizen Alert will continue to have serious doubts about saf!
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transport of HLW and SNF. Why should the public be expected to trust licensing procedures if the relationship to actual accident scenarios cannot be defined?

Computer Modeling

One of stated objectives in the PPS is the validation of computer models. The most significant validation would be under the conditions imposed by the licensing rules. A comparison of computer predicted results of the license tests against full-scale license test would address an important public concern; can the computer modeling replace physical full-scale testing? This question is not trivial as the NRC currently allows computer simulations to at least partially replace full-scale testing. The validation testing outlined in the PPS may be adaptable to the modeling used in the licensing; however, a side by side comparison is unequivocal. Such a comparison will leave no doubt of how well the simulations stack up.

It may be argued that since the test are considered extra regulatory, if the computer simulations bare out the test results, then the modeling would certainly be predictive for the "lesser" licensing tests. This is only strictly true if the configuration of the extra regulatory test is the same as the license test. Variant configurations could yield varying accuracy, which is particularly true when the configuration represents an asymmetric impact or fire. The complexity of strain and force propagation dynamics tends to increase, often significantly, for asymmetric and multiple point contact collisions. Thus, transference of modeling results from a non-regulatory test must be done judiciously and may not address public concerns.

At this time, Citizen Alert is does not see computer modeling as acceptable to license a transportation cask design for use. It was stated on page 11 last paragraph of the report that "...the finite element calculations do not directly give leak rate," which is an indication of one of the limitations to modeling methods. However, we do believe that useful information can be obtained from computer modeling to improve designs that will later be full-scale tested for licensing. At the very least if there is no change in the existing licensing criteria regarding the use of computer modeling then it is incumbent upon the NRC to demonstrate that computer calculations can accurately predict potential radionuclide releases from a severe accident scenario.

Surrogate Materials

Page 9 of the PPS report discusses briefly the issue of using surrogate materials and mock spent fuel assemblies without clarifying the specific nature of these materials. Citizen Alert expects that there will be " mock" materials used that duplicate as closely as possible the actual materials that will be transported.

There are four important considerations here: 1) physical geometry, 2) density characteristics, 3) structural integrity, and 4) potential release characteristics. The first, second, and third items relate to how the assemblies will accelerate and reposition during impact or conflagration. It seems as though according to the last sentence of the first paragraph on page 9, "The other mock spent fuel assembly will be constructed in the same manner as a fresh fuel assembly, but with surrogate material replacing the

uranium dioxide fuel.," that there is some commitment to simulate items one and two above; however, using a "fresh fuel assembly" surrogate will not yield important information regarding risks and hazards of embrittled assemblies that will be the actual payload.

Case 1: there is an impact with an actual cask where the body of the cask is not compromised. So, there is no expected radionuclide release at the accident site; however, the assemblies could have been seriously damaged to a point where extraction from the transportation cask will create increased risks of radiation exposure. It is also possible that due to changes in the internal structure of the damaged assemblies the radiation field emitted by the cask may be different and no longer within existing regulations.

Case 2: there is an impact with an actual cask where the body is in someway compromised. Thus, there is the potential for radionuclide release at the accident scene as well as the implications from case 1. Embrittlement is a critical risk and health factor here, since the radioactive elements in the assemblies are more likely to escape into the environment when the assembly is damaged during an accident.

The effect of an impact upon the actual materials should be evaluated as well. To be conservative the mock assemblies should be constructed with materials that will simulate as closely as possible the structural strength of the most brittle assemblies that are expected to be transported. Certainly, the embrittlement characteristics can and should be experimented with separately, Citizen Alert still sees value in including this element into the test experiments on the whole cask to realistically assess the holistic nature of the hazard in a severe accident scenario. If the NRC is going to the expense of performing these tests, then as much useful information should extracted as possible.

Item number four above, potential release characteristics, is related to embrittlement and the radionuclide mixture in the assemblies. As mentioned in the report, pressurization of the inside of the cask will yield important data on whether containment has been compromised , but will not address the potential for changes in the radiation field in case 1 above. Citizen Alert suggests that the mock assemblies be charged with an identifiable gas at the same pressure as the gas surrounding the assemblies. In this way, if the assemblies are damaged the extent of release and change in radiation field can be better estimated by sampling the gas mixture after the experiment.

The simplified "lumped mass" method being considered (pg. 55, 2nd paragraph) will not properly address potential loss of containment due to damaged assemblies from the heat of a fire (again older assemblies have had holes and cracks). It is also possible in a real accident for there to be a collision prior to a fire, where embrittled assemblies may be damaged in advance of the fire.

Type of Casks Used

The NRC should only use those casks that are to be used for the transportation of SNF/HLW. It is still unclear in the Final EIS for Yucca Mountain that the HI-STAR 100 MPC or similar designs will be used. In fact, the DOE had earlier rejected the use of a multipurpose container for Yucca Mountain. While Citizen Alert favors the MPC concept in general, we don't think the HI-STAR cask should be used for these experiments unless it is clear that they will be used, in particular, for a project of the scale of Yucca Mountain. As long as the transportation component of the Yucca Mountain Project remains fuzzy especially in regards to the types of casks to be used full-scale testing experiments are premature.

Test Configurations

Citizen Alert is concerned about the approach used in determining the test configurations. We certainly expect that predictive calculations will be done in advance of the tests, and then comparisons made; however, the extensive use of the computer modeling in developing the tests opens the door to creating an experiment that will best match the calculated result. In fact, a sound scientifically defensible approach should conduct experiments that challenge the calculations, and show at what point and under what

conditions the calculations fail to be predictive. Indeed, the stated objectives, like foregone conclusions, of the PPS report fly in the face of good conservative scientific procedure.

The impact tests should be conducted not only to plastic deformation, but to failure. The best way to frame the safety of the transportation casks is relative to the potential failure in a real severe accident against the containment limits of the casks. The important question that needs to answered is; are there any severe accidents that have happened and are possible for the shipment of SNF/HLW that will stress the casks beyond the containment limit? Further, does the licensing criteria challenge the casks to at least the extent of such credible severe accidents. It is also of value to speculate regarding severe accidents that may happen and the implications of those as well.

Citizen Alert does see value in the "back breaker" test, and would also like to see the puncture (or crush) test done to failure. The "end on" test suggested for the HI-STAR 100 cask is designed to simplify the calculations by impacting on the corner in line with the center of mass, which is good to challenge end seal failure (if done to that extent). Again, the computer calculations are driving the tests. We would like to see an impact done off the center of mass such that after one corner impacts the unyielding surface and other end also impacts the surface. This is a sort of "slap-down" test, which is a likely scenario in a real accident and would be a good challenge to both the integrity of the cask and to the computer modeling. We are also interested in multiple point or asymmetric impacts as these kinds of impacts are most likely to occur in a severe accident involving separation of the cask from the conveyance.

Pool Fire Tests

Duration of the fire should be at least one hour, and proceed to failure. The Howard tunnel fire in Baltimore demonstrated the potential for a long hot fire. Tests should be done for long times, well beyond one hour, at a temperature of around 1450o F, (or at a high temperature that may occur in a diesel fire) to determine the potential for component failure at elevated temperatures over long periods.

It is not clear that using water in the pool fire (pg. 53 3rd paragraph) test will correctly simulate ground conditions. Typically, water has a significantly higher heat capacity than the ground. Thus, the water will absorb more energy than the ground normally would and yield incorrect heat loss data from the cask. If the pool (ground) is assumed to be an "infinite" heat sink, which is entirely possible, then at issue is the rate of heat loss. Citizen Alert expects that the NRC will clarify this point and use a ground simulation that mimics accurately the heat transfer rate to the ground, which water probably does not.

Probabilistic Metric

The discussion in Appendix A, pp. A-2,A-3, suggests that the particular scenario of the center-of-gravity-over-corner impact has an event probability that "compares favorably" with the event category criteria in the Part 63 NRC licensing rule. First, it appears as though the calculation in paragraph 2 of A-3 counted the hard surface probability twice: once as the total fraction of all rail side surfaces and again as 96 kph impact onto a hard surface. If this is an error then the probability figure will be higher. Second, the calculation is a specific case, and there is no proof that result found can be generalized.

Terrorism Issues

Citizen Alert realizes that the licensing criteria was written for accident scenarios, but there is a need to address the implications of a terrorist attack on a shipment of SNF/HLW. We would like see various terrorist scenarios explored including the impact of a cask with a penetration projectile that can be fired from a shoulder mounted device. It is vitally important to determine what the potential radioactive release could be in a terrorist attack, and then to establish protocals to address those risks and impacts.

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