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General Comment

See attached file(s)

Attachments

Letter on NRC-2013-0136 - 7-31-2013

July 31, 2013

Ms. Cindy Bladey
Chief, Rules, Announcements, and Directives Branch (RADB)
Office of Administration, Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Comments on Docket ID NRC-2013-0136, Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor, Draft Report June 2013

Dear Ms. Blady:

In response to the NRC News (No: 13-053) request for public comment, I am offering these comments and observations for consideration by you and the NRC Staff. I have experience in the nuclear industry and some decades of close involvement in spent fuel storage and transport technology. I have also written on the subject of comparative radiological assessments among nuclear technology events and a variety of non-nuclear industries.

I come to this subject with knowledge and experience, offering herein informed research and supported opinion. However, I do not have the time necessary to drill down to the required levels on the topics of real concern to me in the subject report, and the details that are necessary do not seem to be contained in the report anyway. So, with that in mind, it is certainly true that some of what I present below must be characterized as well-educated surmise, based upon the evidence I find in the report. However, if my comments do produce some review by knowledgeable staff and/or management of those issues I consider to be critically important, then that is the best this process can achieve, I'm afraid.

My first observation is that the staff has done an excellent job in producing a thorough report, not considering the conservative analytical tools and methods or the range of conservative assumptions that staff and/or management must have decided should be applied. So, the analytical work appears above reproach, technically, from my high level review and understanding of the event that has been thoroughly dissected in the report.

Further, the results showing the very low risk and essentially incredible threat from such a beyond-design-basis (BDB) event are mostly consistent with results from work others have done with less sophistication, but the risk numbers still appear to be about 2 orders of magnitude too large, owing to what must result from large conservatisms in the codes and in the assumptions (starting with the assumed probability for a M 9.0+ earthquake in a Seismic Zone 1 site). So, the results comport with expectations, even though they still appear too large, and the event essentially falls into the realm of the incredible.

With that said, my second observation is that while the report produces results that are perhaps useful to NRC staff in comparing a set of potential outcomes to determine the relatively more threatening scenarios, the results, taken individually, as they will be by those with a different agenda, are nothing more than a hyper-conservative projection of outcomes that are widely at variance with experience. In short, the numbers that I can especially identify involving collective dose projections are far too large for any credulity, based upon experience over the last 2 -3 decades. Very conservative modeling and assumptions, when deployed to establish relative outcomes from a set of scenarios, is a perhaps useful approach in determining where real threats may arise. But allowing the hyper-conservative results to be easily stripped from the report, accurately attributed to the most respected nuclear regulatory body in the world, and used for fear-mongering, as can now be done, seems to be ill-considered.

As a result of these observations, the following additional comments are offered for your consideration:

- I question the use of such highly conservative "safety analysis" codes (thermal, structural, source and release calculations, especially in the dispersion, inhalation, ingestion, direct dose rates, population dose, etc. determinations); while such codes have legitimate application for design-bases defense in conservative licensing or certification actions, their use in trying to project real outcomes that society might face under BDB conditions does not seem proper when not accompanied by proper disclaimers; anyone who has used such codes and seen how their results stack up against what really happens with actual events involving radioactive releases knows that the codes tend to overstate the negative outcomes substantially, and, therefore, are not useful in public decision-making that falls outside of the NRC's charter for licensing and certification; specific issues with the models and their assumptions include:
    - The Cs adsorption on surfaces of the intact reactor building (or a fully collapsed building) seem well-understated, especially in the context of a BDB event analysis;
    - The thermal plume generation and the dispersion models result in release forces for sources, as well as source dispersion and distance coverage, that are far too large; for instance, the thermal plume source and energy of ejection for the events of this report are far less than those of Chernobyl;
    - The resistance coefficients for the thermal plume may be too small and so contribute to a much larger release than is credible, especially if the reactor building remains predominantly intact or if it collapses completely into the pool;
    - The MELCOR results do not seem consistent with the testing that has been done on the rapid oxidation of zircaloy; this application of MELCOR does not enjoy a particularly high approval rating.
- It appears there has been no "sanity check" of the individual case results with an actual event such as Chernobyl. In the Chernobyl accident, reactor power escalated to thousands of percent, resulting in a steam explosion, followed in 11 seconds by a vaporized fuel explosion. The full core was dispersed, with 30% to 60% taking up

residence outside the reactor hall, and some materials were displaced into the lower stratosphere. The full core was open to the air, burning outside the hall or in the basement, for 40 days or more as recovery was attempted. Such an event has never occurred before, and the scenarios discussed in this report do not approach Chernobyl in severity. With full core incineration and release directly to the atmosphere for 40 days, Chernobyl dispersed only 34% of its Cs-134 and Cs-137 inventory and 55% of its iodine inventory. Weather conditions, evacuation failures, continued consumption of local foodstuffs, and very poor recovery coordination and implementation maximized population exposures. As a result, the following lifetime (50 year) collective effective dose equivalents (CEDE) were experienced by the populations in the 3 directly affected countries: external of ~ 4 million person-cSv; internal of ~ 2 million person-cSv; and thyroid of ~ 4.7 million cSv. The external and internal doses were experienced by the 5.16 million people in the contaminated areas. For thyroid doses, the coverage included the 215 million people in the total populations of all three countries. The highest exposed population was 1,123 people in the Ukraine that have been projected to receive less than 40 cSv over 50 years. The average annual exposure of the 5.16 million people in contaminated regions would be less than 0.025 cSv. Further, these numbers are known to be conservative estimates, owing to the fact that overestimates of contamination of food were used in the first few years, that direct doses used simple calculations based on average contamination, and the Ukraine overestimated internal doses using calculations that consistently overstated whole-body count doses by an average factor of 4 to 7 (see §157 and §158, Annex J, UNSCEAR 2000), showing the large conservatisms in modeling. Comparing such numbers with the results reported in Figure ES-1 and Tables 27 and 33, for example, we find:

- One event in ES-1 shows a release of 42% of Cs inventory in 3 days; that is just not credible; it took a burning, explosively discharged Chernobyl core 40 days to release 34%;
- Chernobyl released about 3.7 million Ci of Cs-134/137 over 40 days; Table 27 shows somewhere between 8 and 25 million Ci released for worst case scenarios over 3 days; that is simply not rational in comparison to Chernobyl (2 to 8 times greater)
- Table 33 shows one event with a population lifetime collective dose of 35 x 10^6 person-cSv, based (I assume) on a 3 day release of 8.8 million Ci of Cs; that is almost 6 times the results of Chernobyl, depending on how much dose arises from iodine (it should not be that much), and the population in the 50 mile radius around PBAPS is about 5 million, as with Chernobyl; such a result shows that either far too much fuel was analyzed to release large inventories, or the dispersion and dose models are far too conservative, or both;
- Since longer term external and internal doses are principally derived from the dispersion and deposition of cesium, the Chernobyl event, which was as badly mismanaged as is practically conceivable, produced a lifetime dose of about 1.33 person-cSv per Ci of Cs-134/137 released; even the more moderate releases

shown in Table 33 produce lifetime CEDEs that are far worse at about 18 to 25 person-cSv per Ci of Cs-134/137; again, at about 13 to19 times worse than Chernobyl, this is just plainly irrational.

Such inconsistencies and significant modeling conservatisms should be carefully reviewed as to whether the displayed results are consistent with the modeling (a good QA review is probably in order) and whether they should appear in this report as has been said by others, these results are not hyper-conservative; they are wrong.

- It would seem logical, if modeling is the issue here (such safety analysis models classically being unable to project reasonable outcomes, which is especially troubling when used to discuss BDB events with the public), that for at least the dose consequence portion of the analyses, simple use of Chernobyl correlations would result in still conservative dose projections without the need to overstate impacts on the public; I have developed correlation models myself for that purpose, and that is the course I would recommend.
- The NRC still uses LCFs as a determinant of health effects; it is not scientifically correct, with or without the use of DDREFs, and has been repudiated by a number of international organizations; their use does make the report more attractive for those that want more bases for fear to be published by the NRC; the use of LCFs has always been bad science; today, it is acknowledged as junk science; the ICRP's Task Group 84 says: "A clear explanation of the limitations of epidemiology is essential for understanding the reasons why collective effective doses aggregated from small notional individual doses should not be used to attribute health effects to radiation exposure situations, neither retrospectively nor prospectively. The ICRP, UNSCEAR, and others strongly urge that this misuse of collective dose should be avoided. It is recognized, however, that collective dose is a very useful concept which decision-making bodies may use to impose radiological protection measures even at low doses, in part for reasons of social duty, responsibility, utility, prudence and precaution. . . . In sum, theoretical cancer deaths after low dose radiation exposure situations are obtained by inappropriate calculations based on the LNT model and misuse of the collective dose concept." The fact that the most highly regarded nuclear regulatory body in the world still uses LCFs is simply beyond credulity.
- Finally, I would suggest that some part of the report provide more discussion of the doses generated by the events and the risk issue, as well as offering the public a comparison of the collective doses from this report with the collective doses the public receives <u>every year</u> from a selection of non-nuclear industries (out of the 15 to 20 than are most impactful on U.S. population doses). I have attached a Table from one of my journal articles as an example only, showing comparative impacts with 7 such non-nuclear industries whose population dose impacts on the public are unregulated, unmonitored, unreported, uncontrolled and undisputed. Even the NCRP has shown that in excess of 5 million Americans receive more than 2 cSv per year from non-nuclear-energy and non-

nuclear-medicine sources. I have proposed such an approach on several occasions to NRC senior staff, and it has never been accepted. Perhaps it is viewed that such information appears as an "endorsement" of nuclear energy, despite the fact that the NRC often uses comparisons in other situations to help the public understand relative impacts and situations that are not easily comprehensible to the public when presented alone. I expect a similar result with respect to the suggestion this time.

The present contents of this report can be easily cherry-picked by certain organizations for use in fear-mongering. The present draft shows that large collective public doses are "possible," and this could appear in the media with headlines like: NRC Shows Peach Bottom Spent Fuel Pool Can Produce Accident 18 Times Worse than Chernobyl. Of course, as I have attempted to show herein, perhaps the "media event" could be avoided with using more realism in the analysis and comparing those dose results to what non-nuclear industries with unregulated population dose impacts do every year to millions and millions of people.

This report may have been drafted without fully considering the public impact of using very conservative methods and assumptions that produce questionable outcomes, based on experience with BDB events, and it can be viewed as very alarmist in nature. I recommend that the NRC rethink some evaluations and content within this report because of the completely unnecessary fear it may cause members of the public, if presented by those seeking such an outcome.

Thank you for the opportunity to review this draft report. Please let me know if you have any questions.

Sincerely,

Charles W. Pennington

Charles W. Pennington

Table
Comparative Population Ionizing Radiation Exposure in the U.S. (Collective Effective Dose Equivalent): Nuclear Energy vs Seven Non-Nuclear Industries
(Assumes Growth to 300 Reactors over Next 50 Years)

Industry	**Current Annual CEDE (Person-cSv)**	**Estimated Previous 50 Year CEDE (Person-cSv)**	**Projected 50 Year CEDE (Person-cSv)**
Aviation	>0.6 million	>12 million	>28 million
Building Design/Construction	>15 million	>430 million	>750 million
Potable Water Supply	>1.5 million	>38 million	>75 million
Agriculture	>1.3 million	>52 million	>65 million
Construction Materials	>2 million	>78 million	>100 million
Tobacco Supply	>44 million	>3 billion	>2.2 billion
CT Medical Diagnostics	>44 million	>1 billion	>2.2 billion
Total for 7 Non- Nuclear Industries	**>108 million**	**>4.6 billion**	**>5.4 billion**
Commercial Nuclear Energy	<0.03 million	<1.6 million	<2.6 million