Einziger, Robert

From: Einziger, Robert
Sent: Tuesday, May 25, 2010 5:00 PM
To: Cook, John
Cc: Einziger, Robert; Lorson, Raymond; Regan, Christopher
Subject: Preliminary release fraction review of Sandia report

John,

I reviewed the report for items that affected the release rates, i.e. fuel properties, and cladding properties. I did not do a materials review of the absorbers, shield, impact limiters, or cask containment system, and did not look at the thermal properties of any materials This can be done if you desire.

1- Page 2 - it says the analysis is being done for a 17 x 17 WEC assembly at 45 GWD/MTU, the highest burnup any of the three casks is certified to carry. I agreed to this but we also agreed that the study would be done at the current maximum limit of 62.5 GWD/MTU so we can bound the problem. Using only the lower burnup gives a somewhat hollow result since the properties of the fuel only start changing at this level; there is no rim, hydrogen content in the cladding is rather low etc.
2- Page 57 - a report by Kalan et. al. is referenced for the failure behavior of fuel rods. This is a DOE report that I am not familiar with and would like to get a copy. This was a side drop analysis done for 45 GWD/MTU fuel. At this burnup the oxide wastage layer and the hydride wastage layers of the cladding would not be fully formed, and hydride reorientation would not be accounted for. The summary on page 57 says the calculated strains were below the 2% limit stated in the Sanders report. The criteria for failure from Sanders really has no firm support. As a result I am not sure the results of the Kalen report would be applicable to a higher burnup rod.
3- Page 102 – the inventory will be much higher for fuel at 62.5 GWD/MTU
4- Page 104 release rates were quoted in a table with all the justification left to Appendix V. Sec V.5.4.1 and .2. Table V-17 gives release rates but never discusses how these release rates were obtained. The methodology, input data, and assumptions used to arrive at this table should be presented in the report.
5- Page 415 says that if there are no breached rods that no CRUD would be released because "there would be no depressurization even if the cask seals are compromised" This is true if the cask pressure at temperature is only one atmosphere. Many casks are pressurized above one atmosphere at room temperature and even if a cask is pressurized to one atmosphere at room temperature it will be above atmosphere at transportation temperature. The rods do not have to fail in order to release CRUD .
6- Page 415 states that the ratio of the atmospheric pressure to the cask internal pressure is .0.667. Where does this number come from? It surely doesn't bound the modern casks
7- Page 415- There is a statement attributed to Hanson dealing with depressurization and release of material from rods. This statement is irrelevant to the topic being discussed. The topic deals with release from the fuel rods if the fuel oxidizes. A cask will depressurize long before the fuel gets a chance to have any appreciable oxidation. The last line in on the page says that the release fractions from the rods to the cask were developed from data from Hanson but never gave any indication how this was done or the assumption that were made. To be of any value the methodology used to arrive at the release fractions, the input data used and the assumptions made must be clearly described in the report.
8- Page 416 – Hanson makes the case, based on German indentation studies, that the rim is tougher than the body of the fuel and as a result should have a smaller fractional release. The validity of these German studies have been questioned by both NRC and PNL staff due to the size of the indenter used. There is equally contrary evidence thus in the past NRC has assumed a large potential uncertainty in the fracture of the rim region. To accept that the fracture of the rim and the body are nearly equal is ignoring the uncertainty in the data. This has been explained to Sandia Staff (RW) in the past.
9- Page 416. The authors use Hanson as a reference for a fission gas release fraction of 0.5 %. This is reasonable for fuel with a burnup of 45 GWd/MTU that has not been subsequently fractured in an

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impact. Hanson also showed that, the FGR of higher burnup fuel Is substantially higher without further fracture in an accident. During fracture in an accident, the fission gas release can increase substantially. This issue was covered in detail in the appendix to the NRC PRA for storage.

I find this report to be very stagnant. It makes conclusions for older models of casks using a fuel that is just on the brink of being called high burnup. The is not enough information on the methodology used to be able to extrapolate the data to a more realistic and modern case of the very large casks, with high burnup fuel.

A few months ago we had a discussion of what fuel should be used and we decided that Sandia should model both the cases of fuel burnt to the ,maximum allowed by the CoC and also model the case where the fuel is at the high burnup limit allowed in-reactor, currently 62.5 GWd/MTU peak rod average. This second case seems to have been forgotten.

I spent two weeks with RW discussing the release fractions and how to go about addressing the uncertainties in them due to the uncertainties in the input parameters. The results in this report should be consistent with the release fractions in the NRC PRA or an explanation should be presented for the difference. None of these uncertainties was discussed in the report.

I do not know whether it was NRC's or Sandia's choice not to do the high burnup case, and not to do a more complete treatment of the release terms but I think that for the case where the cask system develops a leak the analysis is unsatisfying.

REE.