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NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

WM DOCKET CONTROL
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Tom Johnson

MEMORANDUM FOR: Ivan Catton, ACRS Consultant

FROM: *for* Paul Shewmon, ACRS Member

(Return to WM, 623-SS)

SUBJECT: High Level Waste Packages as Heat Engines

I've got a new thermohydraulics problem for you. -- Or, we had a 'party', and I sort of wish you had been there. The 'party' was the meeting with the NRC RES and Waste Management people about the work they are funding on the high level waste package. I only sort of wish you had been there because I don't think the staff would have been able to answer your questions and I am afraid they felt harassed enough with the questions we had.

The part I would like you to look at is the failed fuel canister as a heat engine for redistributing radioactive material around the surroundings. Rumor has it that DOE will argue that the 'overpack' (the 10cm thick steel container around the fuel) will only undergo uniform corrosion, and will remain sound for at least 1000 years. The staff believes that pitting corrosion may well perforate the package in less than this. But as I understand the pitting mechanism the corrosion reverts to uniform corrosion once the pit penetrates the overpack and is flushed out by water going into the canister. Thus one has an overpack (vessel) with one or more small holes in it, and a hot source of radioactive material inside the overpack. (Actually one has two of these in series if the waste form is glass in a stainless can, or three in series if inside the can is fuel rods with mostly sound cladding.) The question then is whether the waste package is still an effective barrier or is 'failed' and its resistance to flow removed from the equations/model.

The staff argues that they need a program (computer code wreathed, if now submerged, in probability distributions, Monte Carlo manipulations, event trees, and all those good things) to estimate how all this interacts, but when one pushes them on what the code can do and how it is tested they retreat behind the defense that all that is DOE's responsibility to demonstrate, and they only have to see if it is credible several years from now.

This is rambling some, but maybe you see what I am talking about. I have one specific request. When I asked them about how their model (the one being developed by Aerospace Corp) would allow for the pumping action of the hot fuel as a heat engine they said that there was a DOE code which handled such things, and they would use that. I'll send a copy of this to El Igne, and ask him to look in the minutes for this any additional info (Friday afternoon, Ken Stephen's response to one of my questions). Then I wish El would get you in touch with Tim Johnson (DWM) and Ken Stephens so that you can look into the DOE code to see what you think of it, and what it is good for. It may be a 'no never mind' for the inside of the waste package where I am wondering

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about it, but it will become more important as a means of enhancing mixing of radioactive material once the waste package is failed, and one worries about how fast it gets mixed through the environment.

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