November 24, 2010
Annette L. Vietti-Cook
Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Rulemakings and Adjudications Staff
COMMENTS ON PRM-50-93 AND PRM-50-95; NRC-2009-0554

From Aladár Stolmár, Lőrinci, Szabadság tér 3 HU3021 (Hungary)

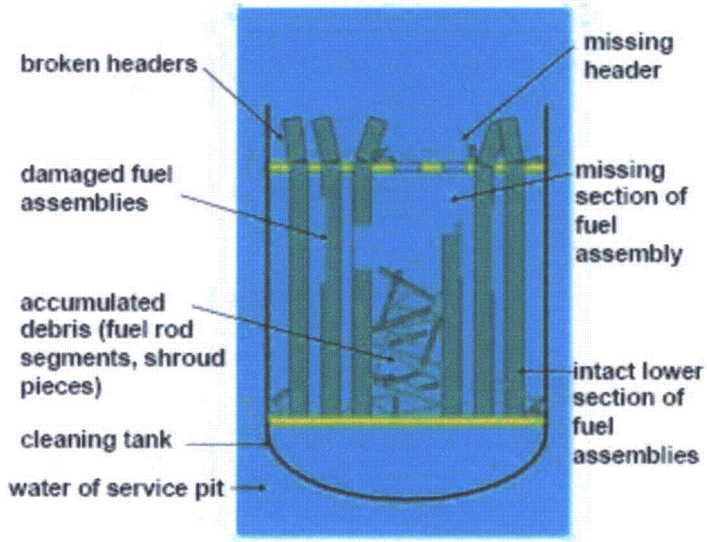
Consideration of the zirconium-steam reaction and the ignition and intense firestorm in nuclear reactor fuel rods is well overdue. Reevaluating the evidence provided by the TMI-2 reactor accident, Chernobyl-4 reactor accident, and Paks Unit 2 fuel washing incident, with consideration of this intense fiery process, will bring us closer to an ultimately safe nuclear power plant design.

For a brief look into the benefits provided by such an effort I am providing two quotes:

1) (http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2004/secy2004-0224/2004-0224scy.pdf) The United States Nuclear Regulatory Commission stated:

"Because the Paks incident resulted in conditions more severe than a traditionally analyzed loss-of-coolant accident, yet the fuel remained well below any melting temperature (i.e., it was coolable), this project appears to have the potential to provide significant insights to fuel behavior under accident conditions."

2) (http://www-pub.iaea.org/MTCD/publications/PDF/TDL-002_web.pdf) The OECD-IAEA Paks Fuel Project Final Report describes the final state of the fuel rods



e 2.11. Distribution of damaged fuel in the cleaning tank

Template=SECY-067

DS 10

„2.4 State of damaged fuel
After the incident detailed visual examination was carried out with the help of video cameras. The examination indicated that most of the fuel assemblies suffered damage. Brittle failure and fragmentation of fuel assemblies was observed. Above the upper plate several assembly heads were broken, standing in inclined position (Fig. 2.11). One assembly header was found far from its original place. Many assemblies were broken and fragmented below the upper plate, too. Some assemblies were fractured in their entirety. Fuel rod fragments and shroud pieces accumulated on the lower plate between the assemblies. Many fuel rod pieces and fragments of assembly shroud were spread in the tank. Some fuel pellets fell out of fuel rods, their form remained mainly intact. Heavy oxidation of the zirconium components was identified. Less oxidation was found in the periphery than in the centre. The bottom part of the fuel remained intact.
The visual investigations have also shown that the fuel assemblies positioned closer to the vertical axis suffered heavier damage, in some cases long parts were simply broken out from them. Thanks to the better position for the radiative heat transfer, the outermost assemblies suffered less heavy damage. The broken fuel pins, shrouds and fallen down fuel pellets formed a heap of debris on the bottom positioning and support plate.
There were no signs of melting or formation of zirconium-steel eutectics on the surface of stainless steel components. This fact indicates that the maximum temperature during the incident remained below ≈1400 oC.
The activity concentrations in the coolant and the release through the chimney are regularly measured and such data were available after the incident, too. The incident happened two weeks after reactor shutdown, for this reason the release of isotopes with short half-life was very low. Integrating the activity concentrations over time and coolant volume in the pool, and summarizing the release through the chimney in time, the total activity release from the fuel was determined for several isotopes. Most of the activity remained in the water, since the incident took place under 13 m water level, only the noble gases were released through the chimney. The integrated activity release was compared to the calculated inventories and the release rate was determined. In case of gaseous and volatile isotopes the release rate was roughly 1% (the precise data are given in Table 2.1). The release rate of non-volatile isotopes was much less. The ≈1% iodine, cesium and noble gas release indicated that the temperatures in the cleaning tank could not be very high, otherwise larger release should have been recorded. Considering these release rates the maximum temperature was estimated about 1200-1300 oC. This temperature range can explain as well that the local oxidation reached 100% in some positions.
The hot cell examination of the damaged fuel could not be carried out at the Paks nuclear power plant, since the power plant does not have the necessary equipment and facilities for the detailed investigation of irradiated fuel.
The very brittle state of the damaged fuel was observed during the removal operations. Several fuel assemblies and fuel rods were fragmented when the damaged fuel was removed from the cleaning tank and placed in the containers."

It is a much overdue duty of NRC and IAEA to evaluate the evidence provided by the TMI-2 accident, Chernobyl-4 accident, Paks-2 incident, and related experiments. Evaluating this evidence, one can see that the ignition of the zirconium fire in the steam occurs at a local temperature of the fuel cladding of around 1000-1200°C, [[and that a self-feeding with steam due

to the precipitation of eroded fuel pellets and zirconia reaction product from the hydrogen stream into the water pool, causes intense evaporation.]]

There are insignificant differences in the progression of the firestorms that occurred in the TMI-2 reactor severe accident, Paks washing vessel incident, and Chernobyl-4 reactor accident; the later defined only by the amount of zirconium available for the reaction. At the mean time, there are significant similarities in the processes leading to the ignition of the firestorm. In all three of the compared cases, it took several hours of ill-fated actions or in-actions of the operators to cause the ignition condition. Also, there are similarities in the end result of the firestorm; namely, that the extent of the fuel damage is much less than it was predicted from any other severe fuel damage causing scenarios, introduced for explanations. Therefore the fraction of released fission products is significantly less than was anticipated from the fuel melting or a so called "steam-explosion" scenario. Also, the fiery steam-zirconium reaction results in a much higher than anticipated (from any other scenarios) rate of Hydrogen production, which in turn requires a review of containment designs.

PUBLIC SUBMISSION

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Docket: NRC-2009-0554
Mark Edward Leyse; Calculated Maximum Fuel Element Cladding Temperature

Comment On: NRC-2009-0554-0024
Mark Edward Leyse; Mark Edward Leyse and Raymond Shadis, on Behalf of the New England Coaltion; Petitions for Rulemaking

Document: NRC-2009-0554-DRAFT-0024
Comment on FR Doc # 2010-27164

Submitter Information

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General Comment

See attached file(s)

Consideration of the zirconium-steam reaction and the ignition and intense firestorm in nuclear reactor fuel rods is well overdue. Reevaluating the evidence provided by the TMI-2 reactor accident, Chernobyl-4 reactor accident, and Paks Unit 2 fuel washing incident, with consideration of this intense fiery process, will bring us closer to an ultimately safe nuclear power plant design.

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Attachments

NRC-2009-0554-DRAFT-0024.1: Comment on FR Doc # 2010-27164

Rulemaking Comments

From: Gallagher, Carol
Sent: Wednesday, November 24, 2010 10:53 AM
To: Rulemaking Comments
Subject: Comment on PRM-50-93/PRM-50-95
Attachments: NRC-2009-0554-DRAFT-0024.pdf

Van,

Attached for docketing is a comment on PRM-50-93/50-95 from Aladar Stolmar that I received via the regulations.gov website on 11/24/10.

Thanks,
Carol

Received: from HQCLSTR01.nrc.gov ([148.184.44.79]) by TWMS01.nrc.gov
([148.184.200.145]) with mapi; Wed, 24 Nov 2010 10:53:06 -0500
Content-Type: application/ms-tnef; name="winmail.dat"
Content-Transfer-Encoding: binary
From: "Gallagher, Carol" <Carol.Gallagher@nrc.gov>
To: Rulemaking Comments <Rulemaking.Comments@nrc.gov>
Date: Wed, 24 Nov 2010 10:52:37 -0500
Subject: Comment on PRM-50-93/PRM-50-95
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