

**From:** Alex Murray  
**To:** Amy Cabbage; Donald Carlson; Howard Faulkner; Stuart Rubin; Undine Shoop  
**Date:** Tue, Aug 14, 2001 6:01 PM  
**Subject:** Germany Trip Report

FYI,

I have taken a quick look at today's version of the trip report. I realize it is still under development and the findings may change. I have some comments and suggestions:

1. General Comment 1 - It's a bit weak on conclusions - we tend to repeat the statements/comments of the researchers without a closing sentence or two from the NRC/U.S. perspective.
2. General Comment 2 - the front half of the report is overly optimistic - the pragmatic comments and other factors from the researchers and presenters need to be included.
3. General Comment 3 - it needs page numbers, maybe section numbers, and maybe a Table of Contents. Also, minor typos and syntax errors in the document - these can be caught on a more final draft.
4. For the enclosures/references, the following need to be added and referenced in the text:
  - Kugeler's writeup on "Concept of inherently safe ..." and "Large Test Facilities"
  - Schroeder et al on "Ceramic Coatings ..."
  - one or two of the papers on D&D of the AVR/THTR.
  - Kalinowski's handwritten ones on pebble flow
  - Kugeler's writeup on waste management
  - There may be another one on AVR SNF management
5. The syntax needs correcting on the last sentence of the transmittal memo.
6. In the Introduction to the Summary, we may want to add a short paragraph on a chronological basis and then lead into the topic based part of the main trip report.
7. Under the section "High Temperature Reactor Research at Julich ..." we need to add statements regarding the effect of helium upon materials, fusing of the metals, bearings etc. The Nacok facility should be listed here as well (referring to another section for the discussion). The last paragraph should also reference the presentation by Kugeler, the use of prestressed concrete (not steel), the potential for uneven expansion of coatings on the macroscopic fuel pebble, and the steel bands that could open for pressure relief during an event. Kugeler also brought up the functioning reactor preservation system, which should be mentioned here and leading to the isolation with sand or other granular materials.
8. Under "High Temperature Reactor Design ..." -
  - the second paragraph mentions the double steel reactor vessel. This should be clarified and put in context - for R&D work, accident testing, different fuels, TRISO was developed at the start of AVR ops etc.
  - there should also be a discussion about confinement vs containment vs stout confinement in here.
  - check the 80 MWe power rating in the last paragraph - 100 MWe was also mentioned.
  - in the last paragraph, it is incorrect to state that the HTR-M is an entirely passive design. The reactor preservation system should be mentioned, and that the HTR-M has passive safety features that function after active safety systems function.
9. Under "Safety Assessment ..." the fourth paragraph needs improvement. Again, several of the key statements from the enclosures and the presentations should be included - the reactor preservation system functions, reactor shutdown, isolation valves, containment vs strong confinement, release via filters, emergency power etc. The text should also mention the passive coolers in the reactor building that use natural circulation of cooling water via three independent trains - these protect the concrete although overtemperatures may result.

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10. Under "Pebble Fuel Element Research ..." - suggest referring to the attachment upfront or directly incorporating the attachment in this section.

11. Under "Pebble Fuel Element Irradiation ..."

- the particle fuel failure range from manufacture was consistently mentioned as  $1E-4$  to  $1E-5$  - this should be mentioned in the second paragraph.

- in addition, several of the presenters mentioned  $1E-3$  after irradiation at temperature - perhaps we should just say that the rate increases with reactor irradiation/use.

- suggest leaving in the 1,600 C impact sentence on cesium release in paragraph 3.

- note potential differences in release mechanisms, silver and cesium by diffusion through "changed SiC" while fission gas release appears to be due to failure of the SiC (paragraphs 3-5).

12. The graphite and pebble/heat xfer sections look fine.

13. Under "AVR operating experience ....", we should clarify if the LOCA test in paragraph 2 also represented the conditions after the actuation of the reactor preservation system.

14. The THTR sections look OK.

15. Under "THTR Licensing ..." the first paragraph should note the higher cost share/burden that the utility would have incurred with continued THTR operation. Also, it started with a shutdown, with a program to decommission the THTR (many components are still onsite due to the SAFESTOR approach).

16. Under "... Facility Tours" paragraph 4 should be incorporated into paragraph 3 (there is an overlap). Also, paragraph 7, first sentence should have "horizontal" replaced with "vertical" for the Nacok cross-section.

17. Under SNF, include the original paragraph or a suitable modification that explains the difficulties of decommissioning to SAFESTOR a reactor that could have fuel pebbles stuck in the system. Also, perhaps mention the graphite dust again.

18. In the pebble fuel attachment, last paragraph, 2nd page - check if that is 200 mm or 200 microns.

19. The last attachment on "Safety Assessment ..." should include disclaimer like language from the NRC - "specific details of the analysis were not provided" - "The delegation did not review the calculations." Also, there should be an acknowledgement that some of these systems would potentially have safety significance in the NRC's regulatory approach.

Alex.

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