NUCLEAR PROLIFERATION
PREVENTION PROJECT

**Statement on FRM II's Continued Use of Weapons-Grade Uranium Fuel**
**Presented at webinar: "Forschungsreaktor Garching: Bombenstoff – wie lange noch?"**
**Hosted by Green Party of the Parliament of Bavaria**
**October 25, 2021**

**By Alan J. Kuperman, Ph.D.**
**Associate Professor, LBJ School of Public Affairs, University of Texas at Austin**
**Coordinator, Nuclear Proliferation Prevention Project (www.NPPP.org)**

During the 27 years since I first spoke in Munich on this topic,[1] the persistent refusal by TUM to end its use of nuclear weapons-grade, highly enriched uranium (HEU) fuel in the FRM II reactor has endangered both German and international security, reflecting TUM's arrogance and lies.

This can be documented by an overview of the history.

In the 1970s, the international community came to realize that HEU fuel poses unacceptable dangers of proliferating nuclear weapons to states and terrorists. Accordingly, at an international conference in 1978, they agreed to convert existing HEU-fueled research reactors to low-enriched uranium (LEU) fuel, which is unsuitable for nuclear weapons, and to design new research reactors to use LEU. Since then, 71 research reactors in nearly 40 countries have been converted from HEU fuel to LEU fuel, another 31 HEU-fueled research reactors have been shut down, and approximately 20 new research reactors have been designed and built to use LEU fuel.[2] Thus, international cooperation has eliminated HEU fuel in over 120 research reactors worldwide, sharply reducing risks of diversion and theft for nuclear weapons. The remaining handful of HEU-fueled research reactors outside of Russia are nearly all on track to shut down or convert to LEU fuel in coming years. Several countries also have redesigned their army reactors, naval reactors, space reactors, and/or medical isotope production facilities to utilize LEU instead of HEU, further reducing proliferation risks.

The most prominent exception is TUM, which defied the international consensus by designing the FRM II in the 1990s to use HEU fuel, and ever since has refused to convert it to LEU fuel. In the 1990s, TUM offered several justifications for its recalcitrance – none of which has stood the test of time:

- TUM claimed that the US also was building a new HEU-fueled research reactor, but the US canceled that project in 1995, prior to construction, on nonproliferation grounds.[3]

[1] Hubert Grundner, "Diskussion um Garchinger Forschnungsreaktor haelt an US-Wissenschaftler erheben massive Bedenken," *Sueddeutsche Zeitung*, June 28, 1994.

[2] Christina Nunez, "The ongoing effort to convert the world's research reactors," American Nuclear Society, July 10, 2020, https://www.ans.org/news/article-211/the-ongoing-effort-to-convert-the-worlds-research-reactors/.

[3] "DOE Facts: A New Neutron Source for the Nation," U.S. Department of Energy, February 1995, 1.

- TUM claimed that the US would provide HEU for the FRM II, but US law prohibited that on nonproliferation grounds, so TUM regrettably encouraged Russia to begin exporting nuclear weapons-grade uranium, exacerbating global proliferation and terrorism risks.

- TUM claimed that the FRM II could not convert to "silicide" LEU fuel, which has been qualified and used worldwide since 1988, even though a US national laboratory study concluded in 1996 that such LEU fuel was feasible for the FRM II.[4] Belatedly, in 2018, a study by one of TUM's own professors confirmed that it was indeed feasible to convert the FRM II to silicide LEU,[5] but TUM has blocked publication of that paper, engaging in a disgraceful cover-up that violates free speech and academic ethics.[6]

TUM now claims that no other high-performance research reactors in Europe or the United States are converting to silicide LEU fuel, citing this as grounds to postpone the FRM II's conversion until development of long-delayed "UMo" LEU fuel, but that too is a lie. In the Netherlands, the "High Flux Reactor" converted to silicide LEU in 2006.[7] In Belgium, the "BR-2," which has higher power and neutron flux than the FRM II, is in the process of converting to silicide LEU, scheduled for completion in 2026.[8] In the United States, the "High Flux Isotope Reactor" has published its plan to convert to silicide LEU.[9] In France, the "Réacteur à Haut Flux" has published a study, co-authored by a U.S. national laboratory, on the feasibility of converting to silicide LEU.[10] Converting these other reactors to silicide LEU typically entails small changes to the reactor's thermal power and fuel geometry to maintain performance, as would be true for the FRM II.

The FRM II's fresh HEU fuel has 93-percent enrichment of the chain-reacting isotope U-235 – identical to the enrichment in U.S. nuclear weapons. The FRM-II possesses approximately 400kg of fresh and spent HEU, sufficient for more than 16 nuclear weapons. The reactor, which I have visited, cannot be guarded with the highest security like a nuclear weapons storage facility because it is located on a university campus. This underscores why the world decided over 40 years ago that civilian reactors should not use HEU fuel. TUM, by defying that international norm, continues needlessly to endanger German and international security. Such unjustifiable and perilous use of HEU fuel must end one way or another. If TUM refuses to convert the reactor to LEU fuel, the German and Bavarian governments should expeditiously require that the FRM II be shut down and decommissioned.

---

[4] N. A. Hanan, et al., "An alternative LEU design for the FRM-II," No. INIS-XA-C--008, 1996.

[5] A. Röhrmoser, "Smallest thinkable LEU elements for FRM II with most progressive and also most conservative fuel options," Reduced Enrichment for Research and Test Reactors, 2018 (submitted and then withdrawn).

[6] DPA, "Forschungsreaktor soll ohne neuen Brennstoff ans Netz," *Süddeutsche Zeitung*, September 24, 2021.

[7] P. J. M. Thijssen, "HEU/LEU conversion of the Petten HFR," Research Reactor Fuel Management, 2006.

[8] S. Van Den Berghe, "BR2 LEU Conversion with High Density Silicide Fuel," International Conference on Nuclear Security, 2020.

[9] B. Betzler, et al. "High Flux Isotope Reactor Low Enriched Uranium Low Density Silicide Fuel Design Parameters," ORNL/TM-2020/1798, Oak Ridge National Lab, 2021.

[10] A. Bergeron, et al., "RHF Conversion Analysis: Feasibility of Silicide Fuel in an Unconstrained Geometry," Research Reactor Fuel Management, 2020.