Who's Trying to Strangle the PBMR?

by Gregory Murphy

The American Society of Mechanical Engineers held a conference in Washington, D.C., this Fall to highlight current research on high-temperature gas-cooled nuclear reactors.[1] These are the new generation of supersafe nuclear reactors using tiny fuel particles which each carry its own containment structure.

The Sept. 29-Oct. 1 conference focussed on the positive benefits of nuclear power, and in particular the many advantages for industry and agriculture from the high-temperature process heat that can be produced by these new generation reactors, which include both the pebble bed design, PBMR, and the General Atomics prismatic design, GT-MHR.

Behind the attacks on the PBMR are funds from George Soros (top right) and the Heinrich Böll Foundation (the foundation of the Green Party), and the hired pen of Greenwich University's Steve Thomas (top left). Above, green terrorists in the 1980s attacking a German nuclear plant.

This focus was driven home with real optimism by the Vice Chairman of General Atomics, Linden Blue, in his keynote address. Blue said that the high-temperature gas-cooled reactor's "time has come"; the new reactor will revolutionize the nuclear industry and all other industries as well.

It was a welcome change compared with the current small and narrow thinking of the nuclear industry, which attempts to sell the nuclear renaissance as the best solution to the non-problem of global warming.

The optimism that Linden Blue brought to his keynote carried over throughout the conference, as evidenced in the animated discussions after the conference presentations, in the hallways and the exhibit center (where nuclear companies have display booths). There has been a shift among some of the people in the nuclear industry, away from the "kicked dog" mentality of the past, to a fresh sense of hope, as was shown by the normally reserved German nuclear vendors. They were expressing true happiness at the prospect of Germany returning to a pro-nuclear power stance, as in the past, which they expect to happen some time after the next election.

The Soros/Thomas Factor

Haunting the 2008 conference was the specter of the latest attack on the South African PBMR, part of a negative campaign which has been going on for the past decade. The current attack was launched by a Soros-linked so-called "professor of energy policy" at Britain's Greenwich University, Stephen Thomas. In July 2008, Thomas wrote a white paper titled, "Safety Issues with the South African Pebble Bed Modular Reactor: When Were the Issues Apparent?" in which he cites a July 2008 report from Dr. Rainer Moormann of the Jülich Research Center. Jülich is the site of the first pebble bed test reactor on which the current design is based.

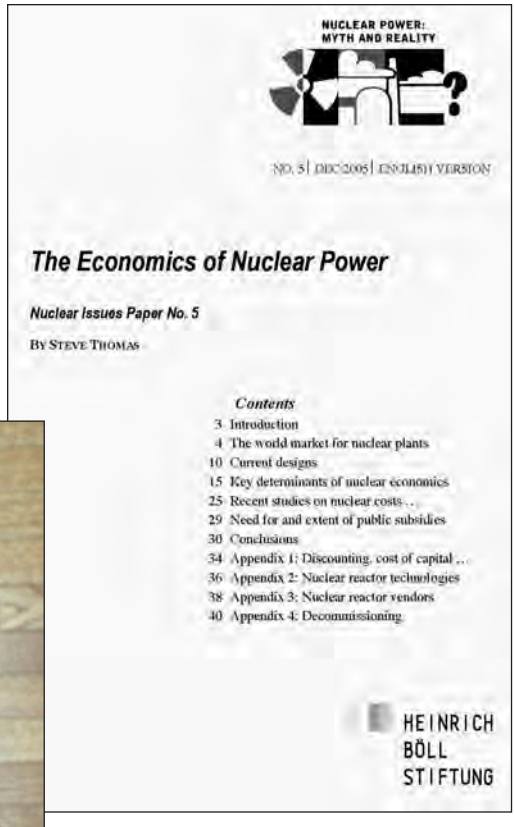
Moormann's report, titled "A Safety Re-Evaluation of the AVR Pebble Bed Reactor Operation and Its Consequences for Future HTR Concepts," was played up by Thomas as a major work of evaluation from the famed Jülich Research Center, which built and operated the AVR pebble bed reactor. In reality, as the conference discussion made clear, the report originated from one disgruntled employee of the institution, Rainer Moormann, who describes himself as a "risk assessment" guy.

In a discussion with this reporter, Thomas gave arguments against the South African PBMR which seemed to be little more

1. The 4th International Topical Meeting on High Temperature Reactor Technology ("HTR 2008: Beyond the Grid").

The decade-long attack by George Soros on the PBMR has been fronted by green fascist and so-called Professor of Energy Policy, Steve Thomas, of the University of Greenwich's School of Business. In July, Thomas sent his recent white paper, titled, "Safety issues with the South African Pebble Bed Modular Reactor: When Were the Issues Apparent?" to anti-nuclear groups and the European and South African media.

University of Greenwich Public Services International Research Unit



NUCLEAR POWER: MYTH AND REALITY

NO. 5 | DEC 2005 | ENGLISH VERSION

The Economics of Nuclear Power

Nuclear Issues Paper No. 5

BY STEVE THOMAS

Contents

HEINRICH BÖLL STIFTUNG

"No probative value," was the verdict of a South African court on one of Steve Thomas's reports on nuclear energy. Here, the title page from his December 2005 report.

than a thinly disguised racism of the British imperial type. Asked to explain why he opposed the pebble bed reactor, Thomas argued first: Why does South Africa believe that it could operate a high-temperature reactor, given the fact that the major nuclear powers have given up on operating them? (Doesn't Thomas know that it was a South African who did the first-ever heart transplant? Or that Japan and China are both operating demonstration HTRs?)

Thomas continued by saying that the pebble bed and other high temperature reactors have not been proven to be economical. Even if they were, he said, countries around the world would not buy them from a new or novel vendor like the South African PBMR, Ltd., because countries tend to be very conservative and usually go with known vendors.

Is Thomas really saying that because South Africa is a black nation, no one will trust them?

This attack by Thomas is not his first. Back in 2005, Thomas was hired to pen a report attacking the pebble bed for the Soros-funded Legal Resource Center in South Africa. Thomas's report was a key part of the case against PBMR in the legal challenge against the environmental impact study.

The legal challenge was joined by Earth Life Africa, a group set up in the 1980s to be the South African Greenpeace, which attached itself to the anti-apartheid movement to gain support and legitimacy. Earth Life Africa runs a large anti-nuclear campaign, called "Nuclear Power Costs the Earth." This is funded by the Heinrich Böll Foundation in South Africa and the Wallace Global Fund.[2] After the presiding judge read Thomas's report, he ruled that the environmental impact study had to be redone. This has caused PBMR undue delays in building the demonstration plant that was set to begin construction in 2004.[3]

When Thomas was asked by this author why he objected to the South African government being the largest stakeholder in the PBMR, Ltd. project, he said that it was because "public money" was being used on a project that has not gotten off the ground, and there are other uses for that same public money, like "health care and water projects." Of course, Thomas doesn't mention that his "reports" are the reason for the delay in building the pebble bed.

Privatization and Transparency?

Let's now look at where Thomas works: His office is in London, at the University of Greenwich's Public Services International Research Unit. This outfit is funded by Public Services International, a confederation of international trade unions, which includes, in the United States, Andy Stern's Service Employees International (SEIU) and the Teamsters. Yet, Public Services International is a grouping of rabid privatizers. According to its website, the group was very active in the former Soviet bloc during the "shock therapy" era of Jeffery Sachs and George Soros's Open Society Foundation.

Every year, the Public Services International Research Unit releases a resistance-to-privatization index, similar to the corruption index of that nation-state destroyer, Transparency International. With this background, it is laughable for Thomas to claim that public money is being misspent on the pebble bed, and not

2. The Böll Foundation is Germany's premier greenie funder.

The Wallace Global Fund is part of the Wallace Genetic Fund that was set up by FDR's Vice President Henry Wallace in 1959. When first established, its mission was to further the legacy of Henry Wallace by helping to develop the world and increase the food supply. But current operations of the Wallace Fund really spit on Wallace's legacy by funding groups that attack modern agriculture and the development of nuclear power, and promote depopulation of the world.

3. For further details on this story, see Dean Andromidas, "Who's Sabotaging the PBMR?" *21st Century Science & Technology,* Spring-Summer 2006.

Stuart Lewis/EIRNS

Mega-speculator George Soros funds the South African environmentalist groups to further the aims of the British in splintering the continent and cutting its population.

given to health care and water projects, which he and his grouping are looking to steal.

The South African *Cape Times* newspaper picked up Thomas's white paper and promoted its deceptions. *Cape Times* green correspondent Melanie Gosling wrote an article titled "New PBMR Will Fail U.S. Standards," which argued, entirely falsely, that the PBMR would not be certified by the U.S. Nuclear Regulatory Commission because it does not include a secondary containment structure in its design. In fact, the self-containing design of the multilayered fuel particles and the reactor characteristics render a secondary containment structure unnecessary for this type of reactor.

Second, Gosling's claim that the PBMR does not meet U.S. safety standards is entirely bogus. The Nuclear Regulatory Commission has not been formally given the request for a design license by PBMR, and currently the NRC is working in close cooperation with the South African nuclear regulatory group to work out what the safety regulations will be.

The argument for secondary containment was the main alarmist point in the Moormann report, and was also played up by Steve Thomas in his white paper. Sources from PBMR Ltd. whom I questioned at the recent conference, said that they had replied to e-mail questions from Ms. Gosling, but that none of their responses was used, even in part. Gosling's question shows that she doesn't understand the principles behind the pebble bed. Moormann, who understands the basic principle, still maintains that a gas-tight containment is needed for pebble bed reactors. How was this rebutted?

This is what the PBMR spokesmen wrote:

> While containment is an appropriate concept for reactors which use water as a coolant, we believe the best concept for gas-cooled reactors such as the PBMR is to filter the helium (i.e. remove the radioactivity). The radioactivity will therefore be contained, not the coolant. . . . The PBMR confinement concept is by no means inferior to that of a containment structure. It is our view that confinement is the best solution for a gas-cooled reactor, both from a technical and safety point of view. Analyses have shown that confinement will reduce—rather than increase—the risk of radiation releases to the public. It is therefore a safer concept. The PBMR confinement concept allows for the release of extremely well-filtered coolant (helium).

PBMR, Ltd. knew that the specter of the Moormann controversy could have cast a pall over the conference, and their scientists and engineers came prepared to intervene with a prepared safety briefing, both in printed and CD format. PBMR also produced a CD of their presentations countering the Moormann report, which was distributed to the conference.

What's Wrong with Moormann's Argument?

Let us now take a look at the source report for Thomas's latest attack, the report by Rainer Moormann. When his paper was issued in July of this year, there was an immediate uproar in the high-temperature reactor community working at the Jülich Research Center, including many internal e-mails attacking the report. In fact, the report is one person's opinion on the data that were accumulated from the 21 years of successful operation of the AVR reactor in Jülich, Germany.

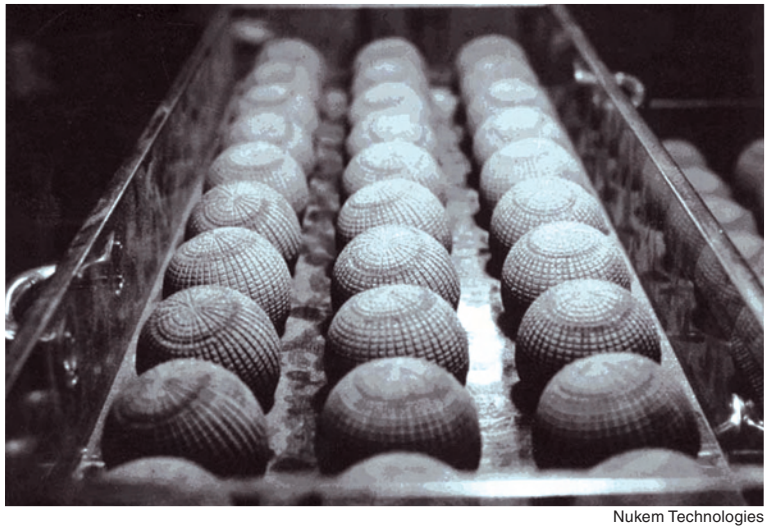
Moormann describes himself as a risk assessment person, and his report shows him to be a person devoted to the precautionary principle: Everything must be shown to be without risk in order for a program or new technology to be brought into use. Moormann's report, however, is based on the 40-year-old design of the AVR. The main concerns he raises are the release of the radioactive isotopes strontium-90 and cesium-137 into the primary coolant loop. Moormann claims in his report that this was caused by the unusually high temperatures at which the AVR core operated. Based on this assumption of these unusually high temperatures, Moormann states that the ability to produce high-temperature process heat, which is a main advantage of the pebble bed, should not have been demonstrated.

Moormann's report is *not* anti-nuclear, as Thomas and the Greens in the media have presented it. His report contains some conclusions that are worth looking at in designing future high-temperature reactors. But his main conclusion, that the pebble bed reactor needs an airtight containment, is just pure alarmism and shows a real failure in his interpretation of the lessons learned at the AVR.

It is to their credit that the organizers of the HTR 2008 confer-

Nukem Technologies

Sample fuel pebbles for the PBMR. Each fuel sphere contains about 15,000 fission fuel kernels. About 450,000 of these pebbles will be loaded into each reactor vessel.



Nukem Technologies

Fuel spheres in production at Nukem Technologies. After the fuel particles are pressed into the core of the fuel spheres, a layer of graphite material is added and the sphere is machined and then carbonized and annealed at 2,000°C. The spheres then go though several quality control tests, including X-rays to check the centricity of the fuel core.

ence invited Dr. Moormann to present his paper there in person, and face his peers. This was the first time, in fact, that this author has seen a real discussion on a controversial paper like Moormann's at a conference. Most often, the author, if invited, gives such a presentation and leaves. To his credit, Moormann took several questions after his presentation and stayed around to discuss his paper with attendees and answer some tough questions about his conclusions.

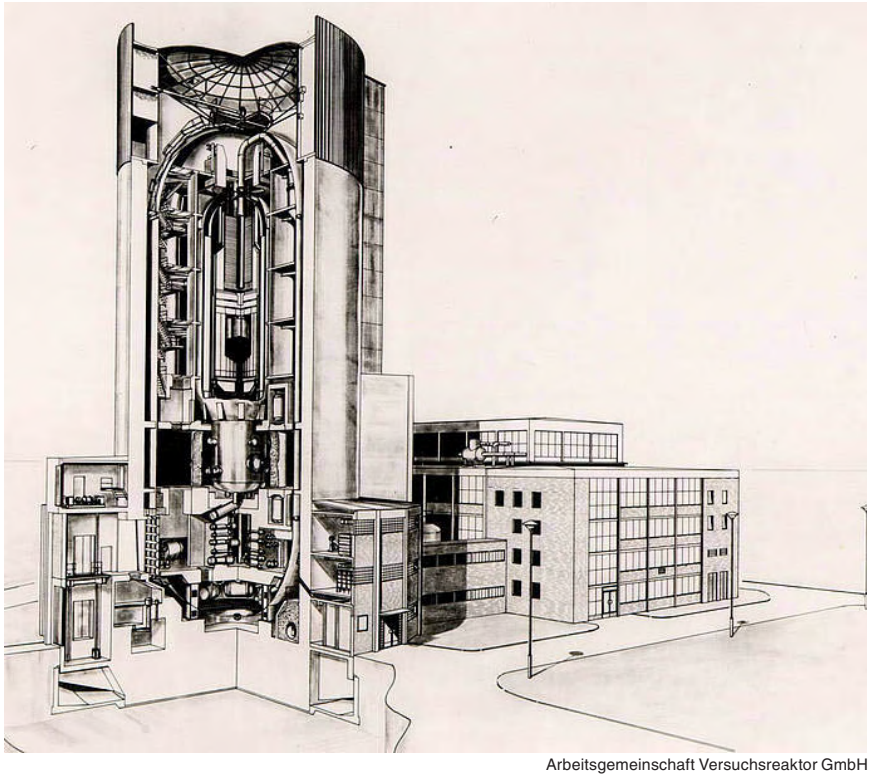
It was exciting to see a real fight about ideas taking place in a nuclear conference, where usually conference attendees just complain and get enraged, but never confront the issue. It is also a good sign for the nuclear industry to show that it is not afraid to confront controversial reports—something the industry has failed to do in the past 30 years.

As part of the general discussion of issues in the Moormann report, there were several other presentations on the data from the experimental AVR. Most of them showed that the majority of the strontium-90 releases happened in the early years of the reactor operation, when poor quality fuel was introduced into the core, and stayed in the core for longer time periods. But, as noted in a presentation by Karl Verfondern, et al. from the Jülich Research Center, titled "Fuel and Fission Products in the Jülich AVR Pebble Bed Reactor," the early fuel was of poor quality and used highly enriched uranium, which was the source of the release of strontium.

Nukem Technologies

The first core loading of the Thorium High Temperature Reactor in Germany, which was constructed in 1983. Both the THTR and the AVR were shut down in 1988 as part of the political reaction in Germany that followed the Chernobyl accident.

In his presentation, Dr. Vernfondern shows that as a better quality of fuel was introduced into the core of the AVR in the mid-1970s, the release of strontium and cesium went down. Most of the strontium activity monitored came from the earlier fuel, as could be demonstated from the 30-year half-life for strontium-90.



Arbeitsgemeinschaft Versuchsreaktor GmbH

Cutaway view of the AVR experimental high-temperature reactor at Jülich, Germany. This was the first HTR to use a pebble bed core, and it operated successfully for more than 20 years, from 1966 to 1988. The AVR demonstrated the high-temperature capability and its safety features, including a safe shutdown with total loss of coolant and no control rods.

Arbeitsgemeinschaft Versuchsreaktor GmbH

Dr. Rudolf Schulten (left) developed the pebble bed concept and built the first prototype, the AVR at Jülich, Germany. Here he is consulting with Dr. Werner Cautius in the AVR control room.

The best rebuttal of Moormann's report came from the scientists and engineers who work with the PBMR. It was masterful in that it judoed the report by showing that, using the exact same AVR data set which Moormann used, their "Dust and Activity Migration and Distribution (DAMD) model" demonstrated (as did most of the other studies) that it was the poor quality of fuel in the beginning of operations of the AVR which was largely responsible for the problem. They also showed that certain core design problems, since recognized, created voids and bypasses in the coolant flows around the pebbles.

One has to remember that the Jülich AVR was a first-of-a-kind reactor; it was the first pebble bed reactor ever built, and operated for 21 years with only minor incidents. In those 21 years of operation, the AVR generated a very valuable data base and there were many engineering lessons learned, which have already had their impact on future design specifications.

One recent development is that with the use of high-temperature fiber optics, it may be possible to monitor the core temperatures of pebble bed reactors. Because of its moving fuel—with pebbles introduced at the top, flowing through, and reintroduced at the top again—it is difficult to precisely monitor the internal temperatures. But that may be solved with the application of engineering principles and some human creativity, the real answer to any design problem.

AVR: A Pebble Bed Success Story

I have discussed the criticisms of the AVR reactor in the Moormann report, and the unscrupulous use of this report by Steve Thomas to attack the South African pebble bed reactor program, which holds such promise for developing Africa. Now let's look at what a success story the AVR and its sister pebble bed reactor, the THTR, really were.

In 1959, the agreement on the construction of a pebble-bed reactor was signed by BBC/Krupp and Arbeitsgemeinschaft Versuchsreaktor GmbH (AVR Experimental Reactor Group). Construction of the AVR, a 15-megawatt-electric dem-

onstration reactor was the first high-temperature reactor to use a pebble bed core, as developed by scientist Rudolf Schulten, the director of the Jülich Nuclear Research Center.

Construction began in 1961, and the AVR went critical in 1966. A year later, the AVR was supplying electricity to the grid. The AVR was originally designed to breed uranium-233 from thorium-232. Thorium-232 is about 400 times as abundant in the Earth's crust as the fissionable uranium-235, and an effective thorium breeder reactor would be considered valuable technology. However, the fuel design of the AVR contained the fuel so well that the transmuted fuels were uneconomical to extract at the time. As a result, the AVR became a test-bed for different formulations of reactor fuel with different coatings. During the 21 years that the AVR operated successfully, 18 different types of pebble fuel were tested. Until the AVR was shut down in 1988, new types of fuel pebbles were loaded into the core.

The AVR tested the pebble bed's main safety features. In one test, during the 1980s, the AVR reactor was brought to full power and the coolant flow was stopped, to demonstrate a loss-of-coolant accident. It was found that one of the main design safety features, the negative coefficient of reactivity (as the reactor fuel gets hotter, it becomes less reactive), responded beautifully as planned. With all coolant lost, the reactor temperature increased but the reactor shut itself down.

General Atomics

The 300-megawatt THTR was unique, having a pressure vessel made of prestressed concrete, instead of the usual steel.

After the operating success of the AVR, another, larger HTR was was constructed in 1983, the Thorium High-Temperature Reactor, THTR-300. Like the AVR, the THTR had a pebble bed design core. The core contained about 670,000 spherical fuel balls, each 6 centimeters in diameter. This reactor was unique, in that the pressure vessel that housed the pebble bed was formed of pre-stressed concrete—the first time this material had been used instead of a steel pressure vessel.

The THTR operated successfully for five years, with only a minor water ingress accident, where water from a burst tube in the steam generator leaked into the reactor core. Nevertheless, both the AVR and the THTR were shut down in 1988, because of the anti-nuclear hysteria that surrounded the aftermath of the Chernobyl reactor accident in April of 1986.

The Beauty of Modular HTRs

High-temperature reactors are the keystone to development because they are modular, and can be built in remote areas like rural areas in India or small city areas in Africa. These reactors can provide electricity and at the same time, provide high-temperature process heat for water desalination where needed, or for producing hydrogen. The fact that these reactors are modular, means that they could be built on site of industrial companies, for example, petrochemical plants, to provide high-temperature process heat to make better plastics. This would be a great benefit to industry, which right now burns large amounts of natural gas just to produce the needed process heat.

All of the possible uses of the pebble bed or the General Atomics prismatic block HTRs are limited only by man's imagination!

References

R. Bäumer, 1990. "AVR: Experimental High-temperature Reactor: 21 Years of Successful Operation for a Future Energy," VDI-Gesellschaft Energietechnik, Vereins Deutscher Ingenieure.

K. Verfondern and H. Nabielek, 2008. "Fuel and Fission Products in the Jülich AVR Pebble-Bed Reactor," Institute of Energy Research, Saftey Research and Reactor Technology Forschungszentrum Jülich, Jülich, Germany, presentation HTR2008-58337.

K. Verfondern and H. Nabielek, 2008. "Fission Product Release from HTGR Fuel Under Core Heatup Accident Conditions," Institute of Energy Research, Safety Research and Reactor Technology Forschungszentrum Jülich, Jülich, Germany, presentation HTR2008-58160.

B. Boer, J.L. Kloosterman, D. Lathouwers, T.H.J.J. van der Hagen, H. van Dam, 2008. "Optimization of a Radially Cooled Pebble Bed Reactor," Delft University of Technology, the Netherlands, presentation HTR2008-58117.

R. Moormann, 2008. "A Safety Re-Evaluation of the AVR Pebble Bed Reactor Operation and its Consequences for Future HTR Concepts," Forschungszentrum Juelich Zentralbibliothek, Verlag http://juwel.fz-juelich.de:8080/dspace/handle/ 2128/3136

C. Stoker, L. Stassen , F. Reitsma, H. vd Merwe, 2008. "PBMR Radionuclide Source Term Analysis Validation Based on AVR Operating Experience," PBMR Ltd, Centurion, South Africa, and D. Olivier, Independent Nuclear Consultants, Grahamstown, South Africa, presentation HTR2008-58338.

Steve Thomas, 2008. "Safety Issues with the South African Pebble Bed Modular Reactor: When Were the Issues Apparent?, A Briefing Paper," London: University of Greenwich, PSIRU (July).