

Delays at Brookhaven reactor worsen US 'neutron drought'

[WASHINGTON] The High Flux Beam Reactor (HFBR) at the Brookhaven National Laboratory in New York State, which was forced to close down in January after a radiation leak, is unlikely to reopen until October 1999 at the earliest, according to the US Department of Energy (DOE).

The prolonged mothballing of the reactor will further exacerbate an existing shortage of neutron beam lines in the United States, say scientists, crowding existing facilities and reducing the scope for innovative experiments that need plenty of beam time.

In the longer term, there is concern that the lack of facilities will drive researchers from the field and lead to a growing divergence between Europe, which is thought to have around 3,000 regular neutron users, and the United States, with perhaps 1,000.

Instead, US scientists who want to study the structure of matter — including chemists, condensed-matter physicists and structural biologists — will have to rely on photons, which are more readily available.

Neutron scientists, who tend to believe that the advantages of neutron scattering are self-evident, are now engaged in a struggle to persuade the DOE and the Congress that this outcome will have an adverse impact on US science as a whole.

But when the Basic Energy Sciences Advisory Committee (BESAC), a panel of external scientists that advises the energy department, met near Washington last week to begin preparing a report on the need to restart HFBR (see box, next page), it was apparent that some members, at least, have still to be convinced that this is so.

The panel, which is chaired by John Stringer of the Electric Power Research Institute (EPRI), Palo Alto, California, has been charged with identifying the impact of the HFBR shutdown, as well as advising on

whether it should be restarted. It is almost certain to call for the reopening of the reactor when it delivers its report in October.

But such a call will not ensure the future of the reactor. And even if it does restart, neutron science in the United States will remain in an uncertain state. Indeed, since 1994 when the US discontinued work on the Advanced Neutron Source (ANS) — a \$3-billion reactor-based neutron source planned for the Oak Ridge National Laboratory in Tennessee — that condition has steadily worsened.

As Europe proceeds with plans for several upgraded and new facilities to address what has been described as a 'neutron drought' (see *Nature* 379, 284; 1996) — including the FRM-II reactor under construction at Munich, and the planned \$1-billion European Spallation Source — and aspirant scientific powers as far apart as Taiwan and Austria plan substantial investment in their own neutron sources, the United States is struggling just to keep what it has.

Even before a leak of tritium closed Brookhaven's HFBR (see *Nature* 386, 3; 1997), the energy department had rejected proposals for the extensive refurbishment of both that reactor and the High-Flux Isotope Reactor (HFIR) at Oak Ridge, Tennessee.

Instead, the department has embarked on improvements to instrumentation at HFIR, and an upgrade of the neutron spallation source at the Los Alamos Neutron Science Center (LANSCE) in New Mexico, which has been able to cut costs by using a particle accelerator paid for by nuclear weapons research dollars.

The department is still pursuing the design of a much larger spallation source, the National Spallation Neutron Source (NSNS), at Oak Ridge. But the \$1.3 billion it would cost to build the NSNS is not yet

assured, and it will produce no neutrons until the year 2005 at the earliest.

For the 270 former users of the Brookhaven reactor, the DOE has good and bad news. The good news is that there is a plan for restart, and outright opposition to the reactor from the local community may be on the wane. The bad news is that this plan will not get the reactor going until October 1999, and that potential pitfalls could push this date back into the next century.

The plan would see the reactor restart at its previous operating power of 30 MW and later upgrade it to 60 MW, the full power at which it operated for a period in the 1980s. Brookhaven scientists are keen to operate at the higher power, as it gives them twice as many neutrons for about 10 per cent extra operating cost.

But the plan would require an Environmental Impact Statement (EIS), to assure the public that a restart decision was safe, before making the structural improvements needed to bring the facility into line with current earthquake-proofing standards.

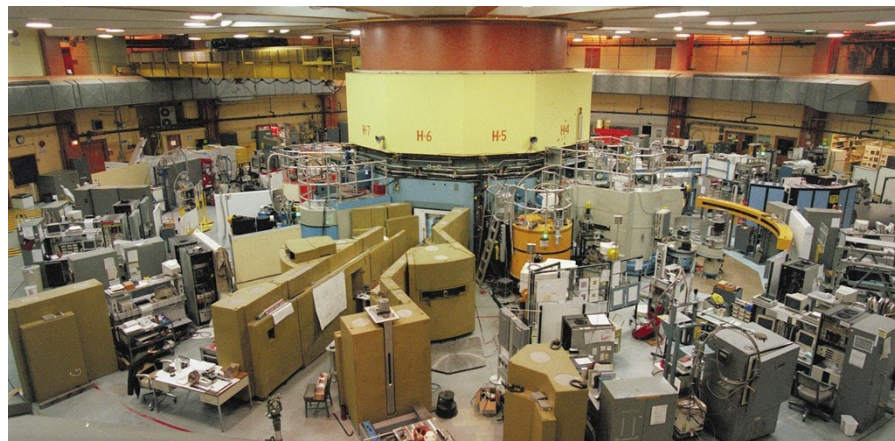
The department is split over the need for the EIS, which it says it can carry out in 15 months. Some officials point out that the complex, \$2-million study is unnecessary to restart the reactor legally. But the prevailing view is that the EIS is needed to reassure the public and — perhaps more crucially — to stave off legal challenges from environmental groups, which might otherwise demand a last-minute EIS, delaying the project further.

Federico Peña, the Energy Secretary, has said he will personally decide in January of next year if the department should pursue the restart option, on the basis of advice from the Long Island community, from the new contractor at Brookhaven — which is expected to be appointed in November — and from BESAC.

The EIS and then the construction work have to be finished before neutron science can resume at Brookhaven. Pat Dehmer, head of Basic Energy Sciences at the energy department, says she is confident the schedule will hold, citing Peña's personal commitment to it.

Sceptics point out, however, that the new contractor may balk at making a recommendation on the safety of the reactor within two months, as the schedule requires. They also point out that Peña is widely expected to be replaced by his deputy and heir-apparent, Elizabeth Moler, by the end of 1998; that the department has never previously completed an EIS in 15 months; and that the EIS would itself be open to legal challenge.

RICHARD DREW/AP



No neutrons today: closure of HFBR at Brookhaven is forcing researchers to look for other sources.

Nonetheless, prospects for the reactor have improved since Brookhaven's crisis peaked in March, at which time some scientists feared the reactor would never reopen. "It is now clear that there are numerous voices, across the community, for restart," says Martha Krebs, assistant secretary for energy.

But BESAC's debate over restart demonstrates how far the expectations of the US neutron community have fallen. According to Lyle Schwarz, chair of Associated Universities Inc., the sacked Brookhaven contractor, the community has always said it needs the new NSNS as well as the existing reactor sources. "I find it strange that we're even discussing the question [of whether HFBR is needed]," he says.

Prospects for the construction of the NSNS have improved somewhat this summer. Both houses of Congress have allowed the administration's request of \$23 million next year for design work on the project. After a detailed review by 60 outside scientists who visited Oak Ridge last month, Dehmer says that money to start construction will be in the 1999 budget, which President Bill Clinton will propose next February.

But the review estimated the cost of NSNS at \$25 million higher than the \$1.265 billion proposed by the design team, and even the latter figure has crept up from the \$1 billion which some observers had expected the facility to cost. The review also ques-

Table 1 Comparison of main US and European reactor neutron sources

Reactor	Power	Flux (10^{14} ntrns/cm ² s)	Instruments	No. of users	Operating cost (annual)
United States					
High-Flux Isotope Reactor (HFIR)	85 MW	5	13	200	\$29m.
High-Flux Beam Reactor (HFBR)	30 MW	10	17	270	\$26m.
NIST Centre for Neutron Research	20 MW	4	25	750	\$6m.
University of Missouri Research Reactor	10 MW	1	7	[60]	\$8m.
Europe					
Institut Laue Langevin (ILL)	57 MW	12	32	1,500	\$26m.
FRM-II (under construction)	20 MW	8	25	[-]	\$25m.

tioned whether it could be built in six years. Any stretch in that timescale would add further to its cost.

NSNS benefits from its proposed location in the home state of Vice-President Al Gore, who is also the favourite to serve as president during its construction phase. Objections to the facility's location from Gore's political opponents in the Congress have been assuaged by a strongly collaborative management plan that will share the project with laboratories outside Tennessee.

In the short term, however, the outlook for neutron availability is bleak. Upgrades will create a better spallation source at Los Alamos and a more flexible reactor at Oak Ridge by the year 2000. But in each case, the modifications will curtail research activity between now and then.

The most popular neutron facility in the United States, at the National Institute of

Standards and Technology (NIST) at Gaithersburg in Maryland, has made some of its capacity available this year to researchers displaced from Brookhaven. The 20-MW NIST reactor has many instruments and a large and diverse user base, but it provides a lower neutron flux than either Brookhaven or Oak Ridge. "I have high-quality science going on which I am displacing to help meet a short term-need," says Mike Rowe, director of the NIST reactor. "I can't keep doing it forever."

The University of Missouri at Columbia, meanwhile, has stepped forward with a proposal to alleviate the shortage that some laboratory officials did not want to hear. According to Missouri's Bill Yelon, a 10-MW reactor at the university could take one-fifth of Brookhaven's users, if the department gives it \$500,000 for instruments and another \$500,000 a year in running expenses. Yelon hopes that this support would help to persuade his university to build a \$28-million facility that is needed for housing extra neutron experiments.

Iran Thomas, deputy director of basic energy sciences at DOE, says that backing for Missouri would bring pleas for support from all the other US university reactors. But several BESAC members like Yelon's proposal. "What's wrong with that as an interim solution?" enquired panel member Jan Herbst, of General Motors.

The answer, unfortunately, is that politics will preclude the DOE from shopping around, either in the United States or abroad, to fill its neutron gap. The cancellation of the ANS, the leak at Brookhaven, and the still precarious status of the proposed spallation source add up to a *de facto* deprioritization of neutron science by the energy department.

While investigators crowd on to the United States' lavish new photon-based facilities, the neutron community will have to fight for space on the facilities remaining. BESAC does not seem impressed by the argument that this is unacceptable: it sent the community leaders off to a room to identify the weak science that will be lost under existing capacity constraints. The EPRI's Stringer hopes the outcome will help BESAC make a compelling case for the restart of Brookhaven. "The decision we're looking for is a positive one," he says. **Colin Macilwain**

Women researchers take on 'old boys' network

[WASHINGTON] Women members of the US Department of Energy's Basic Energy Sciences Advisory Committee (BESAC) have challenged what they see as the remnants of an 'old boys' network' pattern of neutron use that risks circumventing the peer review process.

At last week's meeting of BESAC (see above) several women questioned whether DOE facilities were really open to all scientists on the basis of merit, or whether people with the right connections monopolize beam time at the expense of outsiders. And the women suggested that their gender is heavily underrepresented among neutron users.

Patricia Dehmer, director of the department's \$700-million basic energy sciences programme, has transformed the composition of the advisory panel.

In doing so, she has not

only shifted the gender balance but also demolished the cosy consensus that used to exist between the panel and the programme managers it is supposed to supervise.

Last week's collision arose when Jack Fischer, vice-chair of the Neutron Scattering Society of America, told the panel how researchers with contacts at the facilities can often find ways to explore ideas that they consider interesting.

Geraldine Richmond, a chemist at the University of Oregon and two-year member of BESAC, asked why this was going on, when "this community doesn't have a reputation of generosity to outside users". Fischer responded that good ideas "didn't go away" just because they failed the peer review process.

At that point, Marye Anne Fox, vice-president for

research at the University of Texas at Austin, and the most senior female scientist on the panel, rebuked Fischer for failing to treat Richmond's question seriously and accused him of condoning "a circumvention of the peer review process".

Patricia Thiel, head of materials chemistry at Iowa State University, then asked Fischer for a breakdown of the Neutron Scattering Society's membership. An office-bearer of the society said that women members numbered 15-20 out of a total of 750.

As Thiel observed, this suggested women are grossly underrepresented among neutron users, as compared with their representation in fields of science such as structural biology and many branches of chemistry that could use the technique. **C.M.**