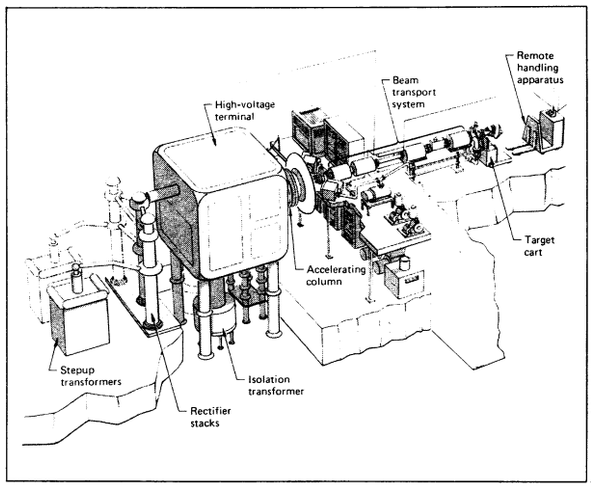
US-Japan neutron source agreement



Lawrence Livermore Nat. Lab.

Neutrons damage things. That is a fact of life that must be dealt with by people who wish to make use of the binding energy of atomic nuclei. Both fission and fusion reactions release neutrons, and those who design reactors must take account of possible neutron damage to the materials used. The world now seems near the verge of practical use of nuclear fusion. Scientists and engineers are so confident that they are already designing "commercial" reactors. For this they need data on how neutrons affect materials. Although there is much experience with neutron damage at fission reactors, scientists are dubious that this information will extrapolate to the fusion situation. The neutrons of interest in fusion have about 14 times the energy of those in fission, so special testing facilities are being built for the 14.5-million electron-volt neutrons of deuterium-tritium fusion.

Two of the nations with large fusion research programs, the United States and Japan, have now reached an agreement for the joint support of one such facility, the Rotating Target Neutron Source II (RTNS-II) at the Lawrence Livermore National Laboratory in Livermore, Calif. Under the agreement Japan and the U.S. will essentially split the $4 million per year operating cost of the facility. In recent years Japan has provided funds for several scientific endeavors located in the United States, but this seems to be the first instance of joint support and mangement of a facility rather than a specific experiment. Kenji Sumita of Osaka University, who is now working at the facility, told SCIENCE NEWS that the Japanese were attracted to the RTNS-II because it is already in operation. With the RTNS-II they save the time it would take to build their own facility.

The heart of the apparatus itself is a copper target, 50 centimeters across, shaped somewhat like the shields worn by female warriors in Wagnerian operas. The target is coated with titanium tritide. A beam of deuterium ions, which has been accelerated by a Cockcroft-Walton machine, strikes the target. Deuterium-tritium fusion occurs, and the emitted neutrons strike the test sample placed just beyond the target. The target rotates at 5,000 rpm, and its axis of rotation swings up and down, so that all of the target surface is exposed to the deuterium beam in sequence. A target lasts 100 hours in this way.

All this is done behind heavy shielding. Entry to the target room, possible only when the apparatus is off and things have cooled down, still requires special gloves and booties to protect against possible residual tritium. Tritium is radioactive. If one should ingest some of it, says Clint Logan of Livermore, facility manager of the RTNS-II, the thing to do is drink lots of beer. Beer is a diuretic, and the best therapy for tritium ingestion is flushing out.

Logan's guided tour of the facility shows that it was built to have two rotating-target apparatuses in operation, although only one functions now. The Japanese money provided in the agreement will allow the second to function. It will also allow operating time to increase from two to three shifts a day (that is, to 24-hour operation) five days a week. RTNS-II thus becomes an international laboratory open to the scientists of both its supporting nations and others as well. The facility's operational and research schedules will be overseen by a committee of two persons from Japan and two from the United States. Much that is done at Livermore is very secret, but much also is not. Work done under this agreement will be open and will be made available to the scientific public.

The research now done at the facility is mostly basic studies of the mechanisms of damage by neutrons. The materials tested are mostly solids and generally the substances that people think of putting into reactor structures. A few biological samples have been done: "Some mice were irradiated once," Logan says. The facility is suitable for any reason a researcher may have for wanting to irradiate something with 14.5-million-volt neutrons, not just fusion reactor studies. —*D. E. Thomsen*

When female fertility starts to decline

Although scientific studies tend to agree that female fertility drops with age, there are conflicting reports about when the decline actually starts. D. Schwartz of the National Institutes of Health and Medical Research in Villejuif, France reports in the Feb. 18 NEW ENGLAND JOURNAL OF MEDICINE evidence arguing that age 30 is the turning point.

Schwartz and his team studied the ability of some 2,000 women to conceive via artificial insemination rendered at 11 medical centers throughout France. All of the women had been diagnosed as presumably fertile on the basis of physical examination, and all of their husbands had been diagnosed as totally sterile. The women were divided into four age groups — 25 years or younger; 26 to 30; 31 to 35; and 35 or older. At the end of the study period, conception success (fertility) rates for the four age groups were calculated.

The fertility of the subjects was found to drop slightly but significantly after age 30 and markedly so after 35 years of age. Specifically, the probability of conception over 12 menstrual cycles was 73 percent for women 25 years or younger and 74 percent for women age 26 to 30. But it was only 61 percent for women 31 to 35 and only 54 percent for women over age 35. The large decrease in this group was not simply due to the inclusion of women over age 40, since the subgroup that was 36 to 40 had the same low probability of conception at the various medical centers included in the study.

In an accompanying editorial, Alan H. DeCherney and Gertrud S. Berkowitz of Yale University School of Medicine contend that the French study is stronger than previous ones exploring the decline in female fertility with age because it controls for male infertility by studying women whose husbands were totally sterile. They also suggest that on the basis of the study, American career women might want to reproduce in their 20's and postpone careers until their 30's in order not to compromise their chances of having children, rather than reproduce in their 30's, as many are now doing.

Jane Murray, special assistant to the president and director of communications and development for the Alan Guttmacher Institute in New York City (which deals with family planning, research and policy analysis), disagrees. "Women's behavior at this point should not be altered," she says. The reason, she explains, is that the French study was a "self-selected sample in that the women were suffering fertility problems to begin with, although it seems that their own fertility was not in question" and thus "might not apply to the population as a whole." And even if the French study results are eventually replicated in the United States, she contends, "the evidence of a drop in women's fertility would have to be weighed against other considerations" before career women could be urged to put childbearing before careers. —*J. A. Treichel*