# FUSION REACTORS IN 15 - 25 YEARS?

Steady advances in understanding the basic problems involved in controlling thermonuclear fusion were reported at the Third Conference on Plasma Physics and Controlled Nuclear Fusion Research in Novosibirsk, USSR, early in August. Estimates of the time it will take to prove the possibility of a system providing the world with almost limitless fuel resources varied between 15 and more than 25 years.

A general attitude of optimism about the future was reflected in a poll taken by a representative of the USSR State Committee. About 75% of the scientists felt that another 5 to 15 years will be required to demonstrate the scientific feasibility of building a fusion reactor of reasonable size. The other 25% felt that more than 15 years would be required. The poll also indicated that after feasibility had been demonstrated probably another 10 years would be needed to build an experimental reactor yielding more energy than it consumed.

This optimism about the future is apparently based mostly on general satisfaction with the progress made in understanding basic phenomena and on recent gains in containment time - the time during which plasma is kept under control in a vacuum by magnetic forces - in some devices. Only about half of those who were asked could give an opinion on the most promising approach and even they were evenly split between the three main experimental systems. All of them named the achievment of adequate containment times as the most difficult problem to be solved.

Altogether 123 technical papers were heard by nearly 400 scientists from 19 countries and two international organizations. Previous conferences in the Agency's series had been held in Austria (1961) and UK (1965).

The experiments which have been in progress can be divided into two endeavours: to create a plasma with suitable properties and to discover fundamental plasma characteristics. In the first category there is interesting work in progress in the Federal Republic of Germany, USSR, UK and USA. At the Kurchatov Institute in Moscow a device known as the Tokamak has been able to keep plasma stable for relatively long periods, the main purpose being to establish the effects of magnetic fields, plasma current and plasma density on the temperature and containment time. In all four countries another device known as the Stellarator has been used, and in an experiment in the Federal Republic of Germany one type of plasma was confined for about one second. In the UK it was found that under certain conditions of injection single particles could be retained in the inner vacuum

while making ten million journeys in the magnetic trap in about 0.6 second. Another type of experiment uses the theta "pinch" method of condensing plasma. In the USA a major new device called Scyllac is being built. In a UK device a hot dense plasma was kept stable for short times.

Extensive theoretical and experimental work was reported from France on methods of using high-frequency fields to accelerate plasmas. Shock-wave methods of heating plasmas appeared promising, especially in advanced work at Novosibirsk. Another technique uses lasers to create and heat plasmas. It is still uncertain whether this method will be applicable in actual fusion devices, but it appears promising and research programmes are in progress in Italy and USA.

Computers are coming into greater use for research. A USA paper showed that "experiments" can be prepared using large high-speed computers and that a plasma can be simulated by designing a problem for the simultaneous mathematical treatment of tens of thousands of particles in an electromagnetic field.

During informal meetings discussions took place about future conferences, including the possibility of one in USA, and methods of reporting to the next Geneva Atoms for Peace Conference in 1971.

---

# RADIOACTIVE WASTES IN THE AIR

Methods of preventing the pollution of air by radioactive waste from atomic centres were discussed in an Agency Symposium held in New York at the end of August. It was agreed that the atomic industry has a good safety record, and suggestions were made that there should now be a concerted effort to prevent air pollution by all industries.

Altogether 52 papers were presented and discussed during a four-day meeting. The subjects covered were the monitoring of air contaminants; the characteristics of contaminants from nuclear reactors; the testing of high-efficiency filters and removal of noble gases; special problems related to heat and moisture; developments in the removal of iodine and its compounds; recent developments in spray technology; airborne wastes from incineration and operational experience.