

called during the debate, was asked what the act's definition of "atomic energy" meant to him as a scientist. Dr. Oppenheimer remarked that coal, oil, people, and numerous other things are atomic energy by this definition because all result from nuclear fission and nuclear transformation; he added, however, "If I were to define 'atomic energy' for the purposes of this act, I would exclude radioactive isotopes from the definition." Any possibility of substituting the word "isotopes" for the word "information" in section 10(a) was dismissed by the Committee's report, and the argument was finally closed by a majority opinion that the AEC isotope export program, which restricted the beneficiaries' use of the materials to pure science, biology, and medicine, was not affected by the section in the law dealing with "industrial purposes."

In announcing its most recent action in expanding the export program to include more varieties of isotopes and to permit their use for industrial research and applications, the Atomic Energy Commission has issued the following statement:

"Our principal reason for enlarging the radioisotope export program at this time is the very high degree of success with which the program has been operated in the past and the benefits which have been derived from the widespread use of isotopes throughout the world. Isotopes produced in the United States have been enthusiastically received by the scientists of foreign lands and the work accomplished with them is contributing importantly to the welfare of all peoples.

"There is nothing secret or evil about radioisotopes in the forms in which they are sold in this country and abroad. While their utilization cannot significantly advance the atomic energy programs of nations, they can contribute, and are contributing, significantly to advancements in basic science, medicine, agriculture and industry. As of today, isotopes constitute the single most important contribution of atomic energy to peacetime welfare.

"Enlargement of our isotope export program is, we feel, in keeping with the foreign policy of the United States, which calls for aid to foreign nations in peaceful development, and, even in the absence of international control of atomic energy, constitutes a field in which international cooperation can be increased."

The new isotope program also permits the Oak Ridge National Laboratory, which produces most U. S. radioisotopes, to provide special irradiation services to scientists of other nations. Under the program, foreign scientists may send special materials to Oak Ridge to be made radioactive by exposure to the intense neutron radiation in the nuclear reactor. The number of foreign scientists who are familiar with isotope research techniques has been increased considerably in recent years, partly through attendance by scientists of other nations at the Isotope School of the Oak Ridge Institute of Nuclear Studies.

Procedures which foreign buyers must use in ordering isotopes from the U. S., as well as information on the procedures U. S. buyers must use in ordering iso-

topes from Canada and the United Kingdom, are described in the 1951 Isotopes Catalog, available from the AEC Isotopes Division, Export-Import Branch, Oak Ridge, Tennessee.

SIXTH UNESCO CONFERENCE

FURTHER DISCUSSIONS ON INTERNATIONAL LABS

Unesco's program in the natural sciences, which has as its primary aims the developing of international scientific cooperation, the encouraging of socially beneficial scientific research, and the disseminating of scientific information, was considered at some length this year by delegates to the Sixth General Conference of Unesco in Paris during the period from June 18th to July 11th. According to the U. S. delegation's informal report of the conference, the proposed international computation center is to be given first priority among the international laboratory projects which are now under consideration by Unesco. Establishment of the computation center had been suggested prior to last year's resolution in Florence that Unesco help in sponsoring a European nuclear physics laboratory; it was therefore felt that work on the computation center should take precedence over the nuclear center. It was recommended that an immediate subvention of \$20,000 be given to help in establishing the computation center and that a loan be given by Unesco if sufficient assurance of financial support for the laboratory is obtained from the interested governments.

As proposed, the computation center would provide an international computing service, together with certain facilities for research; it would also serve to train applied mathematicians. A relatively small governing board is anticipated on which Unesco would be represented to insure maintaining the international character of the center. Although no site has yet been selected, a meeting will be held in November with representatives of interested governments and agencies of the United Nations; it is expected that the site may then be chosen and that progress will be made in gaining immediate and continuing financial support for the center. Each of three nations (Italy, the Netherlands, and Switzerland) had previously indicated its willingness to make a loan of approximately \$75,000 if the laboratory were to be established within its borders. After becoming firmly established, it is not contemplated that the center will receive further financial support from Unesco.

Considerable interest was expressed at the Paris Conference in the proposed European nuclear physics laboratory. Unesco's natural sciences working party, in discussing the possibilities for the laboratory, recommended that problems connected with its establishment be considered primarily as the responsibility of the interested countries, including Sweden, Denmark, Belgium, France, Italy, and several others. Estimates of the cost of such a laboratory have been placed in the neighborhood of twenty or twenty-five million dollars, an expenditure which has been felt to be prohibitive for any single nation among those interested. It will be

necessary, therefore, to settle upon some mutually acceptable financial agreement for establishing and supporting the laboratory. Unesco, it was resolved at the time of the Fifth General Conference in Florence, will neither operate the proposed European nuclear physics laboratory nor contribute to the cost of its construction or maintenance. Unesco's role is simply to help activate and coordinate the efforts of the interested nations in getting the project under way.

NUCLEAR DATA

FOR LOW-POWER RESEARCH REACTORS

Late last year, the United States Atomic Energy Commission, together with the atomic authorities of Canada and the United Kingdom, agreed to the public release of certain information on low-power research reactors, including those nuclear properties of uranium of importance to the design and operation of such reactors. An initial listing of values was made public and plans were made for the supporting description of the experiments and calculations to be released in individual papers. Several of these have been submitted by the authors for publication in the *Physical Review*. The officially released data are listed below.

1. Thermal neutron cross sections for uranium:

The following are currently accepted values in barns for an approximately Maxwellian neutron spectrum with a most probable neutron velocity of 2200 meters/second:

Thermal neutron cross section for	U ²³⁵	U ²³⁸	Natural U
Fission	545	0	3.9
Capture	100	2.6	3.3
Scattering	8.2	8.2	8.2

2. Natural uranium fission cross section between 0.7 Mev and 5.0 Mev (see the accompanying figure).

3. Neutrons per thermal neutron fission:

$$\nu = 2.5 \pm 0.1 \text{ for U}^{235}$$

4. Prompt neutron energy spectrum:

The energy distribution of prompt neutrons resulting from the thermal neutron fission of U²³⁵ is given by the formula:

$$[\sinh \sqrt{2E}] \cdot \exp(-E)$$

where E is the neutron energy in Mev in the laboratory system. This distribution function represents experimental data up to neutron energies of 13 Mev with a maximum deviation of fifteen percent.

5. Fast fission effect:

The following are typical values of the fast fission contribution to the reactivity of research reactors: (a) 2.9 percent in a reactor of the "CP-2" or "GLEEP" type, i.e., low-power graphite-uranium reactors at the Argonne National Laboratory and Harwell, respectively. (b) 3.1 percent in a reactor of the "CP-3" or "ZEEP" type, i.e., low-power heavy water and uranium reactors at Argonne and Chalk River, respectively.

6. Resonance absorption integral

An approximate empirical formula for the effective value of the resonance absorption integral in natural uranium is

$$\int \sigma_a(E) (dE/E) = 9.25[1 + 2.67(S/M)]$$

where the value is in barns, the integral is over the range of neutron energy from fission energy to thermal energy, and where S is the uranium surface area in cm², and M is the uranium mass in grams.

In making the announcement, the AEC expressed the hope that during later declassification actions appropriate credit may be given to the large number of individuals in the United States, the United Kingdom, and Canada who have contributed to knowledge of the above nuclear data.

