industrial development in an internationally safe way. This presents actual ly problems much more difficult to solve than any of the technical developments that are necessary. It will require an unusual amount of statesmanship to balance properly the necessity of allaying the international suspicion that arises from withholding technical secrets, against the obvious danger of dumping the details of the procedures for an extremely dangerous new method of warfare on a world that may not yet be prepared to renounce war. Furthermore, the proper balance should be found in the relatively short time that will elapse before the "secrets" will naturally become open knowledge by rediscovery on part of the scientists and engineers of other countries.

One might be led to question whether the scientists acted wisely in presenting the statesmen of the world with this appalling new problem. Actually there was no choice. Once basic knowledge is acquired any attempt at preventing its fruition would be as futile as hoping to stop the earth from revolving around the sun by degree.

OTHER APPLICATIONS OF ATOMIC POWER

Power production is not the only peaceful use of atomic chain reactions that is in sight. There are other possibilities which may perhaps not compete with the power production in direct economic importance, but perhaps may prove to be ultimately the most fruitful field of development. An operating pile is a source of radioactive materials many orders of magnitude stronger than any source previously obtainable. Radioactive materials are produced partly as a direct consequence of the fission process since the fragments into which the uranium atoms split are radioactive isotopes of elements located in the middle part of the periodic system. These radioactive elements can be purified chemically. Other radioactive substances can be produced as follows. In a going pile neutrons are emitted continuously in very great numbers. Any substance that is inserted in the pile is exposed to an intensive bombardment by these neutrons. When a neutron strikes the nucleus of a substance, several reactions may take place which, in many cases, give rise to the formation of radioactive isotopes. Most elements can be obtained in this way in a radioactive form. The lifetimes of these elements range from a fraction of a second to thousands of years. Among the more significant artificial radio-elements one should mention Carbon 14 with a lifetime of about three thousand years. Radioactive substances can be used for a variety of purposes. The radiations emitted by them are equivalent to the radiations emitted by radium and could be used for medical purposes on a much greater scale than has been possible with radium. Also from the point of view of radiotherapy, the hope has been expressed that it might be possible to take advantage of the fact that the artificial radioactive substances form a variety of chemical elements and one might use the chemical properties in order to achieve a concentration of the active material in the tissue that is to be exposed to the radiations.

Very great hopes have been raised by the possibility of using large amounts of radioactive materials as tracers. Particularly attractive in this respect appears the possibility to use Carbon 14 as a tracer for carbon in organical chemical and bio-chemical work. The use of Carbon 14 in biology is expected to offer means to follow easily the reactions of carbon in the complicated chemical processes of life and it is hoped that the availability of Carbon 14 will be adequate to allow research in this direction to proceed on a very large scale.

It would not be very surprising if the stimulus that these new techniques will give to science were to have an outcome more spectacular than an economic and convenient energy source or the fearful destructiveness of the atomic bomb.