

PHYSICS

Plutonium Needs Filled?

Atomic Energy Commission's report on commercial nuclear power development studies hints plutonium requirements will be met within a short period.

► **SECRECY WRAPS** were removed from new steps toward man's mastery of atomic fuels for production of industrial power when the Atomic Energy Commission issued a report as revealing about nuclear reactors as the famous Smyth report of 1945 was about atomic bombs.

Four groups have made independent studies to evaluate practical power from atomic reactors as seen by engineers and technicians trained in more conventional ways of producing heat and electricity. Their studies are contained in this nuclear power report.

Production of plutonium for military use by the power reactors is contemplated, with the statement that plutonium may not be required by the military after a short period, perhaps five years.

This raises the question whether H-bombs will supersede A-bombs powered by plutonium, or whether enough plutonium will be stockpiled in five years to make all the atomic bombs the military expect to need.

"How long plutonium will be required, and what should be done with the reactor at the cessation of the military demand for plutonium" has a bearing on plant cost and power rates. The question is raised in the part of the report prepared by Monsanto Chemical Co. and Union Electric Co. under the title, 'Plutonium-Power Reactor Feasibility Study.'

A novel kind of reactor using fluid fuel which, in addition to producing power, would breed more fuel than it uses is forecast in the part of the study made by Dow Chemical Co. and Detroit Edison Co., titled "Study of Materials and Power Producing Reactors."

"The theoretical reactor that would incorporate all the most desirable ultimate objectives," this report states, "is a fast breeder with a true fluid fuel. The core of the reactor would be all molten metal. One primary consideration would be safety." Such a reactor for use on shipboard or in a congested area is considered.

Atomic power to make up for the coming shortage of water power capable of development is emphasized in the section of the report prepared by Pacific Gas and Electric Co. and Bechtel Corporation. Their plan calls for natural uranium as fuel, heavy water as moderator and ordinary, or light, water for cooling the reactor.

Closest to present-day reactors is the one planned by Commonwealth Edison Co. and the Public Service Co. of Northern Illinois.

Their engineers figured on a helium-gas-cooled reactor using graphite as moderator.

The possibility of getting power as a by-product of a furnace which produces more fuel than it consumes is only one of the unique features of an atomic power plant.

Although enormous amounts of energy can be gotten from uranium as compared with coal on a weight-for-weight basis, the temperature at which an atomic power plant has to be operated is relatively low. Above 1,000 degrees Fahrenheit uranium changes into its so-called beta phase, which is undesirable for its use as fissionable material.

There is also the chance that, if the atomic pile gets too hot, the whole structure will melt and crumble away. The resulting mess would be no small matter, since nearly 2,000 tons of graphite are needed for the moderator of the kind of pile being considered in this report.

Cooling materials to be circulated through the pile, in order to make use of the heat developed, could be helium gas, ordinary water or liquid metals. Liquid sodium is the preferred coolant in three of the industry reports, but its use brings up many unsolved problems as to whether it will corrode the pipes and how the danger of a leak can be prevented. If sodium comes in contact with water, a serious fire hazard occurs.

Unlike shoveling lumps of coal into a furnace, loading an atomic pile is done at present by inserting, one at a time, carefully machined pieces of uranium metal, each "canned" in an aluminum case. Ways to avoid this costly processing are suggested in the present report, but have not yet been proved in practice. Liquid fuel or fluidized fuel, if it can be made to react satisfactorily, would materially reduce cost.

Similarly, ways to remove the fission products from the atomic pile without shutting it down are needed. Storage of these products until their radioactivity dies away to the level of relatively safe handling is an essential part of running a nuclear reactor. All handling of fission products has to be done by remote control, and all regulation and repair of the machinery that handles them must be carried out also without letting people come within the danger zone of deadly radiations.

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200-INCH EYES MOON—*Photograph of moon, taken with the 200-inch Hale Telescope at the Palomar Observatory, shows a flat region covered with many small craters. The large crater at lower right is Copernicus, one of the best known features of the moon. The sun is illuminating the moon from the left in this photo.*