PHYSICS

Plutonium "Denatured"

Best guess as to meaning of State Department hint is that it is done by mixing with a material to form a combination that will not explode.

By WATSON DAVIS

➤ THE STATE Department committee report on atomic energy control lifts slightly some of the secrecy surrounding atomic fission and atom splitting, but the scientific world still lacks data that in the normal course of peacetime science would be published for the world to know.

Most interesting is the hint that plutonium, one of the atomic bomb elements (the other being uranium 235), can be "denatured."

Guessing as to how this could be done (and, please, Gen. Groves, note that this is my guess only, which I hope does not come under Army security) it may be that the plutonium that fissions explosively could be so contaminated with another non-fissionable isotope of the same element that it could not be exploded. Possibly separating the fissionable isotope useful in bomb making would be a much more difficult task than separating out the bomb element from the material with which it is mixed during its manufacture from uranium 238. This separation is one of the major tasks of the gigantic plant at Hanford, Wash.

Unless the plutonium is sufficiently pure and undiluted by extraneous materials, there will not be enough neutrons to produce the violent and extremely fast chain reaction of the atomic bomb explosion. Each splitting plutonium atom gives out from one to three neutrons, but these must have the chance to reach other fissionable plutonium atoms in a very short space of time without being absorbed and made useless for that purpose.

Many kinds of materials can produce this necessary dilution, but the point in control of plutonium if it were distributed for peaceful power producing uses is that the diluting or denaturing material must be very difficult to separate from the fissionable material. Otherwise a few chemically-wise international gangsters might take improperly denatured plutonium and turn it into purified fissionable plutonium and the first the world would know about this would be the explosion of an atomic bomb.

Another item in the State Department report being studied by the Senate Special Atomic Energy Committee emphasizes more plainly than before that thorium can be the source of fissionable material. This has been implied in the Smyth report, but just what process is used has not been stated. Evidently thorium with the aid of uranium may be transmuted into fissionable atomic bomb material, just as plutonium can be manufactured from uranium isotope 238. It is for this reason that thorium as well as uranium needs to be placed under control if the atomic bomb is to be controlled.

Thorium is a fairly common element in the earth's crust, but deposits of it are presumably not so concentrated or easily used as those of uranium.

Science News Letter, April 6, 1946

Another Major Secret

➤ ANOTHER MAJOR secret has been added to the world's lack of information about the atomic bomb. This is the nature of the denaturing material used to make uranium 235 or plutonium incapable of being turned into an explosive bomb. This contaminating material is something that has been known about for several years during atomic research. Its possible use in solving the difficulties of making atomic bomb materials available to the world has just been announced in the State Department's report on the international control of atomic energy. Its removal from the denatured fissionable material would take a large and lengthy manufacturing operation.

The purpose of the denaturing is to put all the bomb making materials of the world in such a state that only after a lapse of 1½ to 5 years, depending upon the estimates involved, could an atomic bomb be made out of the material. This would allow the distribution, under the proposed Atomic Development Authority plan, of ample quantities of uranium materials that could be used for peaceful production of power.

The evident purpose of keeping the denaturing substance a secret now is to have more unrevealed information to be presented to the United Nations when they accept international control. If the plants and mines producing uranium and thorium are owned by the United Nations, the first step in the relinquishing of national sovereignty has been taken.

The world could best have atomic power for industry and other purposes without the menace of atomic bomb sneak attacks if the sources of atomic power, the world's resources in uranium and thorium, were put under international control by UNO. The international organization would operate the plants through the stage at which the products could be diverted to the making of atomic explosives, and would turn out the denatured product which is safe to use for all legitimate research purposes. If any of the so-called dangerous plants manufacturing U-235 or plutonium were sud-

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denly seized by any nation and thus removed from the control of the United Nations, that would be a virtual declaration of war because the seizing nation, if left alone, within a year or two, could produce an atomic bomb. An essential part of the control by the United Nations of fissionable material would be the ownership and operation of all deposits of uranium and thorium and the plants for extracting these elements. A first step would be an extensive geological exploration of the surface of the earth to discover all deposits of uranium and thorium.

Uranium and thorium are the only two elements, according to the report, which need to be controlled because without them no fissionable materials could be made.

The scientists working on the questions of whether other elements can produce atomic energy by a sustained reaction have relied greatly upon what is called the "packing curve," according to Dr. Charles Allen Thomas, vice president and technical director of the Monsanto Chemical Co., one of the members of the board of consultants to the State Department's committee, here. According to theory developed from the packing curve, only the heaviest nuclei and the lightest nuclei have the subatomic configuration which would allow them to release atomic energy.

While the light atoms do furnish the energy that keeps the stars shining, the scientists who provided information for the report see no practicable way either to provide the millions of degrees of temperature necessary or to create the containers for materials at such temperatures under terrestrial conditions, so they have discarded the possibility of obtaining energy from the disintegration of these light elements.

One essential idea in the report is the distribution of stock piles of fissionable materials and the "dangerous" plants manufacturing fissionable materials throughout the world so that every major region contains them. Thus no one country or region would have a monopoly.

Science News Letter, April 6, 1946

CHEMISTRY

Uranium Is Vital Factor

It is the only essential element for constructing an atomic bomb, but thorium may also be used in chain reactions, report reveals.

➤ URANIUM STANDS OUT as unique among the 92 naturally occurring elements, according to new information released in the State Department's Report on the International Control of Atomic Energy. Only uranium can maintain the chain reaction which is the basis for all development of atomic power, whether for peace or war.

Uranium is one of eight or nine heavy, radioactive elements about which there has been speculation ever since the announcement last August of the principles of atomic fission. In particular, the role of uranium's sister element, thorium, largely used to make self-luminous watch dials and light switches, has evoked curiosity.

In the new report it is revealed that thorium cannot of itself maintain a chain reaction, but it can be used with uranium for that purpose. It could, in effect, be used to stretch the uranium supply. Thorium is therefore included with uranium under the restrictive provisions suggested in the State Department's report on atomic energy control.

The fact that thorium and uranium frequently occur together in the same geological formation greatly simplifies this plan for control by international authority of the sources of fissionable material. Moreover, the type of geological formation where these strange minerals occur is unusual and relatively easy to spot.

We have the authority of the scientists who know all the secrets of atomic energy so far discovered that these elements, thorium and uranium, are the only ones over which it is necessary to maintain a watch to insure their use for constructive purposes. Familiar materials, such as iron and lead, may be used freely in construction of atomic power plants, with no danger of producing bombs as a by-product. Nobody is going to get fissionable atoms out of the clay at our feet.

With the world's supply of the dangerous elements, uranium and thorium, and their artificially created analogues, neptunium and plutonium, under international control, the race for fissionable elements as weapons would end in stalemate. At the same time, their use as sources of power and as research tools would offer stimulating opportunity for untrammeled investigation by scientists of all countries.

New power sources, secrets of nature's production of food and fuel, and new hope in our struggle to understand and control cancer are some of the constructive problems awaiting settlement of the dangerous side of the atomic power question.

Science News Letter, April 6, 1946

Control of Cancer Instead of Atomic Bombs

➤ CONTROL OF CANCER instead of manufacture of bombs is the alternative program offered research scientists by the new report on international control of atomic energy issued by the State Department. Research on atomic fission by-products, although not as spectacular at first glance as atomic power or atomic bombs, will undoubtedly, in the long run, be the great achievement of the atomic age.

These by-products, which are the radioactive forms of the common elements, can replace the non-radioactive forms of the same elements in the tissues of plants and animals. By substituting them for the common forms, individual atoms can be traced through the complicated maze of life processes in plant, animal or man. By this means, chemists are learning the steps by which the plant builds carbon dioxide from the air into the starches and sugars on which we rely for food. Selective absorption of radioactive materials by cancer tissues can be used to place the remedial rays given off by these materials in the tissues they are to treat.

Researches of this type, already begun by scientists in the atomic power research program, have been greatly hindered by restrictions growing out of secrecy conditions deemed necessary on account of the military control of atomic power as a weapon. With the establishment of international control which will limit use of dangerous fissionable material but allow safely denatured material to be released for experimental use, great strides in man's control over his environment are to be expected.

In addition to the radioactive fission products which will play so important a part in chemical and physical researches in the atomic age, there will be developed from the atomic fission reactors considerable quantities of heat which may be usefully employed either for operating steam plants or for generating electricity. An earlier report of