There seems to have been an increase in unusual and undesirable weather in the past decade. When submitted to rigorous statistical tests, these apparent abnormalities do not exceed the limits that can be expected by chance and are consistent with accepted meteorological principles involving large-scale (hemispheric) weather patterns which could not be directly affected by the explosions. The failure to detect statistically significant changes in the weather during the first 10 years of the atomic age is no proof that physically significant changes have not been produced by the explosions, but it does show that a careful physical analysis of the effects of atomic and thermonuclear explosions on the atmosphere must be made.

The energy of even a thermonuclear explosion is small when compared with most large-scale weather processes. Moreover, it is known that much of this energy is expended in ways that cannot directly affect the atmosphere. Even the fraction of the energy which is directly added to the atmosphere is added in a rather inefficient manner from the standpoint of affecting the weather. Meteorologists and others acquainted with the problem are readily willing to dismiss the possibility that the energy released by the explosions can have any important direct effect on the weather processes. However, there remains the possibility that the explosion will serve as a trigger mechanism to divert some much larger natural store of energy from the path it would otherwise have followed.

Three general means by which this might be accomplished have been considered. (i) The debris thrown into the air by the explosion may have some catalytic effect on the behavior of clouds and thereby change the regime of cloudiness or precipitation over wide areas. (ii) The radioactive nature of the debris will change the electric conductivity of the air, and this may have some effect on more directly observable meteorological phenomena. (iii) The debris thrown into the stratosphere by the explosion may interfere with the passage of solar radiation and thereby serve to decrease the temperature of the earth.

Our present knowledge of atmospheric physics makes difficult a final authoritative evaluation of any of these possibilities. The results of studies and experiments conducted by various organizations show the following:

1) The debris which has been thrown up into the atmosphere by past detonations was found to be ineffective as a cloud-seeding agent. Since the techniques for testing nucleating efficiency are not entirely satisfactory, the condensation and freezing nuclei produced by nuclear explosions and their effect on the formation of clouds and the precipitation process must be continually investigated.

2) The amount of ionization produced by the radioactive material is insignificant in affecting general atmospheric conditions. Various theories on the possible connection between the electric properties of the atmosphere and the precipitation process are still in the developmental stage.

3) Dust thrown into the air by past volcano eruptions decreased the direct solar radiation received at the ground by as much as 10 to 20 percent. The contamination of the atmosphere by past nuclear tests has not produced any measurable decrease in the amount of direct sunlight received at the earth's surface. There is a possibility that a series of explosions designed for the maximum efficiency in throwing debris into the upper atmosphere might significantly affect the radiation received at the ground.

4) Much of the increase in severe storms reported in recent years can be traced directly to the improved methods of reporting severe storms that normally occur.

No statistically significant changes in the weather during the first 10 years of the atomic age have been found, yet careful physical analysis of the effects of nuclear explosions on the atmosphere must be made if we are to obtain a definite evaluation of this problem. Although it is not possible to prove that nuclear explosions have or have not influenced the weather, it is believed that such an effect is unlikely.

News of Science

British Report on Radiation Hazards

The Medical Research Council of Great Britain recently published a report of a special committee under the title *The Hazards to Man of Nuclear and Allied Radiations* (see editorial in this issue of *Science*). The conclusions of the report were as follows:

On the basis of the considerations in this report we feel justified in drawing the following conclusions in relation to the use of ionizing radiations in peacetime:

1) *Limitation of the use of all sources of radiation.* Adequate justification should be required for the employment of any source of ionizing radiation on however small a scale.

2. *Dose levels to the individual.* (i) In conditions involving persistent exposure to ionizing radiations, the present standard, recommended by the International Commission on Radiological Protection, that the dose received shall not exceed 0.3 r weekly, averaged over any period of 13 consecutive weeks, should, for the present, continue to be accepted. (ii) During his whole lifetime, an individual should not be allowed to accumulate more than 200 r of *"whole-body"* radiation, in addition to that received from the natural background, and this allowance should be spread over tens of years; but every endeavor should be made to keep the level of exposure as low as possible. (iii) An individual should not be allowed to accumulate more than 50 r of radiation *to the gonads,* in addition to that received from the natural background, from conception to the age of 30 years; and this allowance should not apply to more than one-fiftieth of the total population of this country.

3) *Dose level to the population.* Those responsible for authorizing the development and use of sources of ionizing radiation should be advised that the upper limit, which future knowledge may set to the total dose of extra radiation which may be received by the population as a whole, is not likely to be more than twice the dose which is already received from the natural background; the recommended figure may indeed be appreciably lower than this.

4) *Fallout from test explosions of nuclear weapons.* (i) The present and foreseeable hazards from *external* radiation due to fallout from the test explosions of nuclear weapons, fired at the present rate and in the present proportion of the different kinds, are negligible.

(ii) Account must be taken, however, of the *internal* radiation from the radioactive strontium which is beginning to accumulate in bone. At its present level, no detectable increase in the incidence of ill effects is to be expected. Nevertheless, recognizing all the inadequacy of our present knowlege, we cannot ignore the possibility that, if the rate of firing increases and particularly if greater numbers of thermonuclear weapons are used, we could within the lifetime of some now living, be approaching levels at which ill effects might be produced in a small number of the population.

5) *Recommendations regarding specific uses of radiation.* (i) All sources of radiation, both medical and industrial, should be under close inspection, in order to insure that the high standards of protection now attainable against the absorption of ionizing radiations, and against radioactive materials, are generally observed. Those using radiations should be instructed in the precautions to be taken, and no unnecessary or unauthorized person should be allowed to engage in such occupations. A personal record, not only of doses of radiation received during occupation but also of exposures from all other sources, such as medical diagnostic radiology, should be kept for all persons whose occupation exposes them to additional sources of radiation. (ii) Present practice in medical diagnostic radiology should be reviewed, with the object of clarifying the indications for the different special types of examination now being carried out and defining more closely, both in relation to the patient and to the operators, the conditions which should be observed in their performance. (iii) The uses of radiotherapy in nonmalignant conditions should be critically examined. (iv) The small amounts of irradiation from miscellaneous sources, such as x-ray machines used for shoe-fitting, luminous watches and clocks, and television apparatus, should be reduced as far as possible.

6) *Collection of vital statistics.* As an essential basis for future studies of the genetic effects of radiation, further data are required on the genetic structure of human populations; to this end, there is an urgent need for the collection of more detailed information, when births, marriages, and deaths are registered.

Anticlotting Drug

A new drug, polybrene, to counteract the anticlotting effect of heparin is reported by three Northwestern surgeons, Frederick W. Preston, Robert Hohf, and Otto Trippel, in the current issue of the *Quarterly Bulletin* of Northwestern University Medical School. The new drug was found to be "a suitable antiheparin drug for clinical use."

In a study of 33 patients, it was found that "polybrene promptly neutralized the anticoagulant effect of heparin." Heparin, which normally occurs in the body, prevents blood from clotting. When the heparin mechanism is disturbed, abnormal bleeding occurs, as in hemorrhage after birth, in leukemia, and in bleeding under the skin that causes bruiselike purple patches. In such cases antiheparin agents such as polybrene are useful in neutralizing heparin and, thus, permitting the blood to clot and the bleeding to stop.

Polybrene is similar to two other antiheparin drugs, protamine sulfate and toluidine blue, but "polybrene is more potent than either. It is stable and may be stored for long periods of time." Polybrene "must be given intravenously, slowly, and in dilute solution to prevent toxic effects."

Reactors for Denmark and the Netherlands

The U.S. Atomic Energy Commission has announced that the United States Government will contribute $350,000 toward the cost of a nuclear research reactor project to be undertaken by the Netherlands Centre and a similar amount for a similar project to be conducted by the Danish Atomic Energy Commission.

The American Car and Foundry Industries, Inc., of New York has been selected by the Netherlands to design, engineer, and construct the reactor. The buildings will be designed and constructed by a Netherlands firm. The project will be administered by the Netherlands Reactor Centre, a foundation established within the Netherlands Government in July 1955.

Cost of the reactor is estimated at $2 million or more, and cost of the entire project may run to $3 million. The schedule calls for completion of construction in 21 months following establishment of general specifications for the reactor and its associated equipment and buildings.

The reactor is to be a modified pool type similar to the new Oak Ridge (Tenn.) research reactor now under construction. It will be cooled and moderated with ordinary water and fueled with uranium containing approximately 5.7 kilograms of uranium-235.

The reactor will be used for research in agriculture, medicine, physics, and chemistry and to train people in the design and operational technology of both research and power reactors. Supporting facilities planned by the Netherlands include research laboratories and "hot" caves for handling radioactive material.

The Foster-Wheeler Corporation of New York will design and construct the mechanical components of the Danish reactor. Assembly and installation will be done by Danish firms in cooperation with Foster-Wheeler.

The Danes are planning a nuclear research center on a peninsula near Roskilde, some 20 miles west of Copenhagen. All laboratories and other facilities will be designed and built by Danish companies. The entire project will be operated by the Danish Atomic Energy Commission.

The reactor will be fueled with uranium containing approximately 5.7 kilograms of uranium-235 to be made available to Denmark by the United States. It will be cooled and moderated with ordinary water and will be similar to the Livermore (Calif.) pool-type reactor being constructed for the U.S. Atomic Energy Commission by the Foster-Wheeler firm. Initial cost of the reactor and its associated facilities is estimated to be approximately $1.4 million.

Two members of the Danish scientific staff to be assigned to the center are currently studying at the International School of Nuclear Science and Engineering near Chicago, Ill., which is operated for the U.S. Atomic Energy Commission by Argonne National Laboratory. Another staff member has had 6 months' experience in reactor technology at Brookhaven National Laboratory.

The Danish Atomic Energy Commission has plans to use the reactor for research and training in reactor physics, solid-state physics, metallurgy, reactor technology, radiochemistry, and production of radioisotopes for use in medicine, industry, and agriculture.

Priorities for Polio Vaccine

The U.S. Public Health Service recently recommended that state health agencies extend priority age groups for poliomyelitis vaccine to include all people under 20 and pregnant women as soon as the supply of vaccine warrants such action.

This announcement reiterates a recommendation made by the National Advisory Committee on Poliomyelitis Vaccine last April. The committee at that time recommended that states concentrate their polio program on children under 15 and pregnant women until maximum coverage of this group had been achieved. The Public Health Service, in accepting the committee's recommendation, said that the states should immediately broaden their priority group when this goal was reached.

In announcing the recommendation, Leonard A. Scheele, surgeon general, said: "To date, more than 72 million