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V - BIOLOGY AND MEDICINE

Weapons Test Activities

Program for coordination and evaluation of fall-out data (UNCLASSIFIED). A new office has been activated under the Test Organization during the spring, 1953, test series to provide technical guidance (in an advisory capacity) on fall-out problems, and to assemble, evaluate, and interpret all fall-out data collected by the various test monitoring groups. As the quantitative data become available, evaluations and interpretations are made of the results. The information is then relayed through official channels for immediate public release. In this manner, it has been possible to allay public alarm which might have resulted from erroneous speculations; to keep the Commission and all interested groups currently informed; and to assist in maintaining sound and effective public relations.

As a part of this program, cooperation of the U. S. Public Health Service has been obtained in interpreting to the public the health aspects of fall-out. To assist this group, scientifically qualified personnel were designated at ten AEC installations throughout the country to provide authoritative sources to whom Public Health officials could turn for specific or general information relating to fall-out. Members of both groups were notified through the Nevada office whenever their areas were likely to fall in the path of expected fall-out activity. (End of UNCLASSIFIED section.)

Preliminary data on fall-out studies [redacted]. The fall-out from the first detonation of the current series of atomic weapons tests at the Nevada Proving Grounds occurred in a relatively narrow band almost due east, stretching from about 50 to 200 miles, from point zero. The levels of activity were relatively high but did not exceed the maximum permissible exposure at any populated area. The highest calculated gamma dose for populated areas was at Rockville, Utah, where the estimation was about 2 roentgens for a ten-week period. But even this level has built-in safety factors because it assumes: (1) that people remain in the locality continuously; (2) that none of the activity is lost through weathering; and (3) that there is no attenuation due to intervening walls, floors, etc. The above 2-roentgen calculated dose therefore represents the extreme estimate.

The fall-out from the first shot provided a good opportunity to check the effect of weathering on activity since the fall-out area was concentrated in a narrow band. Also, on the second and third days after detonation a strong wind blew across this area. Monitoring teams returned to the fall-out area on the fourth day after detonation and checked the actual radiation levels with those that were calculated from the reading of the first day. The actual readings on the fourth day were lower than calculated readings by factors of 3 to 6.

The fall-out following the second detonation on March 24 occurred to the northeast from the test site. The locality receiving the heaviest

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fall-out was Lincoln Mine where there are about 300 people living at present. Here the activity rose to about 600 milliroengtens per hour at 2 hours after detonation. At about 7:00 a.m., Pacific standard time, the people at the mine were advised by the Test Organization to remain indoors. Approximately 2 hours later the people were advised that they might go about their normal activities but to remain indoors as much as feasible during the remainder of the day. The calculated ten-weeks' dose at Lincoln Mine, based on the same assumptions as above, is about 3 roentgens. Since the fall-out occurred so soon after detonation, it is estimated that 1 roentgen of this dose was accumulated in about the first 8 or 10 hours. Readings taken both indoors and outdoors indicate that the former levels were about 55 percent of those found outdoors, and thus, of course, the accumulated dose to those remaining inside would be less than the above-quoted dose of 3 roentgens.

A small amount of fall-out which occurred in the Salt Lake City-Ogden region about 14 hours after detonation reached a peak of 4.8 milliroengtens per hour. This quickly dropped, so that 45 minutes later the reading was about 0.7 milliroengtens per hour and then continued to decrease at the usual rate found during fall-out activity. Based on the same assumptions as above, the calculated ten-weeks' dose in these areas is about 40 milliroentgens or 1.3 percent of the maximum permissible exposure.

Civil effects test program. While analysis of test data has not been completed, it appears that predicted blast pressures were achieved inside the communal shelters tested. This preliminary result tends to bear out the accuracy of the shock tube tests of scale model shelters conducted at Aberdeen Proving Ground earlier in the year. However, there is reason to think that these blast levels heretofore considered acceptable may have to be modified downward, with further redesign of shelter entrances, if subsequent analysis of the animal experiments verifies early indications of effects somewhat more severe than expected. (End of [redacted] section.)

Telemetering program [redacted] As has been reported earlier, remotely controlled radiation detection and weather reporting instruments, which telemeter data by radio to a central control point, are being tested during the current test series. To date, where fall-out has occurred in the vicinity of the three experimental stations, accurate weather and fall-out data have been reported in advance of reports received from mobile monitoring teams. Excellent reception has been obtained up to 25 miles from the control point, and surprisingly good results have on occasion been obtained up to 70 miles away. Thus, it would appear technically feasible to locate stations at greater distances from the control point than had been considered practical prior to the tests. While only three stations have been employed in the experiment to date, multiplication of this number by a factor of three, or thirty, or a hundred may be feasible. By the use of more powerful transmitting or relay techniques, or by hooking the system into telephone pairs, it is theoretically possible to cover a 200- or 500-mile zone quite as effectively as the present high-cost,

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multiple-manpower mobile teams. One of the advantages of the telemetering system, readily noticeable during the recent tests, is that the peak in man-hours is reached prior to the detonation, rather than immediately following. As a result, while a flurry of activity ensues in other branches of radiological activity immediately after shot time, the telemetering crew can sit back and wait for the telemetering stations to report in. The stations can also be interrogated by signal impulse, responding with wind velocity, wind direction, temperature, humidity, and so forth. The risk of over-exposure to radiation, always present in mobile operations, is practically eliminated. (End of [redacted] section.)

Industrial Health Program (UNCLASSIFIED)

Improved chemical dosimeters. Under a cooperative program with the National Bureau of Standards, evaluation tests of new radiation detection instruments and their performance characteristics are made continuously. Under this program an improved chemical dosimeter has recently been tested for calibration and rate dependency. This dosimeter, developed under the AEC project at the University of California at Los Angeles, is a two-phase system consisting of water, chloroform, resorcinol, and a dye indicator—bromcresol purple. Exposure rates up to 4,000 roentgens per minute were administered during tests. The results to date indicate that the dosimeter response is not significantly dependent on the rate at which the radiation is received. This lack of rate dependency should make the dosimeters useful in measuring high intensity gamma radiation such as the prompt radiation from an atomic bomb explosion. The readings were in general consistent within 20 percent, which is very remarkable for a color comparison device of this type.

Research Activities

Sensitivity of lymphoid tissues. At Northwestern University Medical School researchers investigating methods for separation of various components of lymphoid tissue have isolated a protein in the cytoplasmic nucleoprotein fraction which has unusual sensitivity to ultra-violet light and to alkalinity. This study is important as very little is known about the composition or properties of lymphoid tissues which are involved in many respiratory infections and presumably influence virulence and growth of micro-organisms found in throat flora. Since lymphoid tissue is known to be highly sensitive to radiation damage, this finding may prove very significant, and further study is being made to define the function of the protein in relation to radiation sickness.

Protective effects against X irradiation. Studies under way at the University of Southern California point to the possible protective effects against X irradiation of fat content in diets. Experiments have shown that rats receiving a diet containing a small amount of cottonseed oil were much more resistant to injury from X irradiation than were animals on a fat-free diet. A marked variability in survival time was noted when animals on these dietary regimens were subjected to repeated sublethal doses of X irradiation in amounts of 300 roentgens at weekly intervals.

It was found that the animals in which fat was present in the diet lived significantly longer than the group receiving a fat-free diet. On further examination, it was shown that the protective action was afforded by the presence of methyl linoleate, a normal constituent of many fats and oils. This fatty acid is considered to be an essential constituent of the diet; as little as ten milligrams per day of this ester afforded significant protection to the X irradiation damage.

It is felt that the protective action may be related to metabolism of the skin as it is known that highly unsaturated fatty acids as linoleate play an important part in such metabolism.

Somatic mutation program. In cooperation with various agricultural experiment stations, Brookhaven National Laboratory has initiated a program using the gamma radiation field for the induction of mutations in fruit trees or other plants of agricultural importance. The value of this program has been widely recognized and already a number of Eastern experiment stations have sent to the Laboratory trees and shrubs which have been set out in sectors at selected distances from the cobalt 60 source. The trees or shrubs ranging in age from seedlings to mature flowering plants have been set out in the field so that they are exposed to chronic radiation, the dosage depending on the distance from the source. Mutations induced by the radioactivity may be expected to appear in buds at any level of growth of the tree or plant. Later, cuttings can be transferred as scions to other nonradiated plants at the home agricultural station. By such large scale irradiation of many different kinds of trees and plants, it is hoped to develop new and commercially valuable varieties which the experiment stations can make available to the public. Mutations may be expected also in the seeds, but it takes very much longer to grow and test these germinal mutations than the somatic variants.

Abnormal growth induced by radiation. An interesting and somewhat unexpected result of chronic irradiation in the gamma field at Brookhaven National Laboratory has been the observation in the spiderwort Tradescantia of marked abnormal overgrowth of flower heads and the presence of many abnormal buds on the stems. These appear on plants receiving between 12 and 37 roentgens per day of radiation. Below this range the growth is normal, but growth decreases above the range. With dosages of approximately 100 roentgens, complete inhibition occurs. The appearance of these abnormally growing plants is very different from the normal. Normally, the first to third auxiliary bud grows into a single flowering stalk, and buds at lower nodes are inhibited. In the critical dosage range cited above, from four to five auxiliary buds develop shoots forming a mass of fused or dissected leaves. These then grow out into single or multiple vegetative shoots, and each sends out a short flower stalk bearing a normally appearing flower head. Cuttings from these plants grow normally, showing that the abnormalities are due to physiological disturbances (perhaps auxin synthesis which inhibits growth is disturbed) rather than to mutation. (End of UNCLASSIFIED section.)

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