DEPARTMENT OF DEFENSE
Tel. LI 5-6700
[redacted] 201

U.S. ATOMIC ENERGY COMMISSION
Tel. ST 3-8000
Ext. 307

JOINT OFFICE OF TEST INFORMATION

410494

CAUTION:
~~BASIC BRIEFING TEXT~~
RELEASE ON DELIVERY

~~EFFECTS OF NUCLEAR WEAPONS~~ TESTING AT THE ENIWETOK PROVING GROUNDS

NOTE: What follows is the approximate text that Dr. Gordon Dunning of the Division of Biology and Medicine, Ato[redacted] Energy Commission, will use in his briefing lecture [redacted] uncleared Observer Group at Eniwetok on the above su[redacted]

Nature and Distribution of Fallout

At the instant of detonation of a nuclear weapon there is produced a blast wave and thermal and initial gamma radiation. The blast and initial gamma effects are limited to areas relatively close in to the atoll where the detonation occurs. The intensity of the light might be harmful to the eyes out to the maximum straight-line-of-sight distance if viewed without protective glasses.

The effect that may result at great distance is that of radiation exposure from fallout. At the time of detonation a large number of different radioactive substances are produced with half-lives ranging from a fraction of a second to many years (the half-life is the time [redacted]al to lose one-half of its radioactivity). [redacted]s high in the air these radioisotopes [redacted]ted with fine particles that settle rela- [redacted]to the earth thus providing time for the [redacted]he short-lived isotopes to decay and also for the wide dispersal of the particulate matter. When the fireball intersects the ground during detonation, the radioisotopes will become associated principally with the larger particles which fall relatively rapidly,

BEST COPY AVAILABLE

(more)

54

[redacted]

thus producing higher concentrations of radioactivity in nearby areas.

The distribution of the nearby fallout (several hundred miles downwind) from high yield weapons detonated near the Earth's surface will be determined principally by the size of the particles formed, their position in the atomic cloud and stem, and especially on the wind structure at the various altitudes. The first two factors are functions of the yield of the bomb and the nature of the surface over which the burst occurs. Figure One presents one generalized concept of such initial distribution in the cloud and stem. The influence of the third factor (wind structure) is qualitatively represented in Figure Two. One example of how wind shear affects the di[redacted] tion of fallout from two similar detonations is show[redacted] Figure Three.

After the radioactive particles reach the Earth's surface they continue to give off radiations, the principal one being penetrating gamma rays. As these are absorbed by the body, a certain amount of biological damage is incurred, and in general the more radiation absorbed the greater the biological damage. One unique characteristic of fallout material is the decay of its radioactive according to the principal of $(time)^{-1.2}$. This means that for every seven fold lapse of time after a nuclear detonation there will be a decrease in activity.

ALOO

For example, in the event fallout occurs one hour after detonation, the activity will be only 1/10 of its initial value by the seventh hour. The total possible out-of-doors gamma dose accumulated from the first to the sixth hour after detonation would be approximately the same as from the sixth hour until a week later. Further, [redacted]ek's dose would be twice as large as all of [redacted] total possible dose for the entire lifetime [redacted]ctive material. To state it another way, for [redacted]the fallout occurs one hour or less after detonation, one-half or more of the total possible radiation dose will be delivered in the next twenty-four hours; but for areas where the fallout occurs a few hours or later after detonation many days or even weeks would be required to accumulate the major portion of the radiation dose, thus providing more time for countermeasures such as evacuation or use of shelters.

55

[redacted]

The inherent variability of such factors as wind-structures, yield of the weapon, etc. will preclude any rule for precise prediction of fallout for all types of detonations. However, as one point of reference, the attached Idealized Map shows the fallout for the March 1, 1954 high yield detonation in the Pacific, based on the assumption that people were to remain living normally in the area. It is to be emphasized that (a) different yields of weapons, different wind structures, and different kinds of land surfaces would result in different fallout patterns, and (b) this is the amount of fallout from a single high-yield weapon.

The unit of radiation exposure is expressed as "Effective Biological Dose" which incorporates the best estimates of effects of weathering (rain and winds) [redacted] ducing the contamination of the environment, of shie [redacted] from normal housing, and of the factor of the biolo [redacted] repair process that is operative concurrently with [redacted] accumulation of the radiation dose.

The two innermost isodose lines shown were selected to suggest regions where (a) a significant percent of personnel might be expected to die (400 roentgens) and (b) a few percent might become ill (100 roentgens) if personnel continued to live normally in these areas and took no special protective measures. These percentages would, of course, rise within the enclosed areas. About 25 - 50 roentgens are required to produce any observable biological effects (changes in the blood picture) which are neither serious nor permanent. The areas encompassed by the 400, 100, and 50 roentgen lines are 5,000, 12,500 and 25,000 square miles, respectively.

[redacted] amount of fallout drops off rapidly beyond [redacted] own on the map. For example, the average [redacted] lout in the United States for the entire [redacted] Spring of 1954 (Operation Castle) produced [redacted] exposure or dose that was only a small fraction of that received from a normal chest X-ray. As a further point of perspective, the average radiation exposure to people in the United States each year from medical uses of X-rays and radioisotopes, the exposure each year from naturally occurring radioactive sources, and the total exposure from all nuclear tests to date are roughly equivalent, i.e. 1/10 of a roentgen.

(more)

[redacted]s important to recognize that radiation itself [redacted] us since we receive an exposure or dose from [redacted]urring sources at a rate of 1/10 (or a little more) roentgens per year. Also, the major factor in evaluating radiation exposure is the total amount received. There may be temporary vises in radiation levels without being of significance in terms of health.

For example, if fallout were to raise the background radiation level by 100 times and this were to persist for a week, the total exposure would be about equivalent to the maximum permitted atomic energy workers each week. In reality, the radiation levels from fallout decrease rather rapidly according to known physical principals described before, but again it is the total amount received that is the determining factor. The 1/10 roentgen exposure, given above, from all tests to date is the total amount.

ALO[redacted]

Fallout on the Marshallese

As you know, there was an unexpected shift in the winds on March 1, 1954 so that significant amounts of fallout occurred on Rongelap Atoll. As soon as this was ascertained air and surface craft were immediately dispatched to evacuate the inhabitants of Rongelap (82 people) to Kwajalein where they were given the best possible medical care. A team of specialists in radiation medicine were flown from the United States to Kwajalein and remained with them for several weeks until they were all well on the road to recovery. The Marshallese were later moved to the island of Ejit where they have been housed and cared for at the expense of the United States Government.

[redacted] have been reexamined by medical teams and [redacted]ood health. There has been no change in [redacted] all newborn have been normal. It is hoped [redacted]ple may be returned to Rongelap in the fall o[redacted] year.

As a precautionary measure, an additional 154 inhabitants were also evacuated from their home island of Utirik to Kwajalein. These received an estimated whole body dose of 15 roentgens with no observable effects either external or internal. They were returned to Utirik in June 1954.

(more)

[redacted] estimated whole body exposure of the Rongelapese [redacted] roentgens. This was sufficient to cause about [redacted] the people to be nauseated and about one-tenth to vomit and experience diarrhea during the first two days. After the third day these symptoms subsided without therapy and there was no recurrence. The total white blood count followed a characteristic course for that amount of exposure, i.e., an increase for the first two or three days and then a sharp drop which fluctuated at lower levels for some two months, followed by a gradual rise. Several additional months were required for the white blood count to approach normal values. Other characteristic blood changes were noted such as depression of the blood platelets.

There is no special or unique therapy for radiation sickness. Rather, patients are given thorough and frequent medical examinations (including blood counts), are provided a good diet and generally healthful environment and restricted to mild exercise and activity.

One of the major factors in recovery is [redacted] vention of secondary infections. The usual treatment [redacted] such cases is routine use of antibiotics. A few of the Rongelapese developed symptoms of respiratory infection (not uncommon to these people) which cleared up after penicillin treatments.

In addition ot the above symptoms, there also occurred skin burns on most of the Rongelapese. This was cause by the fallout material remaining in contact with skin. (See picture) These "burns" were produced by a second type of radiation--beta particles--which have such limited range that the fallout material must be in contact with the tissues or very close to them to produce skin damage. The burns all healed without complications except for one that ulcerated but which also later healed with formation of scar tissue. Loss of hair also occurred on [redacted] people but normal hair regrew in all cases.

[redacted] effects of beta radiation can be greatly [redacted] not completely eliminated, by preventing [redacted] from coming in contact with the bare skin (staying indoors during the time of fallout or keeping the body covered by normal clothing), or by early removal by washing.

(more)

[redacted] complete the medical picture, urinalysis [redacted] the internal deposition of radioactive sub- [redacted] these people was appreciably below a hazard-ous amount. This strongly indicates that for times immediately following a detonation, the external radiation is the dominant hazard.

Monitoring

The measures taken to improve fallout predictions and the expanded program of warning and of monitoring in the Pacific will be described by others. In addition to these, two surveys will be made for detection of any radioactivity in the fish and in the ocean.

One will be made in June relatively near [redacted] Eniwetok Atoll and the second after the end of the [redacted] in more distant waters. Still a third project will [redacted] lect water and marine life samples around the Palau [redacted] for similar analysis. Also, the around-the-year [redacted] monitoring program at Eniwetok and Bikini Atolls will continue.

ALOO

As in the past, there will be about 40 U. S. Weather Bureau stations that will collect any fallout on gummed papers. These are then sent to the Atomic Energy Commission's Health and Safety Laboratory in New York City for counting. Since these data normally will not be available until a few weeks after the fall-out, there will be in operation again 12 AEC installations that will take direct measurements of fallout on the gound which will provide immediate information. Other data, such as activity in the air and/or in the rain, will also be available on short notice.

[redacted] past tests at the Nevada Test Site, [redacted] Commission and the U. S. Public Health [redacted] cooperated in monitoring around the site [redacted] of about 200 miles. This program has [redacted] expanded to include about 30 Public Health monitoring stations throughout the United States. These locations will make measurements similar to those made at the 12 Commission locations.

Thus, there will be a total of 82 monitoring stations in the United States during the test series. (See attached map)

(more)

59

[redacted]ough the cooperation of several other U.S. [redacted]encies, the fallout monitoring program has [redacted] an essentially world-wide coverage embracing an additional 80 stations. (See map). In fact, this network has collected fallout on gummed paper for the past four years. As stated below, samples of many materials have been collected on a world-wide basis and analysed for radioactivity.

These data have provided essential information not only for the United States but will also be made available to the United Nations Scientific Committee which is collecting data on the effects of ionizing radiation on man.

Strontium-90

One of the factors of principal concern [redacted] long range effects of fallout is an isotope called strontium-90. When taken into the body it is selectively deposited in the bones and continues to irradiate the surrounding tissue for long periods of time since it has a half-life of 27.7 years (the time of the isotope to lose one-half of its radioactivity). Massive doses of strontium-90 administered to laboratory animals have impaired the blood forming processes taking place in the bone and have produced bone tumors.

ALOO

As in the case of other radioactive substances taken internally, the potential hazards from strontium-90 are evaluated in terms of maximum permissible amounts in the body—quantities considered safe. For strontium-90 this has been set at one microcurie for adults (a unit that indicates the degree of radioactivity and also the [redacted] of the isotope).

To ascertain and evaluate the strontium-90 [redacted] by nuclear weapons testing, the Atomic Energy [redacted] has organized a major program of collecting and analyzing samples from all over the world. (see map) Samples have been taken of soils, plants, animals, and water, sea water, rain, snow, ice, air in the upper and lower regions, eggs, milk, cheese, wine, penguins, plankton, polar bears, fish, etc. Human samples have been collected from the fetal stage through old age.

(more)

[redacted] ples have been collected and continue to [redacted] aboratories.

In the short time available here, it will not be possible to present all of the major findings. The data can be summarized as follows:

The greatest amount of strontium-90 found in any human anywhere in the world has been about 1/600 of the maximum permissible amount, a quantity considered safe. The average for people in the United States is about 1/1000 of the maximum permissible amount.

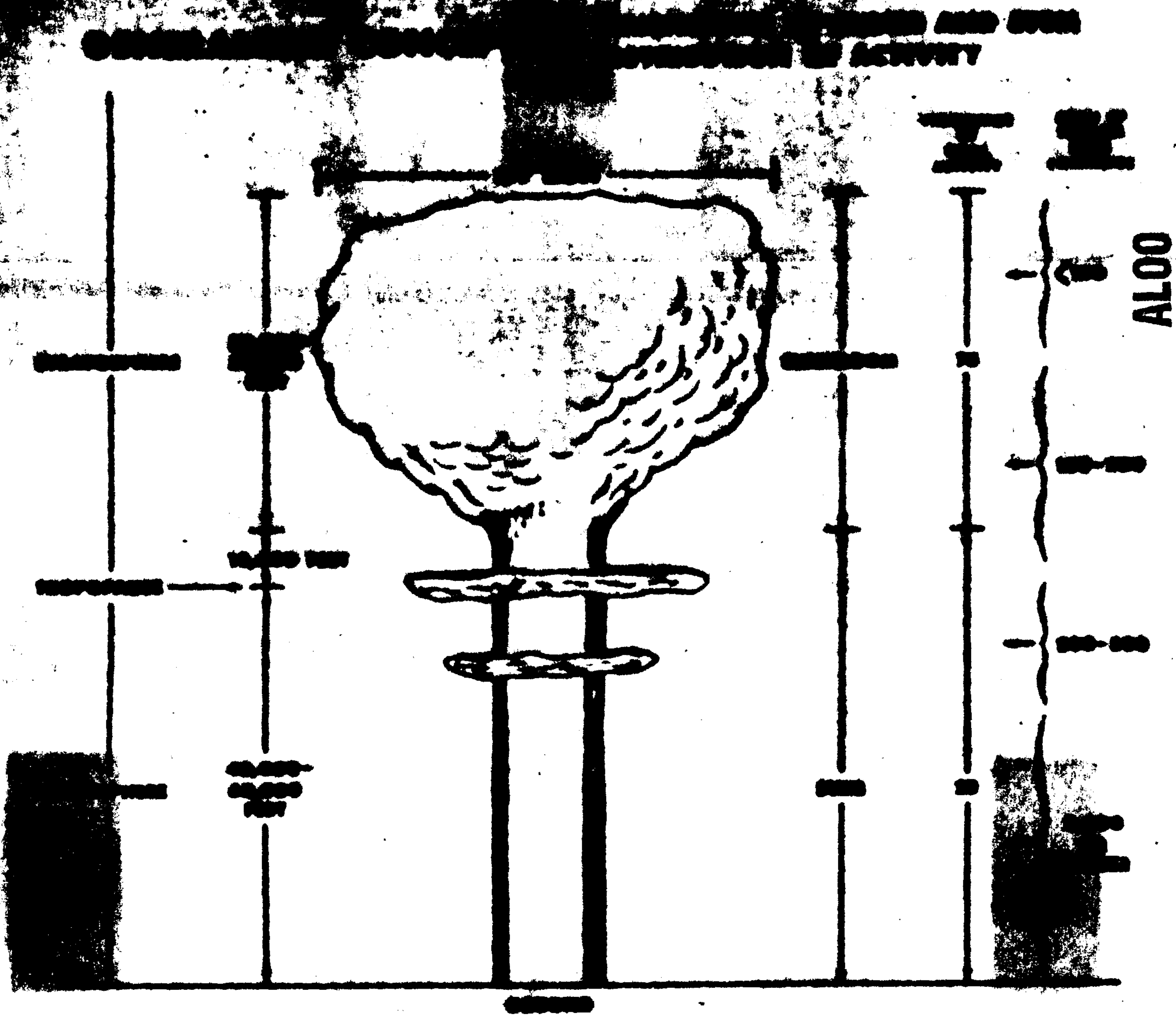
The maximum permissible amount of strontium-90 is that amount which, when maintained in the bones, is not considered to constitute a hazard. This is set at one micro curie per standard adult and may be about one-tenth of what normally would be detectable in the bone structure.

There is still strontium-90 [illegible] in the stratosphere from past detonations which will continue to dribble down to the earth at the rate of [illegible] per year. The total amount yet to fall may be [illegible] times that already down. However, there are two [illegible] factors that must be considered immediately. One, the soil-plant-animal cycle discriminates against the take of strontium-90. Second, (and more important), by far the larger amount of strontium-90 intake by humans comes from the vegetation (either directly or through the milk supply).

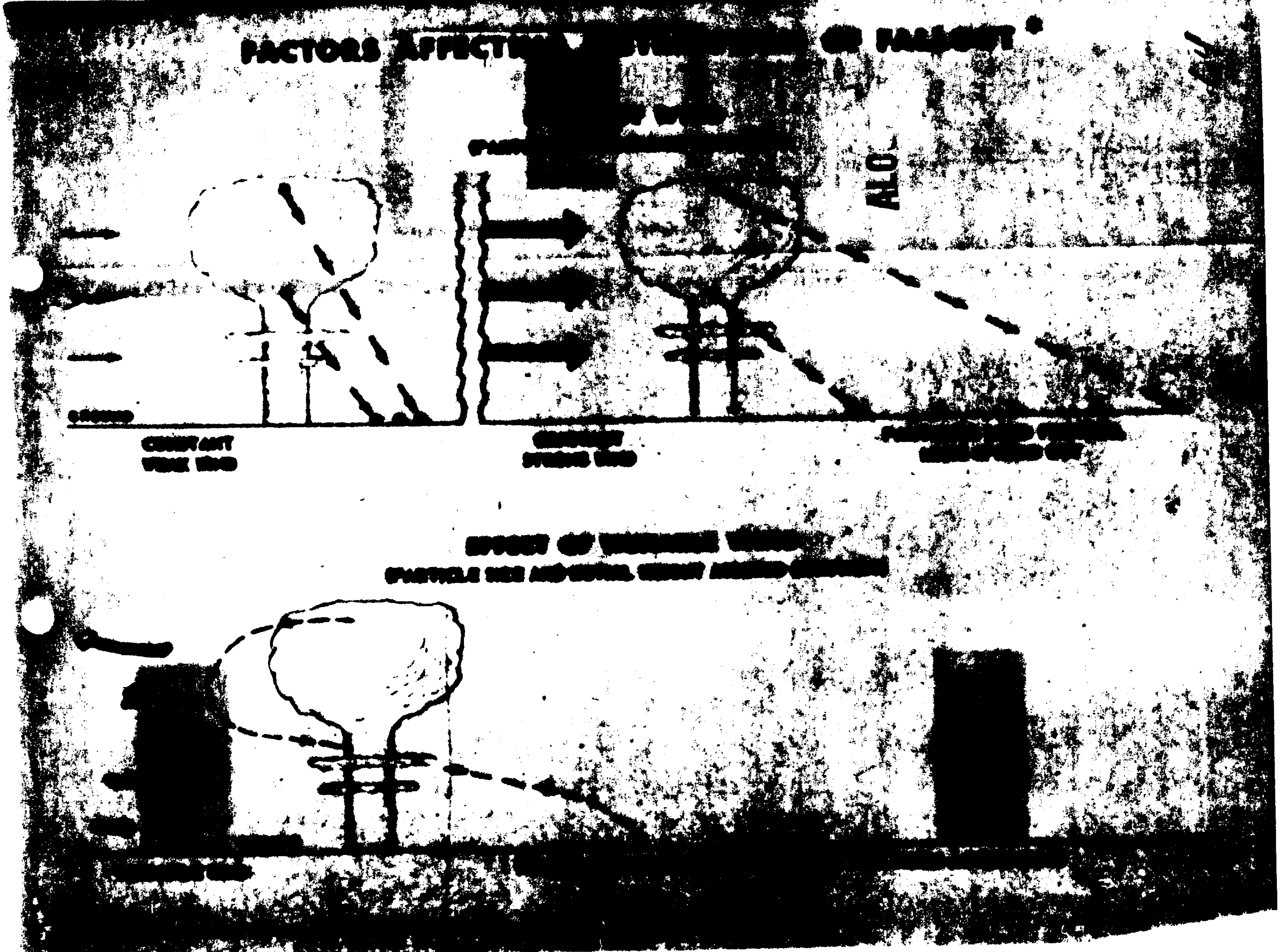
ALOO

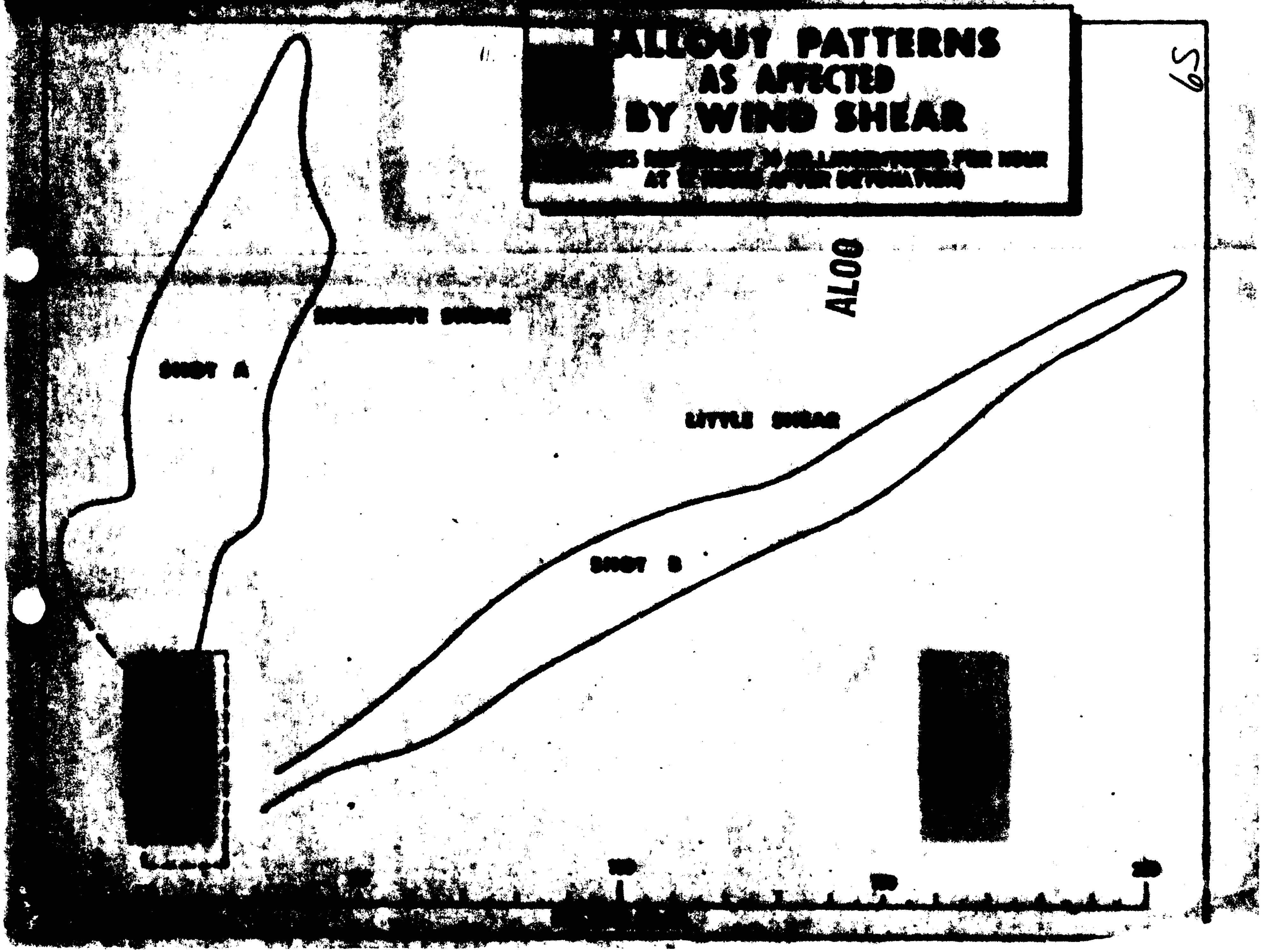
Thus, even if more strontium-90 continues to fall it should do no more than maintain an equilibrium with the amount already deposited within the body. In other words, the amount of strontium-90 now found in humans should be at or near peak values, with a dropping [redacted] sing of time.

[redacted] se, new nuclear detonations will add [redacted] 90 in the world. This problem has been [illegible] analyzed and again time will permit only one major conclusion. About 6,000 times as much strontium-90 as presently exists may be distributed world-wide without creating a hazard.


ALOO


ALOO


FACTORS AFFECTI
ALO


ALLOUT PATTERNS
AS AFFECTED
BY WIND SHEAR
AL00
SHOT A
LITTLE SHEAR
SHOT B
65

IDEALIZED F[redacted]

BASED ON MARCH 1, 1954 [redacted]

ISODOSE LINES ARE [illegible]