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U. S. ATOMIC ENERGY COMMISSION

CIVIL EFFECTS INFORMATION

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PLUTONIUM HAZARDS CREATED BY
ACCIDENTAL OR EXPERIMENTAL
DETONATION OF ATOMIC WEAPONS

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A course of action in the event of accidental or experimental detonations of the type under consideration are uncertain at best. The existing data are admittedly inadequate and they certainly do not necessarily apply to accidental detonations under all conditions. It is not a question of whether or not we are justified in drawing conclusions from the facts that are known, but of being obliged to make at the present time the best guesses possible. This necessity is emphasized by the fact that considerable time unquestionably will elapse before enough additional data can be gathered to permit positive conclusions. For obvious reasons, therefore, the following generalities are given with the full knowledge that they are by no means firmly supported by detailed observations and experimental data, and for the same reasons there will be a calculated attempt to avoid giving specific numbers.

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It would be well to point out here the basic difference between contamination with plutonium on the one hand, and a beta-gamma emitter on the other. We are quite familiar with the condition of ground zero following a nuclear detonation. The level of beta-gamma contamination is such that a person can remain in the area only a very short time, perhaps a matter of minutes, if he is to avoid a serious over-exposure. With plutonium, the time element is of no importance -- one can remain in a plutonium contaminated area indefinitely, provided proper precautions are used. The most important precaution is respiratory protection, which must be essentially perfect. Protective clothing is worn primarily to prevent the spread of contaminated material to uncontaminated areas. It might also be well to re-emphasize a statement made earlier, that plutonium contamination on the ground or on objects is of no significance as long as it remains where it is. It becomes of significance to health only when permitted to enter and remain in the body, and the most important portal of entry is via the respiratory tract. It follows, therefore, that necessary procedures can be carried out deliberately, without panic, and after adequate planning.

Let us hypothesize that there has been in fact an accidental detonation in a plant. Personnel in the immediate blast area may be killed or injured. Were they not killed by the blast, they might quite possibly receive serious doses of plutonium. In the open, this area would cover a radius of some few hundred feet, depending on the order of detonation and the amount of high explosive. Within a structure, the results would depend on the type of construction.

The area affected directly by the blast will be highly contaminated with plutonium, so highly contaminated that no entry into it should be permitted without complete protective equipment. For purposes of rescue and damage control, entry requires not only necessary precautions and a suitable decontamination center, but also trained and experienced personnel, individuals who have had specific training in alpha-monitoring.

The requirement for trained personnel cannot be stressed too strongly. Civil defense, industry and the military establishment now have many people trained for beta-gamma monitoring, but almost none who are familiar with the very different problems and procedures involved in work with plutonium and other alpha emitters.

Any objects that are removed from the area must be decontaminated or otherwise disposed of. The problem of decontaminating the site of the accident may be insurmountable and it may have to be "written off" permanently with at best an attempt to fix the plutonium and keep it from moving around. Demolition and burial of a building is difficult but possible, and may be the best counter-measure.

The detonation will produce a cloud of contaminated dust and smoke which will move in the direction of existing wind currents. If we can accept the data from field experiments, it would appear that this cloud does not present a serious hazard to those who may be in its path, even fairly close (500 to 5,000 feet) to the point of detonation. This does not mean that these individuals will not acquire a plutonium dosage; it does mean that this dosage, because of the short duration of the exposure, will presumably not be injurious.

From the above, we think we can state with confidence that an accidental detonation will not present any significant hazard to health in the period immediately following the blast except for the area of blast damage. This does not mean that problems will not be created; personnel and objects in the path of the cloud will undoubtedly require decontamination, primarily to prevent the spread of active material to other uncontaminated areas, and this will be no small job.

As the cloud containing active material passes along, it will more or less consistently deposit active material on the ground. This will result in a zone of contamination. There will be more or less finite limits to the area where dosimeter readings on the ground will indicate levels of 500 cpm or greater. This must be regarded as the area of residual hazard and it is the area about which something must be done subsequently. First of all, let us consider how large such an area might be. Information collected in the field has clearly indicated that contamination of this significant order of magnitude certainly extends for ten miles or more in a downwind direction from ground zero. This distance certainly should not be regarded as a finite limit but simply to indicate a general order of magnitude. Such an area may be contaminated with plutonium to the extent that Rad-safe supervision of activities therein will be required perhaps permanently. This does not by any means indicate that this piece of real estate is useless for the future; it does indicate that special control measures of one sort or another must remain in effect for a long time to come.

It must be re-emphasized that the situation created in the elongated egg-shaped contaminated area is no cause for panic. Any undue haste would,

as a matter of fact, tend to make the problem worse by producing unnecessary spread of contamination. Days or weeks are available in which one can decide on the proper course of action.

Any area contaminated with alpha emitters to a significant degree will require special treatment in one or a combination of three ways: (1) decontamination; (2) fixation; (3) arbitrary control of access. The actual removal of alpha contamination over a large area is obviously extremely difficult and probably of questionable value unless practically all of the involved area can be handled in the same way. The fixation of alpha activity by such methods as oiling, painting, etc., is reasonably satisfactory, at least for a considerable period, but we must not forget the fact that plutonium has a half-life of 24,000 years. Control of access to such an area might better be described as control of egress from the area for the purpose of preventing transport on shoes, clothing, and objects of contaminated material to clean areas.

Unquestionably, a health problem does exist in such an area but it is one which must be evaluated with great care. Using the type of calculations given above, may a family be permitted to reside in such an area indefinitely, even under supervision? May an individual be permitted to work eight hours a day in such an area? What precautions will be required? These are questions which can scarcely be answered before the fact.

As has been stated, the general conclusions given above stem from the experience gained in a long series of laboratory and field experiments. One would certainly hope that six months or a year from now it might be possible to draw firmer conclusions on which could be based future policies and procedures for field experimentation and more definitive advice for the guidance of civil defense, AEC, and Ordnance authorities, in connection with their various programs.

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