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J. R. Oppenheimer

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Health Hazards related to Plutonium

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L. M. Redman  
JAN 22, 79

A great deal of concern has been expressed during the past two weeks by members of the Chemistry Division about the inability of the Medical Group to detect dangerous amounts of plutonium in the body. This concern was occasioned by the accidental explosion of 10 milligrams of plutonium in Don Mastick's face with the subsequent ingestion of an unknown amount of this material. The questions which have been raised by the chemists are: 1) how much plutonium was absorbed by the gastro-intestinal tract in this case, 2) what fraction of a serious dose does the absorbed plutonium represent and 3) is it safe for Mastick to go back to work in Building D at his old job.

The present medical knowledge of the hazards of plutonium is derived entirely from tracer studies of the metabolism of this element in the rat and from calculation of tissue ionization produced by alpha radiation. Interpretation of Dr. Hamilton's data on rats in terms of humans indicates that 50-100 micrograms of plutonium in the skeletal system is the lethal dose. Calculations of the dangerous dose of plutonium in the lung tissue leads to answers between 0.5-5.0 micrograms depending upon the assumptions which have been made. Dangerous amounts of plutonium in the body should be detectable by finding plutonium in the excreta. If the rate of excretion in man is the same as it is in rats, one would expect to find in the daily output of urine about one ten-thousandth of the amount in the body or  $5-10 \times 10^{-3}$  micrograms in the case of a lethal amount of plutonium. About five to ten times this amount should be present in the stools each day. One can immediately see the difficulty involved in extracting such small amounts of plutonium from large quantities of excreta. As yet no satisfactory method of assaying excreta has been devised although a full time chemist here and another at Chicago have been working on this problem. Concerning the detection of plutonium in the lung, no experimental work has been done although we have some reason to think that enough ion pairs will be present in the expired air to be detectable by suitable ionization chambers.

In several discussions with Mr. Kennedy, Mr. Wahl and Mr. Mastick, we have discussed the advisability of giving a higher priority to the medical problems related to plutonium. It would not seem out of place to raise this question now as accidents similar to the one described above are bound to happen again despite the most elaborate precautions.

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It seemed to us that the following medical problems are the ones to which answers are urgently needed:

1. Development of methods of detection of plutonium in the excreta.
2. Determination of the factor by which the amount of plutonium in the excreta must be multiplied to ascertain the amount in the body.
3. Development of methods of detection of plutonium in the lung.
4. Further and more complete animal experimentation.

I should like to discuss this matter with you at greater length. In the meantime, Mr. Mastick has been transferred to my group temporarily by Mr. Kennedy to work on the problem of detection of plutonium in the excreta.

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cc/ Mr. Kennedy ✓  
 Mr. Wahl  
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